

# ABSTRACTS

International Conference  
on

Advances in Agriculture & Food System Towards  
Sustainable Development Goals

August 22 - 24<sup>th</sup>, 2022

University of Agricultural Sciences, Bangalore  
Jointly organized by



University of  
Agricultural Sciences,  
Bangalore

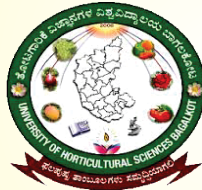


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- Effect of fertilizer sources and rate through drip fertigation on growth and yield of custard apple (*Annonas squamosa* L.) Cv. Balanagar
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- Srinivasappa, K. N<sup>5</sup>.and Vasanthi, B. G<sup>6</sup>. 1\*Ph. D Scholar, Department
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- Genetic transformations in flower crops
- Allen, J.J and Merin E.G\*
- Performance characteristics of self-propelled power operated cutter bar mower
- Rahul Gautam
- Effect of different potting media for foliage plants – An overview
- Kavana, G. B\*, Chandrashekar S.Y1., Pradeepkumar, C. M.2 and Anitha hosalli3
- Microgreens – A concept innovation for nutritional security
- Priyadarshini, V.M1 and Pungavi, R2
- Internet of things (IOT) for smart agriculture
- 1\*J. J. Patel, 2A. M. Patel, 3D. C. Barot and 4Ronak Mangroliya
- Aquascaping – An underwater art
- Jonnada Archana1
- Differential responses of top working methods for quality scion wood production in apple (*Malus x domestica Borkh.*)
- Ankita Dhiman1 and Shiv Kumar Shivandul
- Evaluation and quantification of biochemicals in chekkurmanis (*Sauropus androgynus L.*) using High-performance liquid chromatography (HPLC)



- Shubhada Tayade<sup>1\*</sup> and G. J. Janavi<sup>2</sup>
- Small tractor trolley mounted hydraulic platform for multipurpose work in orchard crops
- Satya Prakash Kumar, A.K. Roul and B. M. Nandede
- Alternative media composition for production of micro-propagated disease-free seedlings of sugarcane (*Saccharum officinarum* L.)
- Krishna Gantoti
- Technological advances in high tech horticulture and precision training
- Sakshi suman
- Physical and engineering properties of selected fertilizers relevant to development of target-oriented fertilizer drill for orchards
- Nenavath Manikyam<sup>1</sup>, A. Carolin Rathinakumari<sup>2</sup>, A.K. Dave<sup>3</sup> and G. Senthil Kumaran<sup>2</sup>
- Integrated approach for enhancing growth and yield of pomegranate (*Punica granatum* L.)
- cv. Bhagwa. Pooja, G. K.1, Honnabyraiah, M. K.2, Swamy, G. S. K.3 and Manjunath, G.4
- Artificial intelligence with Advanced horticulture
- Yash Desai<sup>1</sup> and Ronak Mangroliya
- Influence of various natural farming modules on available NPK, viable microbial count and economics of seed production on African marigold (*Tagetes erecta* L.) cv.
- 'Pusa Narangi Gaiinda' Anjay Singh Bisht<sup>1</sup>, BS Dilt<sup>2</sup>, Manish Kumar Sharma<sup>1</sup>, BP Sharma<sup>2</sup> and Pardeep Kuma<sup>3</sup>
- Influence of pruning and growth regulators on growth and flowering for off-season flowering induction in *Udipi Mallige* (*Jasminum sambac* var. *ayean eanum*)
- Shreedevi Badiger
- Standarising of planting densities on growth, fruiting and yield of Apple cv. *Jerome* under mid-hills of Himachal Pradesh
- Kuruva Mallikarjuna\* and J. S. C handel
- Artificial intelligence in Agriculture
- Varsha Pandey
- Effect of varieties and transplanting dates on yield and quality of kharif Onion (*Allium cepa* L.)
- Sharanya B. R<sup>1\*</sup>, Mahesh Ragi<sup>2</sup> and S. S. Kushwah<sup>3</sup>
- Vertical farming for commercial cultivation of Lilium
- Safeena S.A., Aswath C. And Senthil Kumaran G.
- Effect of exogenous application of auxin on leaf cuttings of Mexican Snow Ball (*Echeveria elegans* Rose)
- Sushil Kashyap<sup>1</sup>, Seema Mourya<sup>2\*</sup>, Sameer Topno<sup>2</sup> and Vijay Bahadur<sup>2</sup>
- Weather monitoring network and data information for precision agriculture in Karnataka state.
- Dr. Manoj Rajan and Nandeesh
- Optimization of design parameters of an induction based electrostatic nozzle using Artificial Neural Network (ANN)
- Bikram Jyoti<sup>1\*</sup>, Ashutosh P Pandirwar<sup>2</sup> and Hitesh Bijarniya<sup>3</sup>
- Technological innovation in farm mechanization- A strategy for sustainable food security
- Vilas Jadhav<sup>1\*</sup> and Ramappa, K. B.2
- Onion detopping machine: Bench work to Start up
- \*A. Carolin Rathinakumari<sup>1</sup> and G. Senthil Kumaran<sup>1</sup> Principal Scientist
- Optimizing sowing and fertilizer applicator parameters by ANN model
- H Manjunath<sup>1\*</sup>, M. Veerangouda<sup>2</sup>, Sushilendra<sup>3</sup>, Vijayakumar Palled<sup>4</sup> and Sunil Shirwal<sup>5</sup>
- Soil and plant health management by artificial intelligence
- H Manjunath<sup>1\*</sup>, M. Veerangouda<sup>2</sup>, Sushilendra<sup>3</sup>, Vijayakumar Palled<sup>4</sup> and Sunil Shirwal
- Pollination potentiality of stingless bee, *Tetragonula iridipennis* (Smith) in Capsicum (*Capsicum annum* L.) under protected cultivation at GKVK, Bengaluru, Karnataka
- Moulya, G.R.#, Jagadish, K. S.\*, Eswarappa, G.\*, Hanumantharaya, B. G.\*\* and Srinivasappa, K. N. \*\*
- Study on stigma receptivity and effect of fruit picking in King Chilli (*Capsicum chinense* Jacq.) for hybrid seed production
- M.B. Devi\*, S.R. Assumi and S. Hazarika
- Cryobiotechnological tool: Cryopreservation of in vitro grown shoot tips of grape (*Vitis vinifera* L.) cv. Fantasy seedless
- Suhasini S. C.\*, Kulapati Hipparagi<sup>2</sup>, Satish Pattepur<sup>3</sup>, Gollagi, S. G<sup>4</sup>. and Sanjivreddi G. Reddy<sup>5</sup>
- Studies on red and white type Dragon fruit as influenced by organic manures and biofertilizers on flowering attributes
- Ayesha Siddiqua<sup>1</sup>, Srinivasappa, K. N<sup>2</sup> and Arshad Khayum<sup>3</sup>
- The performance of papaya (*Carica papaya* L.) on application of different growth promoting substances under different growing conditions
- Jasmitha, B. G., Honnabyraiah, M. K and Manjunath, G.
- Field evaluation of in vitro derived mutants of different varieties of banana on biochemical and quality traits
- Kiran Kumar, K. H., 1 Prakasha, D.P<sup>2</sup>., Kulapati Hipparagi<sup>3</sup>, Prabhuling, G., 4 Basvarajappa, M. P<sup>5</sup>.,
- Hi-tech horticulture: Way forward Manish Kumar<sup>1</sup>, Mukesh Kumar<sup>2</sup> and Deepak Sangwan<sup>3</sup>



- Effectiveness of different mordants and concentrations on the dyeing properties of cashewnut peel on silk Tusharbala Sahoo<sup>1\*</sup> and Nibedita Mishra<sup>2</sup>
- Conjunctive use of microbial and seaweed extract-based bio-stimulants improved soil fertility, fruit yield, quality and net returns in pomegranate (*Punica granatum L.*)
- Ashis Maitya<sup>\*</sup>, Rajiv A Marathe, K. and Dhinesh Babua
- Intelligent process automation in phenotyping drought stress response in horticultural crops
- Laxman R.H.1, Hemamalini P.1<sup>\*</sup>, Kannan S.1, Rashmi K.1 and Senthil Kumaran G2.
- Study on the compatibility of the tomato scions with different solanaceous rootstock
- Shreya Paikra<sup>\*</sup> and Annu Verma
- Screening of mango germplasm against different pests of mango
- Ashish Shivji Bhuvai
- Constraints faced by the Mango Growers in adoption of selected mango production technologies
- Holkar, S.C.1., Sawant, P.A.2., Ekhande, Y. S.3 and Raykar S. S.4 1,
- Effect of bio-digester liquid manure on growth, yield and quality of capsicum under polyhouse condition”
- Srinivasappa, K. N<sup>\*</sup>, Arunkumar, S<sup>\*</sup>, Venugopala Reddy, M <sup>\*</sup>, Boraiah. B.<sup>\*\*</sup>
- Effect of integrated nutrient management on productivity and profitability of underexploited vegetable Yardlong bean (*Vigna unguiculata sub sp. sesquipedalis (L.) Verdc.*)
- Manjesh, M., 2Ramesh Babu, H.N and 3Nagarajappa Adivappar
- IMPACT OF DIFFERENT COLOUR LOW TUNNEL SHADE NETS AND MULCHES ON GROWTH AND YIELD OF CHRYSANTHEMUM (*Chrysanthemum indicum L.*)
- UNDER RAICHUR CONDITIONS
- Manjunatha M. K, B. Maheswara Babu, Ramesh, G<sup>\*</sup>, G.V. S. Reddy and Rajkumar. R.
- ENVIRONMENTAL PARAMETERS UNDER DIFFERENT COLOUR LOW TUNNEL SHADE NETS WITH DIFFERENT MULCHES INFLUENCING THE GROWTH AND YIELD OF CHRYSANTHEMUM
- \*Manjunatha M. K, B. Maheswara Babu, Ramesh, G, G.V. S. Reddy and Rajkumar. R. H.
- **Theme - 3 Advances in Aquaculture Research towards Food and Nutritional security**
- Effect of milkfish produced Greenwater on fish growth, water characteristics and microbial load at varying stocking densities
- Abisha R<sup>\*1</sup>, Kishore Kumar Krishnani<sup>1</sup>, M. Kailasam<sup>2</sup>, Basanta Kumar Das<sup>3</sup> MP Brahmane<sup>1</sup>, and Kapil Sukhdhane<sup>1</sup>
- Role of lipids on fish reproduction
- Ashutosh Lowanshi<sup>1</sup>, Rachna Gulati<sup>1</sup>, Paramveer Singh<sup>1</sup>, Brajesh Pal<sup>1</sup>,
- ASSESSMENT OF SOCIO-ECONOMIC STATUS OF FISHERMAN COMMUNITIES OF THE KOLAR RIVER AT BHOPAL REGION.
- RISHABH SHUKLA
- Establishment and Characterization of Cell Culture System from Gill Tissue of *Amphiprion percula* (Lacepede, 1802)
- Yashwanth B.S<sup>1</sup>, Nevil Pinto<sup>1</sup>, A Sathiyarayanan<sup>1</sup>, and Mukunda Goswami<sup>1\*</sup>
- Utilization of fish processing waste for collagen production
- Mandakini Devi Hanjabam<sup>1</sup>, Amjad Khansaheb Balange<sup>2</sup>
- Physico-chemical, functional and sensory quality of coconut flour as influenced by drying method and its application in *Oreochromis niloticus* Tilapia fish sausage
- Rose Mary James<sup>1</sup>, Malini Mathew<sup>2</sup>, Elavarasan K<sup>2\*</sup>
- SUSTAINABLE FISHERY RESOURCE MANAGEMENT & DEVELOPMENT IN HALDIA, WEST BENGAL
- Suman Kumar Sahu<sup>10</sup>
- First report on isolation of *Aeromonas salmonicida* subspecies *salmonicida* from aquaculture environment in India: Polyphasic identification, virulence characterization and antibiotic susceptibility
- Subham Kumar Pradhan, Md. Idrish Raja Khan, Dibyendu Kamilya, Tanmoy Gon Choudhury<sup>\*</sup>, Rajashree Devi
- Impact of high temperature stress on growth and yield cauliflower
- VINITA MULODIA
- Health and Growth Analysis of *Litopenaeus vannamei* in Semi Recirculatory Aquaculture Biofloc System and Normal Biofloc System
- <sup>1</sup>Priya Maria Vinesh, <sup>1</sup>NH. Arun Das, <sup>1</sup>V. Lakshmi, <sup>2</sup>GB. Sreekanth
- Competency of an indigenous re-circulatory coldwater aquaponics model for pilot scale production of rainbow trout (*Oncorhynchus mykiss*) and lettuce (*Lactuca sativa*)
- Abhay Kumar Giri<sup>1\*</sup>, Sumanta Kumar Mallik<sup>1</sup>, Partha Das<sup>1</sup> and Nityanand Pandey<sup>1</sup>
- Genetic variation analysis for root traits in cowpea (*Vigna unguiculata L. Walp*) core collection
- Aaqif Zaffar, Reyazul Rouf Mir, A. Parvaze, Sofi, Sadiya Shafi, Ramsha Khalid, Sujeela Rani, Samreen Fatima
- Effect of a host-gut derived potential probiotic *Bacillus subtilis* COFCAU\_BSP3 on growth, immunity and resistance of *Labeo rohita* to *Aeromonas hydrophila* infection





- Arya Singh, Tanmoy Gon Choudhury, Dibyendu Kamilya
- Effect of different carbon sources on the growth and survival of critically endangered peninsular carp *Hypselobarbus pulchellus* during fry to fingerling rearing in biofloc system
- Anantharaja.K1\*, Gangadhar Barlaya1, BS Anand Kumar1, Hemaprasanth1 C.H.Raghavendra1, Saroj Kumar Swain2, N.K. Chadha3, Gopal Krishna3, P. Routray2
- Comparative Study on the Nutritional Evaluation of Fish Flesh and Fish Waste Protein Hydrolysates Prepared from Mackerel fish (*Rastrelliger kanagurta*)
- 1Prakash Goraksha Patekar, M.Satheesh1, Halpati Reena1, Banlam J. Marbaniang2, Sikendra Kumar1
- Characterization of virulence potential of *Aeromonas hydrophila* strains isolated from carp culture pond
- Satyajit Behera, Subham Kumar Pradhan, Rajashree Devi, Dibyendu Kamilya, Tanmoy Gon Choudhury\*, Md. Idrish Raja Khan
- Differential protein expression profiling of rohu kidney in response to *Edwardsiella tarda* infection
- Nevil Pinto1, Mehar Un Nissa2, B.S.Yashwanth1, A. Sathyanarayanan, Sanjeeva Srivastava2 and Mukunda Goswami1\*
- Frozen Storage Characteristics of Battered and Breaded Genetically Improved Farmed Tilapia (GIFT) Fillets Packed in PEST/PE and PE Pouches
- LIBEESH P.K1, ANEYKUTTY JOSEPH3 & GEORGE NINAN2\*
- Captive Maturation and Multiple Breeding Technology of Endangered Golden Mahseer (*Tor putitora*) for Its Sustainable Conservation and Rehabilitation
- Akhtar.M.S\*, A. Ciji, Rajesh M, and D. Sarma
- Captive Maturation and Multiple Breeding Technology of Endangered Golden Mahseer (*Tor putitora*) for Its Sustainable Conservation and Rehabilitation
- Akhtar.M.S\*, A. Ciji, Rajesh M, and D. Sarma
- Higher intake of  $\beta$ -glucan impairs reproduction in a female teleost, *Tor putitora* (Hamilton, 1822)
- Alexander Ciji1\*, M.S. Akhtar1, Priyanka H. Tripathi1, Maneesh Kumar Dubey1, Prakash Sharma1
- METABOLIC AND HAEMATOLOGICAL RESPONSE OF RAINBOW TROUT TO NELUMBO NUCIFERA LEAF EXTRACT.
- Mudasir Maqsood Hakim1\*, Towseef Akram1, Nazir Ahmad Ganai1, Syed Mudasir Ahmad1, Oyas Ahmad Asami2, Riaz Ahmad Shah1.
- Utilization of indigenous extractive species for environmental remediation and improved performances of fed species in brackishwater integrated multi-trophic aquaculture (BIMTA) system
- Gouranga Biswas1\*, Sanchita Naskar2, Prem Kumar3, Debasis De3, B.Paramita . Sawant2
- Effects of red bell pepper (*Capsicum annum*) on pigmentation and growth performance of rainbow trout (*Oncorhynchus mykiss*)
- Laika R Baig1, Tasaduq H Shah1, Farooz A Bhat1, Oyas A Asimi2, Adnan Amin3, Imran Khan4,
- Diversity of *Sclerotium rolfsii* and Analysis of Collar Rot Disease Epidemics
- Ritesh Kumar1\*, Abhijeet Ghatak and Arun P. Bhagat
- DIGITAL BIOCHEMISTRY OF NONE-DISEASES HAVING LOW-PROTEIN DIETS, DURING THE OLD-AGES
- Debabrata Das. \*Aranya Das, #Prakriti Das and & Santa Ana Das
- AMINO ACIDS' THERAPY IN MANKIND
- Debabrata Das and #Prakriti Das
- FRAI Division, ICAR-CIFRI, Barrackpore, Kolkata 700120, W Bengal, India
- Aquatic weed as a protein source in the diet of Common carp (*Cyprinus carpio* var. *communis*) fingerlings
- Jahanzaib Khan1, Oyas A asimi1, Ashwani kumar1, Laika R Baig2
- nutritional value
- Shrimp genomics and its application for genetic improvement programmes in aquaculture
- Shekhar.M.S, K. Vinaya Kumar, J. Ashok Kumar, Raymond Jani Angel
- Benzophenone-3, an emerging aquatic pollutant
- Bhautik D. Savaliya\*, G.Rathi Bhuvaneshwari\*\*, Saksi Patil, Tejaswinikinnera
- Anti-Saprolegnia activity of Chloramine-T
- Vinita Pant\*, Kh. Victoria Chanu, Dimpal Thakuria, Raja Aadil Hussain Bhat
- Sustainable aquaculture production antimicrobial compound-producing *Pseudomonas stutzeri* isolated from three spotted crab, *Portunus sanguinolentus*
- Hariharasuthan.R\*, S. Jayalakshmi
- DISEASE MANAGEMENT – antimicrobial activity against human bacterial pathogens
- Hariharasuthan. R\*
- Ecological transitioning of agrifood systems to ensure food and nutritional security in South Asia
- Jat.H.S1\* M.K. Gora1, M. Choudhary1, P.C. Sharma1 and M.L. Jat2
- Incidence of cyst in *Epinephelus diacanthus* (Spinycheek grouper) from West Coast of India
- Dhanalakshmi.M1, S.Shivkumar2, Rinkesh Nemichand Wanjari3, Zeba Jaffer Abidi1, B.B.Nayak1



- Incidence of pink water in Chennai, Tamil Nadu- An alarming bloom
- Keerthivarman G.S1\*, D. Manikandavelu1, S.Aruna1 and N. Muralidharan2
- The potential of microbes in aquaculture
- Indulata Tekam1, Sona Dubey1, Samad Sheikh2, Ashutosh Lowanshi3
- Expression profiling of genes associated with Omega-3 fatty acid biosynthesis in Olive barb a freshwater fish
- Janmejaya Parhi, Kashti Prerna Deorao, Sagar Chandra Mandal
- Effects of low fishmeal diets supplemented with amino acids and phytase on the apparent digestibility and phosphorus retention of Pacific white shrimp, *Penaeus vannamei*
- Manikandan.K\*, N. Felix, E. Prabu, and G. Sathishkumar
- Phytochemical analysis, HPTLC Profile, and invitro Antioxidant and Antibacterial activity of *Cyperus rotundus* L. rhizome extracts
- Radhakrishnan Naveenkumara, R.P.Ramana, Saurav Kumara, V.Anishaa, GM Chandan b
- Evaluation of Cluster Bean [*Cyamopsis tetragonoloba* (L.) Taub] Genotypes for Drought Stress Adaptation and its Effects on Yield
- Samarth R. Patel1, Amarjeet Singh Th2, Sushil Kumar1, Ranbir S. Fougat1
- Improving survival of fish larvae through better weaning strategies
- Saiprasad Bhusare\*, N.Shamna,\*\*,Prakash Patekar, Tejaswini Kinnera, and Sakshi Patil
- Aptamers - An emerging class of molecules that rival antibodies
- Samad Sheikh1, R.P. Raman1, Chovatia Ravikumar1
- Scale microstructure study of *Pomacanthus annularis*(Bloch, 1787)from Veraval harbour, Gujarat, India
- Sheetal K. Bharda
- Cytokines with special reference to inflammation
- RavikumarChovatia1, Gayatri Tripathi1, Samad Sheikh1
- Role of gut microbiome on gut health and nutrient dynamics
- Tejaswini kinnera1\*, N.Shamna ,1\*\*, Saiprasad Bhusare1, Prakash Patekar1, Bhautik Savali
- Financial Feasibility Analysis of Indian Major Carp (IMC) Aqua farms in Andhra Pradesh
- Dr. Potnuru Santosh Kumar1 and Dr. J S Sonnad2
- Assessment of Sea Water Intrusion in Ground Water Samples of different inland blocks of Cuddalore District, Tamil Nadu, India
- Mohamed Ansari Raja. A1 and P P. Mahendran2
- Land Use/Land Cover (LULC) Changes and Mapping of Potential Areas for Climate Smart Aquaculture in PeechiReservoir, Kerala
- Mohammed Meharooof a\* and Vinod Kumar Yadav a
- Toxicity evaluation of Mithi river water samples in zebra fish (*Danio rerio*) embryos
- Harshavarthini M#1, MujahidkhanA. Pathan1, Nalini Poojary2, Saurav Kumar2 and N. S. Nagpure1\*
- Implications of gender inequality in Food and Nutritional security
- Heleena Jati1
- **Theme - 4 Climate Change Resilient Agriculture**
- Effect of land configurations and pigeon pea based strip intercropping on soil moisture storage under rainfed ecosystem
- A.Vijayaprabhakar1 and C. Jayanthi2
- Impact of climate change on water requirement and yield of tomato over different agro-climatic zones of Tamil Nadu
- Guhan Velusamy1\*, Geethalakshmi Vellingiri2, Bhuvaneshwari Kulandhaivelu1,
- Bio-fertilizers—a tool in mitigating greenhouse gas emission in puddled rice (*Oryza sativa*.L)
- ChelviRamesh1, R. Durai Singh2, P.Kannan3 and R.Surya4
- Identifying the trends in Agrobiodiversity and factors responsible for it across different states of India.
- Niharika Kondhalkar, Sathish B. Shivachandra, GB Manjunath Reddy, Yogisharadhya R., Awadesh Prajapati, Shrikant Patra, Kowshik AV, Ashik KS, Md. Mudassar Chanda
- Effect of Nanoscale CaO and MgO on Bio-ethanol Production from Sweet Sorghum
- R. Naseeruddin1, V. Sumathi2, T.N.V.K.V. Prasad3, V. Chandrika4 and P. Sudhakar5
- Effect of exogenous melatonin on the water stress alleviation in black pepper (*Piper nigrum* L.)
- Afforestation drives and its success in cold desert regions: A review
- Ankita Chauhan, Chaman Lal Thakur, Rajender Kumar
- Investigation on Seasonal Rainfall Mass Curves & Development of Synthetic Seasonal Hyetographs for Middle Gujarat
- Bhavin Ram1 and Murari Lal Gaur2
- Screening of Rabi Sorghum Genotypes Under Varied Moisture Regimes for Physiological Performance and Adaptability to Drought Stress
- Brahmesh Reddy B R 1, Kiran B O 2, Patil S B 3, Ashwathama V H 1, Karabhantanal S S 2, Jolli R B 2, Gangaiah B



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- Impact of climate change on crops adaptation and resilience of farming system
- A. Chendra Babu Naidu<sup>1</sup>, G.Vinay and B.Srikanya.
- Nutrient analysis of soil samples from different villages of Gandhinagar, Gujarat
- Sutariya, D.A
- Evaluation of Air Pollution Tolerance and of Selected Roadside Tree Species in Ludhiana, India
- Jyoti Verma<sup>1</sup>, Parminder Singh<sup>2</sup>, Rajni Sharma<sup>3</sup>
- Sulphur-mediated modulation of lead stress by modulating oxidative stress adjusting ascorbate-glutathione cycle in Brassica juncea L.
- Hemanthkumar Manne<sup>1\*</sup>, Nisha Kumari<sup>2</sup>, Sonia Nain<sup>3</sup>, Ram Avtar<sup>4</sup>
- Organic matter as a foundation for ecosystem sustainability
- 1 Mohit Godara, 2 Asha, 3 Akshay Pareek
- Carbon dioxide evolution and fruit yield in tomato under organic nutrition
- Pallavi, K.N.
- Comparative performance of direct seeded rice genotypes by multivariate analysis
- Rakesh Kumar, Ashish Jain and Sonika Bhankar
- Extreme temperature and rainfall events trend over Varanasi
- S Vijayakumar<sup>1</sup>, ?Sudhir Kumar Rajpoot<sup>2</sup>, R Mahender Kumar<sup>1</sup>, R M Sundaram<sup>1</sup>?
- Climate resilient technology to cope with climate change for sustainable production and livelihood
- D.V. Srinivasa Reddy, M.S. Savitha<sup>1</sup>, P. R. Ramesh<sup>2</sup>, N. H. Bhandi<sup>3</sup>, Raju G. Teggelli<sup>4</sup>, Vishwanath<sup>5</sup> and S. Ravi<sup>6</sup>
- Development and optimization of NIR Spectroscopy models for simultaneous multi-trait assessment in diverse cow pea germplasm.
- 1 Siddhant Ranjan Padhi, 2 Arti Barwal, 2Racheal John, 2Kavita Gupta, 2 Sunil Arachak, 2Kuldeep Tripathi, 2Dhamanprakash Wankhedkar, 1Gyanprakash Mishra, 3 Sanjeev Kumar, 2 \*Rakesh Bhardwaj
- Root characterization and identification of drought tolerant dicotyledonous wheat germplasm lines using Stress tolerance Index (STI).
- Shradha HB<sup>1\*</sup>, Uday G<sup>1</sup>, Priyanka K<sup>2</sup>, Gopal Reddy K<sup>3</sup> and Sharmara Jagirdhar<sup>2</sup>
- Cryopreservation of shoot tips of Allium hookeri Thwaites – an underutilized species with multifarious uses
- Subhash Chander\*, Gowthami R., Ruchira Pandey, Vartika Srivastava and Sandhya Gupta Assessment of leaf anatomical parameters to determine drought tolerance in coconut hybrids
- R. Sudha, V. Niral, K. Samsudeen, Neema, M and Aparna Veluru
- Impact of flood resistant red rice variety - Sahyadri Panchamukhi on farmers prosperity of Coastal Karnataka
- Naveen Kumar, B. T., T. J. Ramesha, Mallikarjuna, L., Kedaranath, Chethan, N., Shivakumar, R. and Rashmi, R.
- GBS based linkage map of rice helps identify QTLs responsive for drought
- Nabarun Roy<sup>1</sup>, Rahul Kumar Verma<sup>2</sup>, Mahendra Kumar Modi<sup>1</sup>
- Building Resilience through Root Research: From Phenotypes to Phenotypes for Enhancing Productivity under Water Stress in Legumes
- Parvaze A. Sofi<sup>1</sup>, P V Vara Prasad<sup>2</sup>, Prakash Jha<sup>2</sup>, Sadiya Shafi<sup>1</sup>, Aaqif Zaffar<sup>1</sup>, Samreen Fatima<sup>1</sup>, Sujeela Rani<sup>1</sup> and Ramsha Khalid<sup>1</sup>
- Carbon footprints, energetic and economic budgeting of weed management under conservation agriculture system in maize (Zea mays L.) - wheat (Triticum aestivum) cropping system
- 1 Sachin Kumar\*, 2 Surinder Singh Rana and 1 Ranbir Singh Rana
- Reducing ammonia volatilization and denitrification losses in Wheat field by using microbial consortium
- Sibananda Darjee<sup>1</sup>, Manoj Shrivastava<sup>1</sup>, Shivdhar Mishra<sup>2</sup>, Ashish Khandelwal<sup>1</sup>, Pooja LR<sup>1</sup>, Renu Singh<sup>1</sup>
- Nitrogen mineralization rate of different organic sources in inceptisol of Umiam, Meghalaya
- Lumbini Kalita<sup>1</sup>, Naorem Janaki Singh<sup>2</sup>
- Climate change Resilient Agriculture
- Parveen Kashyap<sup>1\*</sup> and Parminder Kaur Baweja<sup>2</sup>
- Climate Resilient Technology for Active Flood Plain
- Lopamudra Sahoo, Anup Dasa, Chandan Debnath, Vinay Singha, J. Parhib, Biswajit Dasa, V.K. Mishra
- Climate Resilient Agriculture - Need of the century
- Om Prakash Choudhary<sup>1</sup> R.K. Verma<sup>2</sup> S. Aravindh Kumar<sup>3</sup> Rajeev Yadav<sup>4</sup> and Vikash Meena<sup>5</sup>
- Climate smart agriculture for sustainable soil micro flora, food security and protein quality
- Madhu Choudhary<sup>1\*</sup>, HS Jat<sup>1</sup>, ML Jat<sup>2</sup> and PC Sharma<sup>1</sup>
- Influence of Heat units and different pruning months on growth and flowering of Jasminum grandiflorum.
- Khanchana. K and M. Jawaharlal
- Reduction in greenhouse gases
- Suruchi<sup>1</sup>, Pooja<sup>2</sup>
- Impact of rice (O. sativa L.) straw incorporation induced changes in soil physical and chemical properties on yield, water and nitrogen-balance and -use efficiency of wheat (T. aestivum L.) in rice-wheat cropping system: Field and simulation studies



- P R Ramteke\*, BB Vashisht, SK Jalota, Sandeep Sharma
- Evaluation of growth traits in high resin-yielding half-sib families of *Pinus roxburghii* Sargent
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- *Ailanthus excelsa* and *Prosopis cineraria* based farming system - A climate change mitigation option for arid western Rajasthan
- Subbulakshmi, V\*1, Sheetal, KR2, Renjith, PS2 and Nathawat NS1
- Design and quantification of ecosystem services from multifunctional agroforestry established for family farming in India
- Keerthika A1, K.T.Parthiban2 and A.K.Shukla1
- Diversity and relative abundance of insect pests associated with rainfed, tubewell and canal irrigated chickpea crop in hot arid region of Rajasthan
- Sugan Chand Meena, Nisha Patel\*, Archana Sanyal\*, Saranya R, Anil Patidar and Mavji Patidar
- Technology for rapid whey removal for production of chakka
- A.D.Vairat1, P.S. Minz 2, Chitranayak Sinha3, Khushbu Kumari4
- Potential of Agroforestry in Reclamation of Problematic Soils in India
- Avinash Kumar Bhatia1\*, K S Pant1, Saakshi1, Harish Sharma1
- Developing climate resilient chickpea cultivars through nature of gene action and combining ability analysis for heat stress
- Avinalappa Hotti1 and Raghunath Sadhukhan2
- Characterization and identification of photo-thermo insensitive genotypes of cowpea for climate resilience under hot arid environment
- A.K. Verma\*, D.K. Samadia, Chet Ram, Hanuman Ram and Gangadhara K.
- Climate change effect on phytochemistry of Bt cotton
- Shreevani, G. N1., Sreenivas, A.G. 1and Beladhadi, R.V. 2
- Heritability estimates for seed yield of machine harvestable chickpea cultivars in different environments
- 1Laxuman1\*, H. Avinalappa2, Sidramappa3, P.H.Kuchanur4, K. Shiva Kumar5, and L. N. Yogesh6
- Mitigating methane emissions by intelligent management of crop residue, nutrients, and soil moisture in long-term conservation till soil
- Sangeeta Lenka1\*, Rajesh Choudhary2, Narendra Kumar Lenka1, Jayant Kumar Saha1, Asit Mandal1, S. K. Sharma, Ashok Kumar Patra1, Dharmendra Singh1
- Application of randomized response technique in forestry – a case study to measure proportion of forest encroachment in Shimla district of Himachal Pradesh
- Bharti1, Mohammed Javed2, Tauqueer Ahmad1, Smriti Bansal3
- Vulnerability of rural farming communities to climate change and natural disasters: An evidence from Kuttanad wetlands ecosystems of Southern India
- Anu Susan Sam1 and Rajkumar Rajanpillai2
- Change detection of soil total Nitrogen in Bhoirymbong block, Meghalaya using Remote Sensing data
- Sarjana Pattanayak1, Naorem Janaki Singh2
- Drought risk and Agriculture – Economic Impact of Adoption of Climate Resilient
- Technologies in Semi-arid Region of Karnataka
- Josily Samuel1, C A Rama Rao, B M K Raju, Pushpanjali, Nagarjuna Kumar, Osman M, A
- Adaptation Strategies in Changing Climate
- Renu, Anil Kumar and Raj Singh
- Title: Climate change and land degradation in the Sudanian climate domain in Benin
- Adigbegnon Marcell1, Sanoussi Bendjedid Rachad2, Guelly Amé Rébecca3
- A study on rice (*oryza sativa* L.) germination under anaerobic conditions
- Afeefa C H1, Bingiala Laloo2
- Scheduling and rate of nitrogen fertilisation impacted ammonia volatilization losses and yield in maize field
- Renu Singh1, Manoj Shrivastava1, Shivdhar Mishra2, Ashish Khandelwal1, Sibananda Darjee1
- Identification of wheat amphidiploids derived from *Thinopyrum bessarabicum* for grain yield under drought and temperature stress
- Antim1, BS Tyagi2, Ashish Ojha2, Gyanendra Singh2, GP Singh2
- Response of Chinese potato [*Plectranthus rotundifolius* (Poir.) Spreng.] to elevated carbon dioxide concentrations
- Arunjith P1. and Sheeba Rebecca Isaac2
- Assessing intercrop performance and soil health under different agrihorticultural systems in hot arid Western Rajasthan
- Renjith P.S.\*1, N.D. Yadava2, Sheetal K.R1. and N.S. Nathawat2
- Mining nutri-dense accessions from Assam rice collection.
- 1Racheal John, 2Haritha Bollinedi, 1Christine Jeyaseelan, 2Siddhant Ranjan Padhi, 2Neha, 3Rakesh Singh, 3Sudhir Pal Ahlawat, \*3Rakesh Bhardwaj \*4Jai Chand



- Environmental implications of farming systems in mid-hills of Himachal Pradesh
- Shalini Sharma, M.S. Jangra and Satish Kumar Bhardwaj
- Climate change favours flowering in *Vitis x champini* cv. Dogridge
- Linta Vincent\* and Satisha.J
- Climatic change and rainfall modelling - a case study of Alappuzha, kerala
- Neethu R. S1\*, Brigit Joseph2 and Reshma P3
- Climate Resilient Practices Adopted in Flood and Drought Prone Areas of Siwan District, Bihar
- Harsha B. R.1, Krishna Bahadur Chhetri1, Nandeesh C. V.1, Anuradha Ranjan Kumari1, Shivam Chaubey2, Arun Kumar1 and Ratnesh Kumar Jha3
- Adaptation to mitigate climate-induced crisis by pigeon pea growing framers in Karnataka: implications for climate services in India
- Shanabhoga M B1\*, Krishnamurthy B1, Suresha S V1, R Vinaykumar1, Shivani Dechamma1
- Climate Change in Vegetable Production
- Shanel, Shivanjali Sarswat2, Deepa Benwall, Surabh Yadav1 and Rajinder Kumar
- Scientific and managerial innovations for promoting climate smart agriculture
- Archana V. Mahidala1; Pooja R. Nair2 and T. R. Ahlawat3
- Assessing the recreational value of ecosystem services in perspectives of sustainable use of forests.
- Ludarmani\*, Amit Guleria, Pardeep Mahal, and Gagan Mehta
- A quick method to identify salt tolerant genotypes at the seedling stage in wheat
- Srivijay Malipatil, S. S. Biradar, S. A. Desai and S. S. GUNDLUR
- Role of tree species in ecosystem sustainability and environmental conservation
- Asha1, Mohit Godara2, Parmod Kumar1
- Analysis of challenges and strategies in promoting climate change resilient agriculture in Northern Karnataka
- Bheemappa, A1., H.T.Chandranath2, and Shruthi S.M3
- ROLE OF TREE SPECIES IN ECOSYSTEM SUSTAINABILITY AND ENVIRONMENTAL CONSERVATION
- ASHA1, MOHIT2, PARMOD KUMAR1
- Utilization of Identified Local Genetic Resources in *Cassia auriculata* for adaptation and resilience farming in degraded land management
- S.Kala1\*, H.R.Meena, I.Rashmi, Shakir Ali and Ashok Kumar
- Evaluation of Himalayan landraces of black gram (*Vigna mungo* (L.) for yield and its component traits
- Alka Soharu
- Gene expression programming for forest fire risk modeling in Western Himalayas
- Divya Mehta1\*, Parminder Kaur Baweja2, Parul Barwal3, Diksha Bali4 and Parveen Kashyap5
- In vitro propagation and slow growth conservation of *Hedychium coronarium* J. Koenig - a vulnerable medicinal and aromatic plant at In Vitro Genebank, ICAR-NBPGR, New Delhi
- Ravi Gowthami\*, Neelam Sharma, Subhash Chander, Ramesh Chandra, Anuradha Agrawal,
- Vegetable Grafting: An innovative approach for abiotic stress resistance
- Nikhil Thakur1, Dr. Deepa Sharma1, Jasdeep Kaur2 and Rishabh Kumar1
- Characterization of drain discharge from subsurface drainage system at 40 m lateralspacing in saline vertisols of Tungabhadra command area
- Hanamantappa Meti1\*, J.Vishwanath1, A.V.Karegoudar2, H.Veeresh1 and S.R.Balanagoudar1,
- Adaptations and Mechanisms of Plants For Heat Stress Tolerance
- Ibtesam Anjum
- Climate Change Resilient Agriculture
- Ankita Singh
- Impact of climate change on agriculture pea crop production/ yields
- Ashish Kumar Nagar1, Ashutosh Singh Rajpoot2, Siddharth Namdeo3 and Badal Verma4
- Regulation of physiological and biochemical mechanism in wheat under combined drought and heat stress
- Shashi Meena1, Sukumar Taria1, Pavithra Krishana1, Sheel Yadav 2 & Ajay Arora1
- Effects of climate change on vegetable cultivation
- Jasdeep Kaur1, Sonia Sood1, Nikhil Thakur2, Jitendra Kumar1 and Harish. B.M1
- Climate change and its impact on agriculture
- Kunal Narwal and Tarun Sharma
- Modern practices and technology for climate resilient agriculture
- Jaipal1, Vikas Kumar2 and Naseeb Choudhary3
- Role of muconic acid production from paddy straw using indigenous fungus *Aspergillus*
- *clavatus* isolated from rice field of IARI, Pusa, New Delhi in climate change resilient Agriculture
- Livleen Shukla1, Hemant Kumar1, Vikrant Bhati1,3, Sandeep Kumar Singh1, V Govindsamy1, Satish Devram Lande2
- Multipurpose Windbreaks: Balancing Ecosystem services and Crop Yields in Arid Western Rajasthan
- K.R. Sheetal1, P. S. Renjith1, Birbal2, V. Subbulakshmi2 and P. C. Moharana3



- Carbon farming: an viable option for food, soil security and climate change
- Nymisha Alapati,
- Species Distribution Models : Multiple Uses and Methods
- Yasmin Shameem
- Precision farming:- demand of current as well as future agriculture
- Shivendra Pratap Rathore(1)
- Effect of elevated CO<sub>2</sub> and temperature on rice and wheat cropping system in Vertisol of Central India
- Rakesh, Mayanglambam Homeshwari Devi, Nagvanti Atoliya, Bharati Kollah, Santosh Mohan ty
- Rice Biodiversity Status at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India
- A.K.Sarawgi\*, S.K.Nair, Atul Pachauri and Moumita Burman
- DMS Cloud for Global Warming Mitigation
- Sakshi Patil\*, Kundan Kumar.\*\*, Bhautik D. Savaliya and Saiprasad Bhusare
- Molecular identification of fungal endophytes and their ability to confer drought tolerance in sorghum
- Sathwik M N Raj1, Santhosh G P2, Guruprasad A3, Ashok Priyadarshan A M4 and G S Srikanth5
- Drought Severity and Water Management Strategies in North Eastern Transition Zone of Karnataka
- \*Seedari Ujwala Rani1, Pramod Kumar2,,Naveen P.Singh3, Dharam Raj Singh2, S.K.Srivastava3, Ranjit Kumar Paul4 & R.N.Padaria5
- Impact of Dominant Land Uses on Soil Quality in Mid hills and High hills of Himachal Pradesh
- Shubham Sharma1, Satish Kumar Bhardwaj2 and Daulat Ram Bhardwaj3
- Estimation of crop water requirement and irrigation scheduling of rice in Shivamogga district of Karnataka using FAO CROPWAT
- Suprava Nath1\*, N. Devakumar2, Sitanshu Sekhar Patra3 and Abhishek Nanda4
- Rancidity: A limiting factor in the adoption of pearl millet as climate-resilient crop
- Atul Loyal1\*, S K Pahuja1 and Rakesh K. Srivastava2
- Rhizobacteria mediated drought stress alleviation for Sustainable agriculture in climate change era
- Marthala Bhuvaneshwar Reddy1\*, Sanjeev Kumar1, P. Sravani3 and S. Sravani4
- SEED TECHNOLOGICAL APPROACHES TO MITIGATE PRE-HARVEST SPROUTING IN SOYBEAN (*Glycine max (L.) Merrill*)
- Thota Joseph Raju1, S.N. Vasudevan2, Basave Gowda3 and Doddagoudar S. R4
- Effect of spacing on the coppice growth performance of Willow clones
- Tushal, JP Sharma, Anchal, Aman Mahajan and Shikha Thakur
- Performance of Pumpkin (*Cucurbita moschata L.*) and Cluster bean (*Cyamopsis tetragonoloba L.*) genotypes under sodic soil
- K. Kumanan\*, R. Jagadeesan and A. Nithya Devi
- Tuber crops – climate resilient crops for fostering food security
- Limisha N P
- Potato late blight disease prediction using meteorological parameters in Northern Himalayas of India
- Vaidheki1\*, S Hembram2 and Raj Kumar3
- Efficient water use for sustainable dairy production
- Letha Devi G, A Mech, Ravikiran G, Sejian V and M A Katakataware\*
- Growth performance of Brassica cultivars under elevated temperature gradients under present climate change scenario in Gwalior, Madhya Pradesh
- Amita Sharma, S.K. Trivedi and Rohit Sharma
- Assessment of elevated CO<sub>2</sub> levels on yield and nutrient status and uptake in pigeon pea and black gram
- S.K. Trivedi and Amita Sharma
- INTEGRATED FARMING SYSTEMS IN BRINGING RESILIENCE TO CHANGING CLIMATES THROUGH MICROCLIMATE MODIFICATION AND ENHANCED PRODUCTIVITY
- B.L.Manjunath\*,R.H.Laxman and G.K.Ramesha
- Microbial biofilms: An eco-friendly agri-input to enhance soil and cotton productivity
- Kulandaivelu Velmourougane\*, Rachna Pande, Dipak Nagrale, A. Manikandan, D. Blaise
- Agricultural insurance: A mitigation strategy to climate vulnerable risk
- J. Roselyn1, S. Ravichandran2, R. Venkataraman3 and J. Sam Ruban4 1. Research Scholar, 2&4. Associate Professor 3. Professor
- Screening and molecular characterization of bacterial endophytes from *Digitaria sanguinalis* and *Parthenium hysterophorus* for drought stress tolerance in chilli (*Capsicum annum L.*)
- Sagar, S. P.
- Changes in soil phosphorus fractions due to varied residues retention and phosphate fertilizer rates under conservation agriculture
- Priti Tigga1, Mahesh C. Meena1, S. P. Datta1, Abir Dey1, B. S. Dwivedi2
- Influence of training systems on fruit quality properties of apple
- Kuruva Mallikarjuna\* and J S Chandel



- Impact of climate change on Indian agriculture
- Sonal Sharma
- Productivity, resource-use efficiency, and greenhouse gases emission in wheat under a conservation agriculture-based pigeon pea-wheat system
- Tarun Sharma<sup>1\*</sup>, T. K. Das<sup>1</sup>, Susama Sudhithri<sup>2</sup>, Rishi Raj<sup>1</sup>, Suman Sen<sup>1</sup>, and Arkaprava Roy<sup>1</sup>
- Performance evaluation of cocoa genotypes for water deficit condition
- V. Jegadeeswari
- Assessment of women farmers' perspective on impact of climate change on dairy farming
- Dadimi Anilkumar Reddy<sup>1</sup>, Sanchita Garai<sup>1</sup>, Sanjit Maiti<sup>1</sup>, Manjunath K V<sup>1</sup>, Amitava Panja<sup>1</sup>
- Punjab: Policy options for agricultural sustainability nexus
- Sangeet Ranguwal<sup>1\*</sup>, Baljinder Kaur Sidana<sup>2</sup> and Sunny Kumar<sup>3</sup>
- COMPARATIVE ANALYSIS OF BACKCROSS AND SELFED PROGENIES IN SUNFLOWER (*Helianthus annuus* L.)<sup>\*</sup>
- \*Vikas Kulkarni, Sagar Iliger, M. R. Umesh, Muniswami, S. and H. P. Meena
- Biochar Synthesis from Agro Waste to Produce Novel Product for Sustainable Environment
- Nakum Divyangkumar<sup>\*</sup> and N. L. Panwar
- CLIMATE CHANGE IMPACT ON SOILS
- A. Senthilkumar<sup>1\*</sup>, B. Bhakiyathu Saliha<sup>2</sup> and P. Saravana Pandian<sup>3</sup>
- Assessment of irrigation water quality and soil fertility using GIS mapping in Coastal area of Ramanathapuram block Ramanathapuram district Tamil Nadu, India
- V. Arulkumar<sup>\*</sup>, and J. Prabhakaran<sup>2</sup>,
- ANALYSIS OF CHANGING PATTERN OF INDIAN COFFEE SECTOR
- Soujanya C.K.1
- Analysis of impact of climate change and its hydrological impacts for climate resilient agriculture
- Shivam
- Meta-QTL analysis and identification of candidate genes for abiotic stresses in maize (*Zea mays* L.) and their implications in breeding programmes
- Seema Sheoran<sup>1</sup>, Mamta Gupta<sup>1</sup>, Shweta Kumari<sup>2</sup>, Sandeep Kumar<sup>3</sup>, Sujay Rakshit<sup>1</sup>
- Carbon Fixation Efficiency of Trees
- Sumit Nangla<sup>1</sup>, Hari Paul Sankhyan<sup>2</sup>, Jai Pal Sharma<sup>3</sup> and Shikha Thakur<sup>4</sup>
- Impact of Climate Change on Agriculture Production and Crop Stability
- Harshit Mishra<sup>1</sup>, Aditya Bhooshan Srivastava<sup>2</sup> and Sandeep Gautam<sup>3</sup>
- Seed Priming and Stress Memory- A Promising Pair for Drought Stress Mitigation
- Kangan Pandit<sup>1</sup>, Mahesh Kumar Samota<sup>1,2</sup>, Monika Awana<sup>1,3</sup>, Suresh Kumar<sup>1</sup>, Veda Krishnan<sup>1</sup>, Archana Singh<sup>1</sup>
- Nakshtrawise rainfall pattern for agro-climatic zones of Karnataka state.
- Manoj Rajan and N. G. Keerthy
- Role of direct seeded rice in reduction of greenhouse gases
- Ritika Joshi<sup>1</sup> and Ashish Khandelwal<sup>2</sup>
- Phenotyping to dissect genotypic differences and identify source for moisture stress tolerance in Capsicum species
- Usha Rani E.,<sup>1\*</sup> Laxman R. H.<sup>1</sup>, Madhavi Reddy K<sup>2</sup>., Naresh P<sup>2</sup>., Kannan S.<sup>1</sup> and Hemamalini P<sup>1</sup>.
- **Theme - 5 Post-Harvest Technology: Agri-Value & Supply Chain for Sustainable Production**
- Biochemistry, fatty acid profiling and value addition of cashew sprout
- P. Preethi<sup>1</sup>, S. Mangalassery<sup>2</sup>, S.V.R. Reddy<sup>1</sup>, S.V. Ramesh<sup>3</sup>, S. Kumari<sup>4</sup> and S.S. Shetty<sup>4</sup>
- Physical and functional properties of extruded snack products prepared by blending of defatted peanut flour with corn flour
- P. R. Davara<sup>1</sup>, Mohit H. Muliya<sup>1</sup>, M. N. Dabhi<sup>1</sup>, V. P. Sangani<sup>1</sup>
- A study on marketing channels and marketing efficiency of vegetables in mid-hills of Himachal Pradesh
- Parul Barwal<sup>1</sup> and Subhash Sharma<sup>2</sup>
- Effect of blanching on the quality of green peas during freezing
- V. P. Sangani<sup>1</sup>, A. N. Dalsaniya<sup>1</sup>, P. R. Davara<sup>1</sup>
- Biodegradable and antimicrobial nanofilm from rice starch (kanjivellam) for food packaging and preservation
- Chinju Saji<sup>1</sup>, Shyma Sherin<sup>2</sup>, Malavika M3, Devika Giri<sup>4</sup>, P. K. Arshya<sup>5</sup>, Anujna Das<sup>6</sup>, Dr.Megha Shejoy<sup>7</sup>
- Marketing strategies adopted by Self Help Groups in Navsari district
- Priyanka Maity<sup>1</sup> and Ruchira Shukla<sup>2</sup>
- Future of warehousing technologies (Global vs Indian Scenario)
- Pavithira Vijayan
- Agricultural waste: Innovative techniques, challenges and future goals
- Saroj Bala<sup>1</sup> and Urmila Gupta<sup>2</sup>
- Consumer preferences for the products of minor millets in Tumakuru district of Karnataka
- Arjuman Banu, Ganapathy M.S., Siddayya, Girish M.R., Govinda Gowda V., Shamshad Begum and Mohan Kumar,



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- Study on zeolite filler polyethylene composite film containing silver and chlorine to extend the shelf life and maintain nutritional quality of acid lime fruits stored at ambient and refrigerated condition
- Praveen Gidagiri, M. D. Jameel Jhalegar, S. L. Jagadeesh and Babu A. G.
- Studies on development and storage of kiwifruit based probiotic beverage
- K. Ranjitha<sup>1</sup>, Harinder Singh Oberoi<sup>2</sup>, Pushpa Chethan Kumar<sup>3</sup> and S. Bhuvaneshwari<sup>4</sup>
- Influence of ozone treatment on carbohydrate content of wheat (*Triticum aestivum*) during bulk storage
- M. Shingala Abhishaben<sup>1</sup>, Dr. M. N. Dabhi<sup>2</sup>, Dr. P. J. Rathod<sup>3</sup> and R. Rathod Ravikumar<sup>4</sup>
- Optimization of wall materials for spray-dried shrimp shell (*Metapenaeus dobsoni*) protein powder and its impact on instant soup mix
- U. Lakshmi Seethi<sup>1</sup>, C. G. Joshy<sup>2</sup>, A. Jeyakumari<sup>2</sup> and A. A. Zynudheen<sup>3</sup>
- Study on drying characteristics of Simarouba glauca leaves
- S. S. Bhuva<sup>1</sup>, M. B. Darshan<sup>2</sup>
- Development of simarouba glauca leaf extract enriched edible food wraps
- Aswathy.K.S<sup>1</sup> and George Ninan<sup>2</sup>
- Information sources used by the farmers in agricultural inputs purchase: A case study of high hills temperate wet zone of Himachal Pradesh
- Ankit Pathania<sup>1</sup>, Rashmi Chaudhary<sup>2</sup> and Samriti<sup>3</sup>
- Recent trends in pectin extraction from apple pomace
- Ruchi Sharma<sup>1</sup>, Aastha Verma<sup>1</sup>, Harpreet Kaur Saini<sup>1</sup>, Anupama Anand<sup>1</sup>, Chahat Thakur<sup>1</sup> and Anjali Gautam<sup>1</sup>
- Post-harvest technology and food processing
- Archita Thakur<sup>1</sup> and Abhimanyu Thakur<sup>2</sup>
- Physicochemical characteristics, antioxidant properties and glycemic index of different types of basmati rice
- Febina M and Maya Raman
- UV irradiated mushrooms as a source of Vitamin D<sub>2</sub>
- K. C. Dileep<sup>1</sup>, Rakesh Sharma<sup>1</sup> and Priyanka<sup>1</sup>
- Implications for Agriculture waste management
- Dr. Subhita Kumawat<sup>1</sup> and Prabhudayal Kumawat<sup>2</sup>
- Use of post-harvest technology in adding value to flower crops
- Divya<sup>1</sup>, S.K. Sehrawat<sup>1</sup> and Raveena<sup>2</sup>
- Amelioration of pomegranate syrup and RTS with the fusion of chia seeds and sensorial attributes
- Gouthami Y<sup>1</sup>, Bhuvaneshwari G<sup>2</sup> and S. L. Jagadeesh<sup>3</sup>
- Groundnut shell: Waste to beneficial products a review
- Sukhdeep Kaur<sup>1</sup>, Gagandeep Kaur<sup>2</sup> and Gurveer Kaur<sup>3</sup>
- Moisture dependent physical properties of psyllium seeds for different varieties
- Nirav U. Joshi<sup>1</sup> and Mukesh N. Dabhi<sup>2</sup>
- Development of protein and mineral enriched gluten free cookies from quinoa and millet flour blends to combat malnutrition
- Monika Mahajan<sup>1</sup>, Prabhjot Singla<sup>2</sup> and Sucheta Sharma<sup>2</sup>
- Effect of different moisture content on the physical characteristics of dill seeds
- Vidhushi Mehta<sup>1</sup>, R. F. Sutar<sup>1</sup>, and Chandani Popalia<sup>2</sup>
- Effects of process parameters on rice based extruded snack food
- P. S. Sapariya<sup>1</sup>, V. P. Sangani<sup>2</sup> and P. R. Davara<sup>3</sup>
- Standardization of recipe for noni and kokum blended RTS beverage
- Prasad Patil<sup>1</sup>, K. S. Thippanna, S. L. Jagadeesh, G. Bhuvaneshwari, D. L. Rudresh and Arunkumar kamble
- An economics of harvesting, processing and marketing of *Phyllanthus emblica* in Mizoram: A case study of Champhai Serchhip and Aizawl District
- K. Pung Rozar
- Postharvest technology: Agri value and supply chain for sustainable production
- Richa Kumari
- Nutritional evaluation of functional fermented non-dairy beverage from roselles calyces
- Sarda Laikhuram<sup>1</sup> and Vijayalaxmi K.G<sup>2</sup>
- Effect of temperature and period on the functional and bioactive compounds of pearl millet (*Pennisetum glaucum* L.) grains during storage
- Shilpa S. Selvan<sup>1</sup>, Debabandya Mohapatra<sup>2</sup>, Adinath Kate<sup>2</sup>, Manoj Kumar Tripathi<sup>2</sup>, Karan Singh<sup>2</sup>, Manoj Kumar<sup>3</sup>, Abhijit Kar<sup>4</sup>, Bharat Modhera<sup>5</sup>
- Effect of pretreatments on shelf life of jackfruit bulbs
- H. B. Suma<sup>1</sup>, A.G. Babu<sup>2</sup> and S. L. Jagadeesh<sup>3</sup>
- Shiitake (*Lentinula edodes*) mushrooms: An unexplored source of functional polysaccharides with anti-diabetic potential
- Shuvarghya Chakraborty<sup>1</sup>, Sanjeev Kumar<sup>1</sup>, Archana Singh<sup>1</sup>, Susheel Sharma<sup>2</sup>, Anil Dahuja<sup>1</sup> and Veda Krishnan<sup>1</sup>





- Value addition in strawberry (*Fragaria x ananassa* Duch.) through active packaging system
- Swarup Anand Dutta<sup>1</sup> and Pritam Coomar Baruah<sup>2</sup>
- Standardisation of dehydration process and nutritional analysis of wild ginger (*Zingiber zerumbet*)
- Effect of pre-treatments on drying and quality characteristics of infrared dried apple slices
- Yashaswini S.N.
- Impact of antioxidant and antimicrobial biodegradable based film on shelf-life extension of chhana podo
- Ashritha B, Siva Kumar S, Rekha Chawla, Veena N and Viji P
- A comparative study of chemical and mineral constituents of Kolakhar produced from parts of different banana cultivars
- Aradhana Bordoloi<sup>1</sup> and Dharindra Nath Hazarika<sup>2</sup>
- Thermal modification of *Acrocarpus fraxinifolius* Wight & Arn. (Pink cedar) wood: a sustainable and eco-friendly approach
- Raveena Thakur
- Role of ICAR-KVK, Ballari in handholding fig growers and SHGs through entrepreneurship development programme and linking them with PMFME's ODOP scheme
- Shilpa Huchchannanavar<sup>1</sup> and B. K. Ramesh<sup>2</sup>
- A study on standardization of fig value added products from different varieties of figs grown in Ballari district of Kalyana Karnataka
- Shilpa Huchchannanavar<sup>1</sup>, B. K. Ramesh and R. P. Jayaprakash Narayan<sup>3</sup>
- Standardization of spray drying technology for production of custard apple powder
- Priya, B. Kurubar, A. R. Ashok, H. Ramesh, G. Udaykumar, N. Umesh, M. R and Rajkumar
- Process optimization for aqueous extraction of pigments from annatto (*Bixa orellana* L.)
- Manoja V<sup>1</sup> and Sudha P<sup>2</sup>
- Optimization and value addition of functional surimi based nuggets
- Anjana Jose E<sup>1</sup> and George Ninan
- Processing and value addition from dragon fruit
- Devang N. Khalasi<sup>1</sup>, Trimur R. Ahlawat<sup>2</sup> and Avnish K. Pandey<sup>3</sup>
- Impact of buckwheat flour incorporation on nutritional, structural and rheological characteristics of gluten free biscuits
- Rashim Kumari and Mahesh Gupta
- Characterizing cotton seed for industrial applications
- Jyotirmay Mahapatra, Prem Shanker Tiwari, Krishna Pratap Singh and Balaji Murhari Nandede
- An investigation of the predictors of losses and the constraints in post-harvest management
- Subhashree Sahu<sup>1</sup>, V Sangeetha<sup>1</sup>, Reshma Gills<sup>2</sup>, Sitaram Bishnoi<sup>1</sup> and Sukanya Barua<sup>1</sup>
- Impact of FPO-led maize marketing on farmers income in Karnataka
- Likhitha S
- Development and performance evaluation of lucerne harvesting machine
- J. V. Nandaniya, T. D. Mehta and S. K. Gaadhe
- Possibility of underusing cereals in the human diet
- Faruk Ansari, Sanjay Patidar, Priyanka Arya and Priyanka Chauhan
- Preservation and processing of fish
- Priti Mishra<sup>1</sup>, Madhuri Sharma<sup>2</sup>, Anil Kewat<sup>3</sup>
- Role of foodomics in food safety and quality assurance
- Anupama Anand<sup>1</sup>, Manisha Kaushal<sup>2</sup>, Devina Vaidya<sup>3</sup>, Anil Gupta<sup>4</sup>, Harpreet Kaur Saini<sup>5</sup>, Ruchi Sharma<sup>1</sup>, Chahat Thakur<sup>1</sup>, Anjali Gautam<sup>1</sup> and Aastha Verma<sup>1</sup>
- Time course of changes in physico chemical, sensorial and microbiological qualities in freshly extracted coconut milk
- P. P. Shameena Beegum, Alka Gupta, Murali Gopal, S.V. Ramesh., P. Sugatha, R. Pandiselvam, M. R. Manikantan, K. B. Hebbar
- Proximate composition of developed composite flour used for bakery products
- Sumitra Chhotaray
- Exploring the nutritive and functional properties of by-products from mango fruits
- Harpreet Kaur Saini<sup>1</sup>, Devina Vaidya<sup>2</sup>, Manisha Kaushal<sup>3</sup>, Anupama Anand<sup>4</sup>, Ruchi Sharma<sup>5</sup>, Chahat Thakur<sup>6</sup>, Aastha Verma<sup>7</sup>, Anjali Gautam<sup>8</sup>
- Production and quality evaluation of ready to eat fortified rice extrudates from selected NRRRI rice varieties
- Sivashankari. M1, Torit B Bagchi<sup>1</sup>, Awadhesh Kumar<sup>2</sup>, Subudhi HN<sup>2</sup> and Sutapa Sarkar<sup>2</sup>
- Fortification of Aonla candy using karonda extract
- Vijay Rakesh Reddy S1,<sup>2</sup> Mukesh Berwal<sup>2</sup>, Ramesh Kumar<sup>2</sup> and Preethi P1
- Extraction and characterization of liquid smoke from locally available wood smoke
- Reshma CS<sup>1</sup>, Bindu J2, and Sathish Kumar K2
- Potential of selected underutilized leafy vegetables against CCl<sub>4</sub> induced oxidative stress on wistar rats
- R. Hamsa<sup>1</sup>, K. R. Vasudeva<sup>2</sup>, G. K. Sadananda<sup>3</sup> and V. M. Chandrashekhara<sup>4</sup>



- Impact of drying temperature and pretreatment on non-enzymatic browning and its associated biochemical changes in white guava (cv. Allahabad Safeda) fruit bar
- Karthik Nayaka V. S., Tiwari R. B., Narayana C. K., Vasugi C., Shamina Azeez, Ranjitha, K., Venugopalan R. and Bhuvanewari S.
- In vitro digestion improved the bioactive properties of the optimized formulation of eggnog
- Kamini Sharma<sup>1</sup>, Heena Sharma<sup>1</sup>, A. K. Singh<sup>1</sup>, and Priyanka Singh Rao<sup>2</sup>
- Sensory characteristics and proximate composition of food products developed from minor millets
- Laghima Arora<sup>1</sup> and Renuka Aggarwal<sup>1</sup>
- Antioxidant and anti-diabetic activities of banana pseudostem and inflorescence extracts
- K. S. Gayathry<sup>1</sup> and Jenny Ann John<sup>2</sup>
- Value addition of underutilised little millet as a ready to reconstitute smoothie mix
- Neeharika B, Jessie Suneetha W
- Genetically Modified Food: Bane or Boon
- Priyanka Chauhan, Faruk Ansari, Anchal Chauhan and Sanjay Patidar
- Influence of common processing methods on the storage stability of foxtail and proso millet
- Shenazdeep Kaur<sup>1</sup> and Renuka Aggarwal<sup>1</sup>
- Detection of adulterants in honey: Need of an hour
- Sukhmanjot Kaur, Sandhya and Gurveer Kaur
- Post-Harvesting Technology: Agri-Value & Supply Chain for Sustainable Production Agricultural Waste Management
- Mehvish Bashir<sup>1</sup>, Shijaatt Hussain Bhat<sup>2</sup>, M.A Dar<sup>3</sup>, S.S Kubravi<sup>4</sup>, Quadri Javeed Ahmad<sup>5</sup>, Huzaifa Farhein<sup>6</sup>, Tehniya Bashir<sup>7</sup> and Beenish Khuroo<sup>8</sup>
- Comparative anthocyanin purification capacity of adsorbent and ion-exchange resins
- Effect of pretreatment on engineering properties of pearl millet (FBC 16) and foxtail millet
- Kashish Choudhary<sup>1</sup>, Gurveer Kaur<sup>2</sup> and Sandhya<sup>3</sup>
- Bioactive compounds of turmeric powder affected by grinding method and feed temperature
- M. N. Dabhi<sup>1</sup>, P. R. Davara<sup>1</sup>, H. P. Gajera<sup>2</sup>, Nirav Joshi<sup>1</sup>, Parth Saparia<sup>1</sup>
- Anindita Paul<sup>1,2</sup>, Anirban Dutta<sup>1</sup>, Aditi Kundu<sup>1</sup>, Supradip Saha<sup>1</sup>
- An investigation causes of post –harvest losses of major fruits in district Prayagra, Uttar Pradesh
- Ramchandra<sup>1</sup>, Nitin Barker<sup>2</sup> and Ashish S. Noel<sup>3</sup>
- Optimization of ultrasonic assisted hydrophobic deep eutectic solvent-based extraction of lutein esters from marigold using response surface methodology
- Soumyajit Ghoshal, Anirban Dutta, Supradip Saha, Aditi Kundu and Anupama Singh
- Utilization of pomegranate by-product for oxidative and microbial stability of muffins
- Namrata Ankush Giri, Nilesh N. Gaikwad, Ashish Maity, Manjunatha N. and R.A. Marathe
- Digestibility and stabilising properties of citric acid esterified cassava starches prepared at various concentrations and hydrolysis time
- P.S. Adhiyamaan<sup>1</sup> and R. Parimalavalli<sup>2</sup>
- Export of Indian Spices –Analyses of Growth, Instability and Direction
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- Valorisation of jack fruit seed instant soup mix - a sustainable food based approach to meet the challenges of malnutrition
- Madhavi Reddy M<sup>1</sup>, Anjana Thampy<sup>2</sup>, Shravani KA<sup>3</sup>, Nagaraj<sup>4</sup>
- Natural colour pigments as functional food ingredients
- Anjali Gautam<sup>1</sup>, Ruchi Sharma<sup>1</sup>, Anupama Anand<sup>1</sup>, Harpreet Kaur Saini<sup>1</sup>, Pooja Soni<sup>1</sup>, Aastha Verma<sup>1</sup> and Chahat Thakur<sup>1</sup>
- Quality Function Deployment (QFD)-Fuzzy logic approach to deduce consumer's requirement for the quality attributes of kheer
- Harshitha M<sup>1</sup>, Menon Rekha Ravindra<sup>1</sup>, Supreetha S<sup>1</sup>, M Sivaram<sup>2</sup>, Monika Sharma<sup>3</sup>
- Cooking quality, nutritional composition and consumer acceptance of functional jackfruit pasta enriched with red amaranthus
- B. S. Swathi<sup>1</sup>, Lekshmi G.P.R<sup>2</sup> and M. S. Sajeev<sup>3</sup>
- Development of enzyme linked immunosorbent assay using recombinant cathepsin B5 antigen for early diagnosis of bovine tropical fasciolosis: A new approach
- Pinaki Prasad Sengupta<sup>1</sup>, Siju Susan Jacob<sup>1</sup>, Bandakote Sreeramareddy Pavithra<sup>1</sup>, Atru Gnana Surya Chandu<sup>1</sup>, Opinder Krishna Raina<sup>2</sup>
- Influence of ultrasonication-assisted enzymatic extraction on physico-chemical, structural and prebiotic potential of soluble dietary fiber extracted from pomegranate peel
- Shriya Bhatt<sup>1,2</sup>, Mahesh Gupta<sup>1</sup>
- Exploring the nutritional perspective of Azolla for its application as functional food ingredient
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- Combined effects of 1-MCP and MAP on fruit quality of guava cv. Arka Mridula during cold storage
- Sachin A. J., D.V. Sudhakar Rao., S. Vijay Rakesh Reddy., Ranjitha K., Karthik Nayaka V. S.
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- Madhubala Thakre1, Hanamant1, Rutuparna Senapati1, Akshay1, A. Nagaraja1, M.K. Verma1, Shalini Gaur1, Supradip Saha1, Eldho Verghese1, Gopala Krishnana S1 and Amitha S.V. Mithr
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- Revision of existing seed multiplication ratio and its significance in quality seed production system in India
- Radhika C<sup>1</sup>., Govind Pal<sup>2</sup>, Udaya bhaskar K.<sup>3</sup> and Rajendra Prasad S<sup>4</sup>.
- Use of robotics in food and beverage industry: Technology towards agriculture 5.0
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- Apple pomace use for value-added products in food industry
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- Studies on vase life of *Asparagus densiflorus* 'Sprengerii' as influenced by different chemical preservatives
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- Vennila Murugan1, Manikandavelu D1, Aruna S1 and Rajeswari C1
- PERFORMANCE OF SOVIET CHINCHILLA RABBIT ON DIET SUPPLEMENTED WITH INDIAN CORAL PLANT (*ERYTHRINA STRICTA*)
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- ECONOMICS OF ANIMAL DISEASES: A SYSTEMATIC REVIEW IN SMALL RUMINANTS
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- EPIDEMIOLOGICAL INVESTIGATION OF PNEUMONIC PASTEURELLOSIS INDICATE POSSIBLE CARRIER STATUS OF PASTEURELLA MULTOCIDA IN SHEEP FARMS IN KARNATAKA
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- A V Kowshik, R Yogisharadhya, G B Manjunatha Reddy, Mohd. Mudassar Chanda, Awadesh Prajapathi, Srikanta P Patra, Niharika Kondhalkar, Vinod M Sharma, K S Ashik, S N Mallikarjunaiah and Sathish B Shivachandra
- SURFACE PROTEINS OF PROBIOTIC LACTOBACILLI EXHIBIT STRAIN SPECIFIC PROTECTIVE ROLE IN COLITIS MICE
- Chandhni PR1, Diwas Pradhan, Sunita Grover
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- “AMELIORATIVE EFFECT OF FOXTAIL MILLET (SETARIA ITALICA) FORTIFIED FERMENTED PROBIOTIC LASSI ON INDUCED OBESITY AND TYPE-2 DIABETES”
- Pallavi Ratha<sup>1</sup>, Om Prakash<sup>1</sup>, Gautam Kaul<sup>1</sup>
- SIMULATION APPROACH TO COMPARE DIFFERENT BIOGAS BURNER DESIGNS
- P.S. Minz<sup>1</sup>, Chitranyak<sup>2</sup>, A.D. Vairat<sup>3</sup>, Nitin Tyagi<sup>4</sup>, J.K. Dabas<sup>5</sup>
- QUALITY ASSESSMENT OF IMPROVED GRASSES FOR LIVESTOCK NUTRITION ON DEGRADED GRASSL & UNDER MID HILL CONDITIONS OF H.P.
- Shalley<sup>1</sup>, Rameshwar Kumar <sup>2</sup>, Nesar Ahmad Nesar <sup>3</sup>, Punam <sup>4</sup> and Naveen Kumar<sup>5</sup>
- HERITABILITY ESTIMATES OF PRODUCTION AND REPRODUCTION TRAITS OF FIRST LACTATION IN CROSSBRED CATTLE
- SIMRAN KAUR, AK GHOSH, D KUMAR, RS BARWAL, BN SHAHI and SUNIL KUMAR
- SOIL ENZYMATIC ACTIVITY AND MICROBIAL COUNT AFFECTED BY DIFFERENT NUTRIENT MANAGEMENT PRACTICES UNDER FODDER PEARL MILLET CULTIVATION
- Rakesh Kumar<sup>1\*</sup>, Hardev Ram<sup>2</sup>, Sandeep Kumar<sup>1</sup> and Praveen B. R. <sup>1</sup>
- EXPLORING THE NUTRITIONAL POTENTIAL OF WILD GRASS FODDER FOR MEGA HERBIVORE (ELEPHAS MAXIMAS) IN FOOTHILLS OF WESTERN GHATS
- \*M. Packialakshmi <sup>1</sup>, M. P. Divya <sup>2</sup>, K. Baranidharan <sup>3</sup>, K.T. Parthiban <sup>4</sup>, S. Geetha <sup>5</sup> and K.N. Ganesan <sup>6</sup>, R.Ravi, S.Manivasakan
- DEVELOPMENT OF CEREBELLUM IN PRENATAL GADDI SHEEP FETUSES
- Brij Vanita<sup>1</sup>, Rajesh Rajput<sup>1</sup>, Virender Pathak<sup>1</sup> and Ankaj Thakur<sup>2</sup>
- DOUBLING FARMERS INCOME THROUGH INCREASING MECHANISATION OF DOMESTIC PROCESSING EQUIPMENT AT LARGE SCALE IN DAIRY AND FOOD SECTOR
- Mahendra Kumar<sup>1</sup> and Shankar Lal<sup>2</sup>
- DEVELOPMENT OF CEREBELLUM IN PRENATAL GADDI SHEEP FETUSES
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- Mahendra Kumar<sup>1</sup> and Shankar Lal<sup>2</sup>
- EFFECT OF ALUMINA DOPING TO BIOGENICALLY SYNTHESISED ZNO NANOPARTICLES FROM COW URINE
- Somveer<sup>1</sup>, Dr. F. Magdaline Eljeeva Emerald<sup>2</sup>, Shivanand<sup>3</sup>
- MANGO FLAVOURED MILK FROM STABILIZED SOUR COW MILK
- Maumita Adhikary, Anindita Debnath, M.K. Sanyal, Kuntal Roy, Milan Mandal
- ROLE OF ARTEMISIA ANNUA ESSENTIAL OIL IN METHANE MITIGATION FROM RUMINANTS UNDER IN VITRO CONDITIONS
- Ankit Kumar Jangir, Parul Chaudhary, Goutam Mondal\*
- EFFECTS OF ORAL LACTOFERRIN AND PROBIOTIC INTERVENTIONS IN EARLY LIFE ON GUT HEALTH AND NEONATAL PIGLET MORTALITY
- Varun Kumar Sarkar <sup>1</sup>, Ujjwal Kumar De <sup>2</sup>, Anju Kala <sup>3</sup>, Ashok Kumar Verma <sup>3</sup>, Anuj Chauhan <sup>4</sup>, Babul Rudra Paul <sup>1</sup>, Srishti Soni <sup>1</sup>, Jitendra Singh Gandhar <sup>1</sup>, Pallab Chaudhuri <sup>5</sup>, Manas Kumar Patra <sup>4</sup>, Chethan Gollahalli Eregowda <sup>6</sup>, Gyanendra Kumar Gaur <sup>4</sup>
- CONVENTIONAL AND COPRO-PCR TECHNIQUES FOR DETECTION OF TAENIID EGGS OF DOGS
- P. Roja\* and V. Chengalva Rayulu
- METAGENOMIC INSIGHTS IN RESPONSE TO HOST-SPECIFIC PROBIOTICS SUPPLEMENTATION UNDERLYING THE DIFFERENCE IN PERFORMANCE, IMMUNITY, AND FECAL MICROBIOTA OF PRE-RUMINANT BUFFALO CALVES
- Vinay V.V., Sachin Kumar\*, Supriya Chhotaray, G. Mondal, Nitin Tyagi, and A.K. Tyagi
- NOVEL POLYMORPHIC VARIANTS IN STEAROYL-COENZYME A DESATURASE 1 (SCD1) GENE ASSOCIATED WITH MILK FAT CONTENT IN EGYPTIAN AND INDIAN BUFFALO BREEDS
- Sonia Sihag<sup>1</sup>, Vinod Chhokar<sup>1</sup>
- EFFECT OF RICE DISTILLERS DRIED GRAINS WITH SOLUBLE (RDDGS) ON PRODUCTION PERFORMANCES IN LOW INPUT TECHNOLOGY (LIT) MEAT PURPOSE COLOURED CHICKEN IN TRIPURA
- Tapan Kumar Das, Bikas Chandra Debnath, Jewel Debnath, Debolina Kar, Bijoy Sarkar, Biplab Debroy and Seuli Saha Roy
- ROLE OF VITAL INGREDIENTS IN TECHNOLOGY OPTIMIZATION AND QUALITY EVALUATION OF PIZZA CHEESE (MOZZARELLA)



- Viji P C\*, Rekha Chawla , Nitika Goel ,Siva Kumar S and Veena N
- ADVANCES IN DAIRY AND VETERINARY SECTOR TOWARDS SUSTAINABLE DEVELOPMENT GOALS MOLECULAR CHARACTERISATION OF ENTEROBACTERIA FROM RESPIRATORY INFECTIONS OF ANIMALS.
- Lincy Bernard\*, R.Sridevi, Rutuparna , Lavanya.V, M .Nagalingam and B.R.Shome
- CHARACTERIZATION OF RECYCLED MANURE SOLIDS AS COW BEDDING MATERIAL
- Priyanka Meena, Mukund A. Kataktalware\*, Rekha Ravindra Menon, Jeyakumar Sakthivel, Mamta Chauhan, A. Manimaran, B. Srinivas and Ramesha K.P.
- CAROTENOIDS ENRICHED GHEE AND ITS QUALITY PARAMETERS
- Ankit Chavhan<sup>1</sup>, Laxmana Naik<sup>2\*</sup>, Sonu K. Shivanna<sup>3</sup>, Priyanka Singh Rao<sup>2</sup>, and Rama Krishna Prasad<sup>4</sup> <sup>1M. Tech Scholar, 2Scientist, 3Senior Technical Officer, 4Technical Officer</sup>
- PREPARATION OF MORINGA POD PULP POWDER AND EVALUATION OF PHYSICO-CHEMICAL AND BIO-FUNCTIONAL PROPERTIES
- Sonu K. Shivanna.<sup>1</sup>, Laxmana Naik<sup>2\*</sup>, Priyanka Singh Rao<sup>2</sup>, and Ankit Chavhan<sup>3</sup> <sup>1PhD Scholar, 2Scientist, 3M.Tech Scholar</sup>
- RESOURCE USE EFFICIENCY OF FARMING SYSTEM IN KORAMANGALACHALLAGHATTA VALLEY PROJECT AREA
- Pavithra, K.N.<sup>1</sup>, G.M. Gaddi<sup>2</sup> and Pooja<sup>3</sup>
- **Theme - 7 Role of Agrochemicals, Biological & Technological Interventions Towards Safe Food and Nutritional Security**
- Temperature and moisture dependent virulence of the entomopathogenic nematodes against larval and pupal stages of *Spodoptera frugiperda* (Lepidoptera: Noctuidae)
- Jagadeesh Patil\*<sup>1</sup>, V. Linga<sup>1</sup>, Kesavan Subaharan<sup>2</sup>, Omprakash Navik<sup>1</sup> and J. C. Sekhar<sup>3</sup>
- Effect of organic manure and nitrogenous fertilizers on jassid population and yield in brinjal
- Kapil\*<sup>1</sup>, Dilbag Singh Ahlawat<sup>2</sup>, Kalpana Yadav<sup>3</sup>
- Pesticide residue deposits in Unmanned Aerial Vehicle spray system in maize and rice crop
- A. Suganthi<sup>1</sup>, P. S. Shanmugam<sup>2</sup>, T. Srinivasan<sup>3</sup>, S. V. Krishnamoorthy<sup>1</sup>, R. Kumaraperumal<sup>4</sup> and K.Bhuvaneshwari<sup>1</sup>
- Reaction of cowpea genotypes for resistance against legume pod borer, *Maruca vitrata* (Fabricius)
- Aarthi Sakthi and Selvanarayanan Venkatesan
- Susceptibility of white grub, *Melolontha cuprescens* Blanchard infesting apple to local strain of *Beauveria brongniartii* (Saccardo) in Himachal Pradesh
- 1,2Abhishek Rana\*, 1Ravinder Singh Chandel, 1Kuldeep Singh Verma, 3Anudeep B. Malannavar
- Management of *P. xylostella* on cauliflower crop through novel group of insecticides
- Abhijith. N1\*, Tirupati Murali Krishna<sup>2</sup>, Kaarumanchi Kiran Kumar<sup>2</sup> and Kayam Devaki<sup>1</sup>
- A new class of dual-purpose nanoparticles for detection vis-à-vis photocatalytic degradation of pesticide residues in water
- Abhishek Mandal<sup>1\*</sup>, Neera Singh<sup>1</sup>, Dibakar Sahoo<sup>2</sup>
- Identification of Sources and Mechanism of Resistance in Jute Germplasm against Lepidopteron Pest Complex
- B. S. Gotyal<sup>1\*</sup>, S. Satpathy<sup>2</sup> and V. Ramesh Babu<sup>2</sup>
- Confirmation of the presence of chitinase gene in native *Beauveria bassiana* isolates causing the mortality of cassava mite, *Tetranychus truncatus* Ehara (Acari: Tetranychidae)
- Chaithra Manju<sup>1</sup>, T. Pameela Devi<sup>1</sup>, Deeba Kami<sup>1</sup> and Bhagyashree Sira Neelakanthiah<sup>2</sup>
- Life fertility studies of different populations of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee)
- Vanshdeep Dhandal<sup>1</sup> and Rakesh Kumar<sup>2</sup>
- Field evaluation of integrated pest management modules against sucking insect-pests in okra under mid hills of Himachal Pradesh
- Tanuja Banshtu, Y. R. Shukla, Ramesh Kumar Bhardwaj, Sandeep Kansal, Kuldeep Thakur and S. C. Verma
- Evaluation of different sex pheromone trap designs against shoot and fruit borer, *L. orbonalis* in brinjal
- Kahkashan Wali, Swati S. Gamit, C. B. Varma,
- Development of sustained release encapsulations of pesticides using biopolymers as suitable carriers: A review
- Naincy Rani, Parveen Kumari and Anil Duhan
- Population growth parameters of *Aphelinus asychis* Walker on *Myzus persicae* (Sulzer) in bell pepper
- Priyanka Sharma, PL Sharma and SC Verma
- Evaluation of biopesticides against *Callosobruchus maculatus* Fabricius in chickpea under stored conditions
- Sindhura. K. A1 and P. H. Godhani<sup>2</sup>
- *Plumeria alba*, an attractive alternate host for the mass multiplication of papaya mealy bug parasitoid, *Acerophagus papayae*
- S. Sheeba Joyce Roseleen and V. K. Satya
- *Rhizophora dominica* (Coleoptera: Bostrychidae): Studies on screening techniques of wheat genotypes/varieties for resistance
- Syed Mohamed Ibrahim S.\* , F. K. Chaudhary<sup>1</sup>, V. Prithiv Raj<sup>2</sup> and B. Rajasekharan<sup>3</sup>





- Bioefficacy of enhancement brown algal seaweed with organic inputs against rice leaf folder, *Cnaphalocrocis medinalis* Guenee (Lepidoptera: Crambidae)
- S. Balamurugan\* and R. Kannan
- Efficacy of various organic pesticides against *Leucinodes orbonalis* in brinjal crop
- Manoj Kumar Mahla, Hemant Swami, Anil Kumar Vyas
- Characterization of fatty acid composition from wax secreted by grapevine mealybug, *Maconellicoccus hirsutus* (Green)
- Ekta S. Bhojar, Deependra Singh Yadav, Ahammed Shabeer T. P., Santosh S. Ajabe and Anita R. Pardeshi
- CRISPR-Cas9 mediated genome editing: a novel tool for Insect Pest Management
- Shiwani1, P.S. Shera1, Shveta Thakur1 and Mayur Wabhitkar1
- Morphological and molecular screening of different wild *Ipomoea* sp. and sweet potato (*Ipomoea batatas* (L.) Lamarck for sweet potato weevil resistance
- B.G. Sangeetha1, C. A. Jayaprakas1, T. Makeshkumar1, Shirly Raichal Anil2
- Jute stick activated carbon (NINFET-JAC) as an alternative clean-up agent to graphitised carbon black for pesticide residue analysis in food materials
- Rakesh Kumar Ghosh1\*, Deb Prasad Ray1, Sambhu Nath Chattopadhyay1, D. B. Shakyawar1, Kaushik Banerjee2
- Persistence and residue dissipation behavior of dimethoate and malathion in tomato fruits
- Ekta Kaushik and Jatiender Kumar Dubey
- Survey and surveillance of spotted pod borer (*Maruca vitrata*) as potential pest of yard long bean (*Vigna unguiculata* sub spp. *sesquipedalis*) in Southern Karnataka
- Ramesh M Maradi\*, K. Rajashekarappa and G. Durga
- Agricultural Chemical Waste Management
- Pooja1, and Suruchi2
- Decontamination studies of fenvalerate, imidacloprid and profenofos residues on cabbage using household products
- Sheenam Bhateja
- Effect of intercropping with biopesticide application on incidence of major insect pest of cauliflower
- Anil Kumar Vyas, Hemant Swami and Manoj Kumar Mahla
- Studies on residues and dissipation of fluensulfone and fluopyram in/on tomato
- Kanad Mukherjee
- Assessment of resistance in greengram genotypes against spotted pod borer, *Maruca vitrata* (Fabricius)
- Revathi Mani and Selvanarayanan Venkatesan
- Development of novel molecules through bioinformatics approaches for the ecofriendly pest management strategy
- R\*. Gandhi Gracy and T. Venkatesan
- Physicochemical aspects of vermiwash obtained from neem leaves and its potential use as biopesticide
- Abdullah Ansari and Khashminie S. Shivdat
- The effect of attract and reward strategy in enhancing biological control of brown plant hopper, *Nilaparvatha lugens* in rice
- Himabindu Parsi1 and Chitra Shanker2
- Bio-efficacy of different acaricides against two spotted spider mite, *Tetranychus urticae* Koch infesting okra under field condition
- Swati S. Gamit, Kahkashan Wali and C. B. Varma
- Incidence level, nature of damage and management of *Celosterna scabrator* (Coleoptera: Cerambycidae) infesting grapevines
- Gokul S. Shankhpal and Deependra Singh Yadav
- Demonstration of effective concentration of *Isaria fumosorosea* against Rugose Spiraling Whitefly in coconut
- Kanuri Komala Siva Katyayani Kanuri 1, Nelli Yashwanth Kumar Nelli 2, Dibya Sree Dutta 1, Palash Deb Nath1
- Biopesticides: an organic approach for pest management in cabbage
- Vipul\*1, D. B. Sisodiya 2 and Ankit Saini1,
- Sustainability of Italian honeybee, *Apis mellifera* L. in an innovative flow hive under Bengaluru conditions
- K. S. Jagadish, P. K. Gana, M. S. Nature, B. V. Shwetha, G. Eswarappa and K. T. Vijayakumar
- Traditional ways of seed treatment with botanicals to control storage insects and to increase seed germinability in field conditions of Sesame
- Gagandeep Singh1\*, V.S. Mor1, Axay Bhuker1, Rahul Kumar1, Sultan Singh1, Manuj Saini2, and Puneet3
- Bio-efficacy of organic treatments on the population of major insect pests infesting cabbage and cauliflower
- Hemant Swami, Manoj Kumar Mahla, Anil Kumar Vyas
- Bio-efficacy of organic treatments on the population of major insect pests infesting cabbage and cauliflower
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- Characterization of fatty acid composition from wax secreted by grapevine mealybug, *Maconellicoccus hirsutus* (Green)
- Ekta S. Bhojar, Deependra Singh Yadav, T. P. Ahammed Shabeer, Santosh S. Ajabe and Anita R. Pardeshi
- Insect pests and parasitoids in the rice fauna's ecosystem

- Mary Lisha J1 and Kanagarajan R2
- Field evolved resistance to insecticides and the biochemical mechanism involved in pink bollworm, *Pectinophora gossypiella*, (Lepidoptera: Gelechiidae)
- T. N. Madhu1\*, K. Muralimohan2, V. Chinnababu Naik3, Prabhulinga, T3, Rachna Pande3 and Shah Vivek3
- Development and validation of management modules for rugose spiralling whitefly *Aleurodicus rugioperculatus* Martin in coconut
- B. Vinothkumar\*, V. Sivakumar, P. Latha, A. Gowsalya, B. Meena, C. Sudhalakshmi and S. Praneetha
- Nature of damage and spatial distribution pattern of stem borer, *Stromatium barbatum* (Cerambycidae: Coleoptera) infesting grapes
- Santosh S. Ajabe, Deependra Singh Yadav and Ekta S. Bhoyar
- Effect of surface and seed treatment on rice seed storage pest *Sitotroga cerealella* (Olivier)
- R. Vigneshwari1\* and A. Suganthi2
- Effect of seed treatment and botanicals on the damage caused by *Atherigona soccata* on sorghum
- Ritu bhall\* and Arvind
- Development of a multiresidue method for analysis of multiclass pesticides in vegetable by gas and liquid chromatography with triple quadrupole tandem mass spectrometry
- Rounak Saha,
- Strategies to improve RNAi efficiency for insect pest management
- Shveta Thakur1, Sudhendu Sharma1, Anil Sood2, Shiwani1 and Mayur Wabhitkar1
- Antifeedant activity and biochemical effects of essential oils and their major constituents on rice moth, *Corcyra cephalonica*
- Sowmya, M, Kesavan Subaharan, T. M. Vinaykumar, and M. L. Mahalakshmi
- Structure Activity Relationship (SAR): A novel approach for developing new generation insecticides
- Atul Raghunatha Mohapatra\*1, Dilipsinh B. Sisodiya2, Kaushik D. Parmar3 and Ramji G. Parmar4
- Identification of potential resistance donors against brown planthopper, *Nilaparvata lugens* from indigenous genotypes of India
- \*Guru-Pirasanna-Pandi G, Aashish Kumar Anant, Soumya Bharati Babu, Raghu S, Annamalai M, Basana-Gowda G, Naveenkumar Patil, Totan Adak and P. C. Rath
- Bioinsecticidal potency of Piper chaba Hunter leaf extract against *Aulacophora foveicollis* Lucas: evaluation of active chemical constituents, mode of action and phytotoxicity
- Sushovan Das1, Arnab Kundu1, Sandip Mondal2, Bappa Ghosh1, Arijita Bhattacharyya1, Debasish Singha1, Narayan Bhowmick1, Kusal Roy3, Sankhajit Roy1
- Exploration of Insecticidal Property in the Bruchid Resistance Genotype V2802BG of *Vigna radiata* through GC-MS Analysis
- J. K. Lekshmi1\*, J. S. Kennedy2, N. Senthil3 and D. Malarvizhi4
- Sorption behaviour of Modified QuEChERS clean-up agents on pesticides Madhu Tippannanavar, Sudama Sahu, Harshang Talaviya, Sumit Shekhar, Tirthankar Banerjee,
- Bijedra Singh
- Evaluation of newer insecticides against sucking pests of brinjal Akanksha Narayan Humane and P.R. Zanwar Effect of pesticide residue on vegetable
- Diksha Thakur, Dinanter Pal Kaur, Pooja
- Understanding of programmed cell death (PCD) in *Xanthomonas axonopodis* pv. *glycines* for plant disease control
- Jyoti Tripathi 1,2 and Satyendra Gautam1,2\*
- In vitro evaluation of the efficacy of fungicides against basal rot of garlic
- Sonakshi1, Rishika Dangi1 and Meenu Gupta2
- In vitro evaluation of fungicides, bioagents and botanicals against *Alternaria alternate* causal agent of leaf and fruit spot of Apple.
- G. S. Madhu1\*, Sajad Un Nabi2, Javid Iqbal Mir2, Vishal Dinkar2, O. C. Sharma2
- In-Vitro Bioremediation of E-Polymer Employing Potent Bacterial Strains Moumita Chakraborty
- Management of Anthracnose Rot (*Colletotrichum* Spp.) of Tomato using ethanol based plant extracts
- Chetna Mahajan1, Monica Sharma2, Rakesh Devlash1 and Riya1
- Antifungal potentiality of *Aspergillus niger* isolates as a bio-control agent against *Fusarium wilt* of guava
- R. Gangaraj1, A. Nagaraja2, T. Prameeladevi1, Rubin Debbarma1, Anjali Kumari1, Amrita Das1 and Deeba Kamil1\*
- Growth and nutrient uptake of black pepper cuttings as positively affected by arbuscular mycorrhizal fungi under nursery conditions
- C. Sarathambal\*, V. Srinivasan, R. Sivaranjani, A. Jeevalatha, K. P. Subila and Priya George
- Identification of new sources of resistance to MYMV and powdery mildew in green gram
- Abhimanyu Ingle\*, S. B. Revanappa, P. R. Sabale, Gurupad Balol, B. Manu and M. Suma
- Profiling of Non-volatile Secondary Metabolites of *Chaetomium globosum* and In-vitro evaluation for potential antifungal activity against soil borne fungi
- Rakesh Kumar\*, Aditi Kundu and Vijay Kumar



- Plant defense inducers for the management of Alternariaster leaf spot and Sunflower necrosis disease
- Poornima\*, Vikas Kulakarni, Vijaykumar N. Ghante and M. R. Umesh.
- Antagonistic activity of yeasts and botanicals against the post-harvest rot caused by *Penicillium digitatum* in Kinnow mandarin
- A. Aravinthkumar and Harender Raj Gautam
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- Sonali Parwan, Harender Raj Gautam, Devinder Kumar Banyal and Diksha Sinha
- In vitro evaluation of chemicals against *Xanthomonas campestris* pv. *mangiferaeindicae* causing Bacterial canker in Mango
- Riya<sup>1</sup>, Kumud Jarial<sup>2</sup>, Deepika Sud<sup>1</sup> and Chetna Mahajan<sup>1</sup>
- Recombinase polymerase amplification assays for *Pythium* spp. and *Ralstonia pseudosolanacearum* detection in ginger
- A. Jeevalatha, Fathimath Zumaila, C. N. Biju and K. C. Punya
- Influence of weather parameters on the incidence of mango anthracnose (*Colletotrichum gloeosporioides* Penz and Sacc.) in South Chhattisgarh
- Vikas Ramteke<sup>1</sup>, Anurag Kerketta<sup>2</sup>, Anurag Sanadya<sup>1</sup>, R. S. Netam<sup>1</sup> and Narendra Kumar<sup>1</sup>
- Identification of novel multi-race resistance in Lentil germplasm against seven races of *Fusarium oxysporum* f. sp. *lentis*
- K. Nishmitha<sup>1</sup>, Deeba Kamil<sup>1</sup> and S. C. Dubey<sup>2</sup>
- Morphological and molecular screening of different wild *Ipomoea* sp. and sweet potato (*Ipomoea batatas* (L.) Lamarck for sweet potato weevil resistance
- B.G. Sangeetha<sup>1</sup>, C. A. Jayaprakas<sup>1</sup>, T. Makesh Kumar<sup>1</sup>, Shirly Raichal Anil<sup>2</sup>
- Prevalence and distribution of *Euphorbia* (*Euphorbia heterophylla*) rust (*Melampsora euphorbiae*) in Western Maharashtra
- M. B. Dawale, T. K. Narute, P. B. Khaire, S. B. Latake and Sirisha Thakare
- Effect of native *Trichoderma* spp. on *Fusarium* wilt disease of Banana
- T. C. Archith and V. Devappa
- Soil solarization along with FYM enriched *Pochonia chlamydosporia* is effective in managing root knot nematodes in organic capsicum under polyhouse
- K. Kranti KVVS, Vinod Kumar, Ramkesh Meena and Anil Sirohi
- Physiological and molecular portraying of the saprophytic pathogen, *Macrophomina phaseolina* in Castor for developing self-effacing biological management strategies
- C. P. Manjula<sup>1</sup>, A. G. Sangeeta<sup>1</sup>, Yamanura<sup>2</sup>, S. D. Neharu<sup>1</sup> and Divyashree<sup>1</sup>
- Effect of foliar application of plant defense activators on alternaria blight and seed yield in radish seed crop cv. Japanese white
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- M. Sival<sup>1</sup>, S. J. Sreeja<sup>1</sup>, K. N. Anith<sup>2</sup>, Susha S. Thara<sup>1</sup> and G. Heera<sup>1</sup>
- Sustainable management of post harvest disease fruit rot in papaya caused by *Colletotrichum gloeosporioides*
- Mahesh M. Chaudhary<sup>1</sup>, Dinesh H. Chaudhary<sup>2</sup> and D. S. Patel<sup>3</sup>
- In vitro evaluation of different chemicals against pumpkin and bottle gourd isolate of *Xanthomonas cucurbitae*
- Somya Hallan<sup>1</sup>, Kumud Jarial<sup>2</sup> and Suman Kumar<sup>1</sup>
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- Alka Jangra, Garima Sharma, Sonia Sihag and Vinod Chhokar
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- Deeksha Suresh<sup>1</sup>, Aditi Atreya<sup>1</sup>, Elisa Lobo<sup>1</sup>, Vivek Chandramohan<sup>2</sup>, Sunil Kumar C<sup>1</sup> and Sasmita Sabat<sup>1</sup>



- BIOACTIVITY PREDICTION OF MICROBIAL-DERIVED NATURAL PRODUCTS USING MACHINE LEARNING ALGORITHM
- Sneha Murmu<sup>1</sup>, Himanshushekhhar Chaurasia<sup>2</sup>, Shashank Shekhar<sup>3</sup>
- OVEREXPRESSION OF BANANA GDP-L-GALACTOSE PHOSPHORYLASE (MAGGP) GENE ENHANCES THE ASCORBIC ACID BIOSYNTHESIS IN ARABIDOPSIS THALIANA
- Siddhant Chaturvedi and Siddharth Tiwari
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- Sivaji Mathivanan
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- Jane I. Reuben-Kalu<sup>1,3\*</sup>, Renuka R<sup>2</sup> and Tukwasichukwuobi L. Kingsley<sup>3</sup>
- PLANT GROWTH PROMOTING BACILLUS FLEXUS M2 IMPROVES BRASSICA NIGRA ARCHITECTURE UNDER CADMIUM STRESS
- S. R. Manoj, C. Dineshkumar and P. Indra Arulselvi\*
- PHYTOREMEDIATION CAPABILITY OF THE UNDERUTILIZED AQUATIC LEGUME OF MANIPUR: NEPTUNIA OLERACEA LOUR.
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- Nickhil C1,\* and Debabandya Mohapatra
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- ETHNOBOTANICAL AND COMMERCIAL VALUE OF CYNODON DACTYLON (L.) AND OCIMUM SANCTUM (L.) FOR THE SUSTENANCE OF LIVELY HOOD OF FARMERS
- A. Krishnaveni\*, Pandiyan\*. M., C. Sivakumar, V. Radhakrishnan and E. Jamuna
- WASTE-TO-WEALTH, TOWARDS A SUSTAINABLE ZERO-WASTE IN A CIRCULAR ECONOMY: AN OVERVIEW
- Pravidhi Sharma<sup>1</sup>, R.K Aggarwal<sup>2</sup>, Gagan Mehta<sup>3</sup>
- IDENTIFICATION AND CHARACTERIZATION OF ANTIMICROBIAL PEPTIDES DERIVED FROM URINE AND ITS PUTATIVE CLINICAL APPLICATION AGAINST PATHOGENIC MICROBES
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- A COMPARATIVE STUDY ON ANTI-OXIDANT PROPERTIES OF AQUEOUS, METHANOLIC AND CRUDE HESPERIDIN EXTRACT OF MANDARIN ORANGE PEEL (CITRUS RETICULATA) WITH A FLAVANONE COMPOUND HESPERIDIN
- Shivkumar<sup>1</sup>, N Shamna<sup>1</sup>, Manish Jayant<sup>1</sup>, Dilip Kumar Chowdary<sup>1</sup>, M Dhanalakshmi<sup>2</sup>
- INTEGRATED RESOURCE MANAGEMENT FOR SUSTAINABLE AND QUALITY FOOD PRODUCTION
- Dharinkumar Jayswal, Ammu V K, Amit Kumar Juneja
- ACUTE AND CHRONIC TOXICITY OF MERCURY IN FISH
- Madhuri sharma<sup>1\*</sup> and Priti Mishra<sup>2</sup>
- EFFECT OF DIETARY SUPPLEMENTATION OF PEB-1 FORMULATION CONTAINING PHYTOCOMPOUNDS FROM PHYLLANTHUS NIRURI, ASPARAGUS RACEMOSUS AND ANDROGRAPHIS PANICULATA ON GROWTH, FEED CONVERSION RATIO (FCR) AND SURVIVAL OF HYPSELOBARBUS PULCHELLUS FINGERLINGS
- Ananda Kumar Banahalli Sriramareddy. S1., Gangadhar Barlaya1., Anantharaja,1 K., Ragavendra Channaveer Huchhappa.1, Sudanshu Shekar Mishra.2 and Hemaprasanth Kannur1
- DEVELOPMENT AND COMPARISON OF REGRESSION MODELS FOR DETERMINATION OF STARCH IN CHICKPEA USING NIR SPECTROSCOPY
- Madhu Bala Priyadarshi<sup>1\*</sup>, Anu Sharma<sup>2</sup>, K.K. Chaturvedi<sup>2</sup>, Rakesh Bhardwaj<sup>1</sup>, S.B. Lal<sup>2</sup>, M.S. Farooqi<sup>2</sup>, Sanjeev Kumar<sup>2</sup>, D.C. Mishra<sup>2</sup>, Mohar Singh<sup>1</sup>
- ASSOCIATION AND MULTIVARIATE REGRESSION ANALYSIS OF GRAIN YIELD AND YIELD



- CONTRIBUTING TRAITS IN MAIZE (ZEA MAYS L.)
- J. Bonipas Antony<sup>1\*</sup> and R. M. Kachapur<sup>2</sup>
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  - Prachi Mahla
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  - Ritika Chakrabarty, Gargi Sharma, Purna K. Barua
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  - Reena Prusty\*, O. P. Awasthi and S. K. Singh
  - INFLUENCE OF INDOLE-3-BUTYRIC ACID (IBA) ON ROOTING ABILITY OF BOUGAINVILLEA SPP.
  - Anita Hosalli, G. K. Seetharamu, Mallikarjun Hebbal, G. B. Kavana
  - STUDIES ON POLYMER SEED COATING WITH NUTRIENTS AND PESTICIDES ON GROWTH AND YIELD OF RADISH (RAPHANUS SATIVUS L.)
  - Prerna\* and D. K. Mehta
  - INFLUENCE OF FISH AMINO ACID ON THE GROWTH, YIELD AND QUALITY OF AMARANTHUS
  - A. Nithya Devi, K. Kumanan and P. Paramaguru
  - EFFECT OF INM ON VIABILITY AND VIGOUR OF CORIANDER SEED AFTER ARTIFICIAL AGEING
  - Vinod Kumar<sup>1</sup> and S. K. Tehlan<sup>2</sup>
  - ESTIMATION OF YIELD LOSS IN ASHWAGANDHA DUE TO OROBANCHE INFESTATION
  - Kuldeepsingh A. Kalariya\*, Ram Prasanna Meena, Parmeshwar Lal Saran, Narendra Gajbhiye
  - PHYTOCHEMICAL SCREENING OF PLANT EXTRACT OF BHRINGARAJ (ECLIPTA ALBA L.) MORPHOTYPES
  - R. M. Shalini<sup>1</sup>, K. Hima Bindu<sup>2</sup> and V. K. Rao<sup>3</sup>
  - EXOGENOUS PLANT GROWTH CHEMICALS ENHANCE PRODUCTIVITY AND POSTHARVEST QUALITY OF FRUITING VEGETABLES IN WATER SCARCE REGIONS
  - G.C. Wakchaure\*, P.S. Khapte, Satish Kumar and J. Rane
  - DOUBLING FARMERS INCOME THROUGH INTEGRATED FARMING SYSTEM APPROACHES
  - Abhilash Mishra\*, Tanzin Ladon and Priyanka Chauhan
  - EVALUATION OF GENETIC DIVERSITY OF MANDARINS USING MORPHOLOGICAL MARKERS AND SSR MARKERS
  - Megha Raghavan<sup>1</sup> and S. R. Singh<sup>2</sup>
  - BIOCHEMICAL CHANGES IN FLOWERING EXPRESSION OF CITRUS SPECIES
  - A. K. Jadhav and R. M. Sharma
  - EFFICIENCY AND EFFECTIVENESS OF MUTAGENIC AGENTS (GAMMA RAYS AND ETHYL METHANE SULPHONATE) ON BOUGAINVILLEA SPP.
  - Anita Hosalli\*, Seetharamu G. K., Shivapriya M., Amreen Taj., B. N. Gangadhar, Rajiv Kumar., Anjaneya Reddy
  - EVALUATION OF BLACK PEPPER CULTIVARS OF KERALA FOR YIELD AND QUALITY TRAITS
  - P. Reshma, G. S. Sreekala, R. S. Neethu and Nainu Joseph
  - STUDIES ON NUTRIENT AND NUTRACEUTICAL ASPECTS OF SNAP MELON (CUCUMIS MELO. VAR. MOMORDICA) FOR NUTRITIONAL SECURITY
  - S. Praneetha\* R.Muthuselvi, V. Sivakumar, C.Sudhalakshmi, B. Meena P. Latha and B. Vinothkumar
  - NANOTECHNOLOGY FOR FOOD SAFETY AND SECURITY
  - \*Hardik Patel, Ronak Mangroliya and Yash Desai and Kiran Patel
  - INFLUENCE OF INDOLE-3-BUTYRIC ACID (IBA) ON ROOTING ABILITY OF BOUGAINVILLEA SPP.
  - Anita Hosalli\* and G. K. Seetharamu, Mallikarjun Hebbal, G. B. Kavana
  - INTEGRATED NUTRIENT MANAGEMENT IN VEGETABLE CROPS
  - Yugvinder\*, Kuldeep Kumar and Naveen Kumar
  - RESPONSE OF MICROBIAL CONSORTIA AT GRADED LEVELS OF N P K ON GROWTH AND FLOWERING PARAMETERS OF ASIATIC LILY UNDER PROTECTED CULTIVATION
  - P. V. Shilna Mukundan<sup>1</sup>, B. Hemla Naik<sup>2</sup>, S. K. Nataraj<sup>3</sup>, M. Ganapathi<sup>4</sup> and Y. Kantharaj<sup>5</sup>
  - WEALTH GENERATION THROUGH MANAGEMENT OF TRICKY WATER HYACINTH
  - Ronak Mangroliya, Yash Desai, Hardik Patel and Jolly Patel
  - BIOFORTIFICATION OF VEGETABLES FOR FOOD SAFETY AND NUTRITIONAL SECURITY
  - Deepa Beniwal
  - AGRITOURISM TO ENHANCE INTEGRATED FARMING MODEL: A CASE OF GAURIKOT AGRITOURISM CENTRE
  - Kawita Bhatt and V. L. V. Kameshwari
  - EFFECT OF PRE SOWING SEED TREATMENT ON SEED QUALITY OF PADDY HYBRID KRH-4 UNDER DSR METHOD
  - Kavya\*<sup>1</sup> and S. N. Vasudevan<sup>2</sup>
  - INFLUENCE OF ORGANICS ON SEED YIELD AND OIL CONTENT (%) IN SAFFLOWER (CARTHAMUS



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  - Elavena War, C. P. Suresh and H. Rapunga Flory
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  - EFFECT OF SLOW-RELEASE UREA AND NITRIFICATION INHIBITOR ON N- DYNAMICS IN WHEAT
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  - EFFECT OF COCONUT SHELL BIOCHAR ON PHYSICAL, CHEMICAL PROPERTIES AND AVAILABLE MAJOR NUTRIENT STATUS OF ACIDIC SOIL
  - D. S. Rohitha1, B. Mamatha 2 and K. M Srinivas Reddy 3.
  - EFFECT OF FOLIAR NUTRITION ON GROWTH AND YIELD OF KHARIF COWPEA
  - Bhavik J Chaudhary1 and P. P. Chaudhari2
  - EFFECT OF APPLICATION OF FOLIAR NITROGEN AND POTASSIUM APPLICATION ON LEAF NUTRIENT CONTENTS OF FIG (FICUS CARICA L.)
  - Kiran Masta
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  - Suryakanta Kashyap1, Virendra Pratap Singh2 & Rakesh Kumar1
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  - V. Yamuna1, P. Nethra2, M. Ashwini3 and U. V. Mummighatti 4
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  - Shanmugapriya Deiveegan1, Dr. Roy Stephen2, Dr. Viji Mariasoosai Mary3, Dr. Prathapan
  - CLUSTERING APPROACH TO CLASSIFY SOIL SAMPLES OF KARNATAKA
  - Vinay, H. T1. Mallikarjun. B. Hanji2, V. Ramamurthy3 and Mohan Kumar, T. L4.
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  - Mamidi Hemalatha and S. S. Chandrashekhar
  - FODDER QUALITY OF BERSEEM AS INFLUENCED BY ZINC AND IRON FERTIFORTIFICATION
  - Praveen B. R., Maneesha, Magan Singh, Sanjeev Kumar and Chethan Babu R. T.
  - SOIL FERTILITY, GROWTH, YIELD AND ROOT QUALITY OF RADISH (RAPHANUS SATIVUS L.) AS INFLUENCED BY INTEGRATED NUTRIENT MANAGEMENT PRACTICES
  - Shilpa1, Parveen Sharma2, Akhilesh Sharma3 and Ranbir Singh Rana4
  - INTERACTIVE EFFECT OF RESIDUE AND NITROGEN MANAGEMENT PRACTICES ON SOIL ORGANIC CARBON STATUS UNDER RICE-WHEAT
  - CROPPING SYSTEM Prayasi Nayak1 and Sumit Chaturvedi2
  - PROCESS ANALYSIS OF PRODUCTION OF FERTILIZER AND DETERMINING LOSS DUE TO FAILURE TO MEET THE SPECIFICATION
  - Rohma Ansari1, Asha B. Kayarwar2, Dr. S. N. Suryawashi3, Dr. N.T. Bagde4
  - ORGANIC MANURE AND FERTILITY LEVEL AFFECTS THE FLOWERING, YIELD AND QUALITY ATTRIBUTES OF OKRA UNDER HEAVY CLAY SOIL OF SOUTHERN RAJASTHAN
  - Hemraj Meena1, Kavita A1., Nirmal Kumar Meena2\*, Rajesh Sharma3, Ashok Kumar3 and Rahul Chopra4
  - YIELD AND ECONOMICS OF FOXTAIL MILLET (SETARIA ITALICA) AS AFFECTED BY APPLICATION OF ZINC AND IRON IN NORTHERN TRANSITIONAL ZONE OF KARNATAKA UNDER RAINFED CONDITION
  - P. Priya,.1 and P. Ashoka.2
  - INFLUENCE OF MICROBIAL CONSORTIA AND WATER SOLUBLE FERTILIZERS ON PHYSIOLOGICAL AND LEAF YIELD PARAMETERS IN ANNUAL MORINGA VAR. PKM – 1
  - R.Balakumbahan1, V.Viji2 and V.Sivakumar3
  - STANDARDIZATION OF HPLC-PDA METHOD FOR DETERMINATION OF IMAZETHAPYR RESIDUES IN SOIL AND ITS APPLICATION IN REAL SOIL SAMPLES COLLECTED FROM TREATED URDBEAN POTS
  - Namrata Laskar1, Krishnasish Das1, Mrunalini Kancheti2
  - ROLE OF AGROCHEMICALS, BIOLOGICAL AND TECHNOLOGICAL INTERVENTIONS TOWARDS SAFE



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- Somi Choudhary
- SURVIVAL OF MICROBIAL INOCULANTS IN CAPSULE BASED FORMULATION
- B. Ameer Pasha, Nargis Fathima, Sangamesh Kayakad and G. P. Brahma Prakash
- TO ANALYSE THE EFFECT OF VARIOUS BIOFERTILIZERS AND CHEMICALS ON ELECTRICAL CONDUCTIVITY AND FIELD PARAMETERS IN WHEAT [TRITICUM AESTIVUM (L.) EM. THELL] SEED
- Sultan Singh<sup>1</sup>, V.S. Mor<sup>1</sup>, Axay Bhuker<sup>1</sup>, Gagandeep Singh<sup>1</sup> and Manuj Saini<sup>2</sup>
- FORMULATION OF PACHYRHIZUS EROSUS SEED OIL CONTAINING ROTENONE AS POSSIBLE BIOPESTICIDE
- Arka Gangopadhyay, Sayan Pan and Ramen Kumar Kole
- VARIETAL RESPONSE OF BARNYARD MILLET GENOTYPES AGAINST SHOOT FLY, ATHERIGONA FALCATA (MUSCIDAE: DIPTERA)
- Pandit<sup>1\*</sup>, K. J. Puneeth Kumar<sup>2</sup>, L. Vijaykumar<sup>2</sup> and Honnakerappa S. Ballari<sup>1</sup>
- DEVELOPMENT AND EVALUATION OF CELOSTERNA SCABRATOR MANAGEMENT STRATEGY AND IT'S ECONOMIC ANALYSIS UNDER FARMER VINEYARD CONDITIONS
- Deependra Singh Yadav and Gokul S. Shankhpal
- CONTROL OF BIOFILM IN FOOD PROCESSING ENVIRONMENT WITH METHANOLIC EXTRACTS OF CITRUS LIMON, AVERRHOA CARAMBOLA AND BRASSICA JUNCEA
- Rajendran Thomas, Devarshi Bharadwaj, Songeeta Singha, Abinash Kumar, Vivek Kumar Gupta
- ADVANCEMENT OF FOOD AND NUTRITIONAL SECURITY THROUGH HOME GARDENING AND URBAN AGRICULTURE IN RESPECT TO COVID-19 PANDEMIC
- B. R. Abha Ayushree
- FOOD AND NUTRITIONAL SECURITY
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- INTEGRATED FARMING SYSTEM APPROACH: A WAY FORWARD TO ALLEVIATE POVERTY
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- PREPARATION OF MORINGA POD PULP POWDER AND EVALUATION OF PHYSICO-CHEMICAL AND BIO-FUNCTIONAL PROPERTIES
- K. Sonu, Shivanna, Laxmana Naik\*, Priyanka Singh Rao, and Ankit Chavhan
- TRANSFORMING AGRICULTURE IN INDIA THROUGH THE 'TRIPLEHIGH' SYSTEM: A CASE STUDY ON NATURAL RICE FARMS OF NORTH COASTAL ZONE IN ANDHRA PRADESH, INDIA
- Jyothirmai Balla and Kishor Goswami
- THE STATUS OF GROUNDWATER POLLUTION AND AGRICULTURE IN TIRUPPUR DISTRICT OF TAMIL NADU
- G. Arun Prasath and D. Velmurugan
- CHARACTERIZATION OF PHYTOCHEMICALS AND PIGMENTS IN DIFFERENT EXTRACTS OF RED SEAWEED, GRACILARIA CORTICATA, AND THEIR ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES
- Minnu Rose Joy., Maya Raman\* and V. Radhalakshmi
- KNOWLEDGE, HYGIENE PRACTICES AND AWARENESS ON ANTIMICROBIAL RESISTANCE (AMR) AMONG MEAT HANDLERS IN ASSAM, INDIA
- Gurrappanaidu Govindaraj<sup>1\*</sup>, M. B. Shanabhoga<sup>1</sup>, Banani Das<sup>1</sup>, M. Nagalingam<sup>1</sup>, Mahmoud Elthoth<sup>2</sup>, Abin Thomas<sup>2</sup>, Jennifer Cole<sup>3</sup>, Dominic Moron<sup>2</sup>, Mark Holmes<sup>4</sup> and B. R. Shome<sup>1</sup>
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- Srutee Rout<sup>1</sup> and Uday S Annapure<sup>2,3</sup>
- EVALUATION OF TRADITIONAL NOURISHMENT PROPENSITIES OVER MODERN DIETARY PATTERN OF LACTATING MOTHERS OF BIJNOR DISTRICT
- Shakuntala Gupta<sup>1</sup>, Sourabh Maheshwari<sup>2</sup>, Krishna Kumar Singh<sup>1</sup>, Shivangi<sup>1</sup>, Pratima Gupta<sup>1</sup>, Pintoo Kumar<sup>1</sup>, Bhupendar Kumar<sup>1</sup> and Shailendra Yadav<sup>1</sup>
- COMBATING HIDDEN HUNGER THROUGH BIOFORTIFICATION
- Vidya Madhuri Eere
- REPELLENT EFFECT OF BOTANICALS EXTRACTS AGAINST LARVAE OF CORCYRA CEPHALONICA (STANTON)
- Punam N Madavi\*, A K Sadawarte, D B Undirwade
- COST-EFFECTIVE CLARIFIED MOLASSES MEDIUM FOR THE BIOSURFACTANT PRODUCTION USING BACILLUS TEQUILENSIS RP01 AND ITS ANTIFUNGAL ACTIVITY AGAINST FUSARIUM
- R. Parthasarathi<sup>1</sup>, R. Elango<sup>2</sup>, N. Kavnilavu<sup>1</sup>, S. Harini<sup>1</sup>, K. Akash<sup>1</sup>
- POST HARVEST LOSSES CAUSED BY STORED GRAIN INSECT-PESTS WITH SPECIAL REFERENCE TO WHEAT
- Vasu Mehta\*
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- Theme - 8 Global and Regional Policy Transformation
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- HarishKumar H.V1, Anuja A.R2, Shivaswamy G.P3, Achal Lama4, Rajesh T5 and K.N. Singh6
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- Generative Adversarial Networks (GANs) for Agricultural Stock Market Prediction
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- Women Empowerment in Agriculture for Livelihood Security
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- Policy Options Promoting Market Access to of Vegetable Producers and their Impact on Farmers Livelihood: Empirical Evidence from High Hills Region of Himachal Pradesh, India
- Pankaj Thakur1\*, Piyush Mehta2, Rahul Dhiman3, Krishan Kumar4, and Sahadeva Singh5
- Study on Food Habits among the Adolescent Girls of Vijayapura District of Karnataka
- 1Shruti Nayak., \*2Prashanth S. J., 1Ashwini, A., and 1Savita V. Jammanakatt
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- EMPOWERING FARM WOMEN THROUGH VALUE ADDITION AND PRODUCT DIVERSIFICATION
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- ONLINE MODE OF EDUCATION AND CONSTRAINTS IN DIPLOMA AGRICULTURE COLLEGE, ICAR - KRISHI VIGYAN KENDRA BIDAR, KARNATAKA.
- Sunilkumar N M1, Rakesh varma 2, Akshay kumar3, Ningadalli mallikarjun4.
- Personality assessment among post graduate students of Tamil Nadu Agricultural University
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- An analytical study on the relationship between academic self concept and academic achievement
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- NATIONAL EDUCATION POLICY 2020 - an international perspective
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- National Education Policy: A meandering pathway for revolutionizing Indian Education
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- Ekhande Y. S. 1, Sawant P. A.2, Holkar S. C. 3 and Raykar S. S. 4
- Transformations in Education and Research: Towards Inclusion and Excellence
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- NEP 2020 - Attempt to manufacture a whole child
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- A revamp in Agricultural Education system in India – A vital step for revolution in Education, Research and Extension
- T. N. Dhanalakshmi1\* and N. Shashidhara2
- Virtual classroom and Agri-DIKSHA: embracing the future of digital learning in agriculture higher education
- 1Anshu Bharadwaj,1Sudeep, 1Alka Arora,1Mukesh Kumar,1Shashi Dahiya,1S.N.Islam, 1Soumen Pal, 1Rajender Parsad, 2Anuradha Agrawal, 2R.C.Agrawal

**Theme - 1**  
**Sustainable Transformation of**  
**Agriculture & Food Production System**  
**in Alleviating Poverty**



## **BIOFORTIFICATION: AN APPROACH TOWARDS NUTRITIONAL SECURITY**

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### **ABSTRACT**

The food security of a rapidly expanding global population is a vital focus of future crop improvement initiatives. Even if there is a reasonable portion of calories available for the current population, malnutrition is a concern. Malnutrition is primarily driven by micronutrient deficiency, which has devastating effects on health. In order to create a healthy society, it is necessary to establish not just food security but also nutritional security. To combat hunger and attain nutritional security, the agricultural scientific community has chosen biofortification as a method for crop improvement. In this process, various strategies such as agronomic biofortification, microbe-mediated biofortification, traditional breeding-mediated biofortification, and genetic engineering are also applied. In addition to crop improvement efforts, governmental interventions are required to make biofortified food available to the undernourished population. This study explores the various biofortification strategies and their contribution to nutritional security.

**Keywords:** Malnutrition, Biofortification, Genetic engineering.



## Food matrix interactions, micro structure and molecular configuration of starch contributes to ‘Low glycemic nature of pearl millet’

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**ABSTRACT** Trends of obesity and diabetes globally has maligned carbohydrate rich foods, highlighting inherent glycemic potential (IGP) as a major quality indicator. Even though there is a ‘healthy halo’ as well as diabetic friendly appeal to pearl millet (PM), comprehensive systematic studies were lacking. Further more, shift to look nutritional quality of crop/diet from single component mode to matrix approach also accelerated our research towards unraveling the possible governing factors of IGP in PM. The present work thus aimed to investigate such variables (micro-structure, food matrix composition/interaction as well as molecular configuration). *In-vitro* oro-gastro intestinal simulation model of starch dynamics revealed PM to be low IGP (63.71%) compared to rice (65.89%). Micro-structural analysis revealed that high pericarp thickness ( $22.71 \pm 0.20 \mu\text{m}$ ) could be a vital component hindering the easy accessibility of carbolytic enzymes even though granule size ( $2.16 \pm 0.12 \mu\text{m}$ ), as well as endodermal surface area ( $1199.64 \pm 2.86 \mu\text{m}^2$ ), was lower than control rice. It was also found that dense food matrix components and higher starch-lipid (S-L) interaction visualized by CLSM contributes to the resistance towards digestive enzymes. The molecular structures were explored using FTIR, XRD to understand the synergistic effects of short-range and longer-range molecular patterns ( $R_{1047/1022}$ : 0.80 & CD %: 21.73%) of PM starch, which revealed the superior crystalline compactness as vital towards low IGP. The results show the importance of micro structure, dense composition, molecular configuration of starch as well as component interactions (S-L) in attenuating starch digestion in a real food matrix (*i.e.* PM) while the complexities of real digestion should be considered and explored using dynamic models in future.

**Key words:** Pearl millet; inherent glycemic potential, intrinsic variables, food matrix





## ROLE OF ARBUSCULAR MYCORRHIZAL FUNGI IN SOIL FERTILITY AND PLANT NUTRITION

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### ABSTRACT

Arbuscular mycorrhizal fungi (AMF) are soil microorganisms that may create symbiotic relationships with most terrestrial plants. By increasing the root absorption area, these soil microbes help the plants to absorb more nutrients especially phosphorus (P). In return, the symbiont receives plant carbohydrates for the completion of its life cycle. AMF also helps plants to deal with biotic and abiotic stressors such as salt, drought, severe heat, heavy metals, infections, and pathogens. The processes of adaptation of AMF to abiotic stressors are typically associated to enhanced hydromineral nutrition, ion selectivity, gene regulation, osmolyte production, and phytohormone and antioxidant synthesis. A study was conducted to evaluate the effect of AMF on the solubility and availability of native phosphorus and its impact on crop growth and yield of test crop tomato. Treatments were combinations of four doses of P (100%, 75%, 50%, 25%) along with P solubilizers (*Pseudomonas*, and *Bacillus*.) and P mobilizer (AMF). From the study it was observed that, the treatments imposed no significant difference with respect to the electrical conductivity, organic carbon, organic matter and available nitrogen content. 50% P + AMF recorded the highest available nitrogen content (282 kg ha<sup>-1</sup>) among all the treatments. The highest value was noticed in the treatment with the application of AMF along with 75% P. The analysis of data on the available micro nutrients revealed that the treatments had significant influence on available Zn content with the highest value recorded by the treatment receiving 25% P + AMF whereas the effect was non-significant with respect to available Fe, Mn and Cu content. The application of 100%N, 75%P, 100% K along with AMF recorded the highest fruit yield, and nutrient uptake.

**Keywords:** Arbuscular mycorrhiza fungi, Symbiosis, Phosphorus, Plant growth, Sustainable agriculture



## **Exploration on the links between root biomass and soil carbon, nitrogen and phosphorus fractions.**

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### **ABSTRACT**

The plant roots control and influence soil organic carbon dynamics by providing organic C to the soil primarily in the forms of root litter and rhizodeposition. The study was carried out in the three Agro- ecological units (AEUs) of Kerala to account for the contribution of root biomass to SOC and NP pools. The soil samples were collected from depths of 0-20 cm and 20-60 cm using core sampling technique. The root biomass from soil samples were separated out and soil samples were analyzed and regression and correlation studies were done. The soil bulk density showed an increase while pH and EC, showed a decrease towards depth in all the AEUs. The different fractions of soil C and N showed a decrease while P fractions exhibited an increase with depth for all the AEUs. The root biomass and soil C, N and P fractions were positively and significantly correlated at both sampling depths. The highest correlation between root biomass and soil C fractions was recorded by dissolved organic C – DOC (0.976) followed by recalcitrant C (0.931) and labile C (0.975) followed by DOC (0.953) for surface and subsoil respectively. From the regression analysis,  $R^2$  value was highest for DOC (0.95) and LC (0.94) at sampling depths of 0-20 cm and 20-60 cm respectively. The organic N and labile P exhibited highest  $R^2$  value and were found to be more correlated to root biomass at both sampling depths.

**Keywords:** Soil organic carbon, root biomass, N fractions, P fractions



## **“Nutrient Biofortification of Vegetables”- Need of an hour**

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### **ABSTRACT**

Food security has been a top global concern in recent decades. The developing world is now emphasizing on nutritional security, which includes food that is abundant in minerals and vitamins, after establishing a successful lead in food security. Vitamins and micronutrients are crucial for the growth and development of humans. In low and middle-income nations, deficiencies in one or more micronutrients, like zinc, iron and vitamin A, are common and jeopardise the physical and mental health of millions of individuals. Any lack of these elements results in "hidden hunger." Additionally, because of the wide consumption of vegetables by people and presence of essential phytochemicals like fibre, antioxidants, vitamins, and minerals, vegetables are considered as the pillars of healthy nutrition and have been focused more for biofortification. The need of the hour is to biofortify vegetables with vitamins and micronutrients in order to combat the various health problems that emerging nations are encountering. Three main methods *i.e.*, conventional, mutational breeding, agronomic approaches, and genetic engineering are utilised to biofortify the vegetables crops. These strategies have a great deal of potential to tackle this vitamin and micronutrient deficiency. To increase the micronutrient content of vegetables, numerous genes are accessible these days for various target characters. By multiplying the amount of minerals and vitamins in vegetables, these technologies can be of great assistance to improve the nutritional status of the world.

**Keywords:** Vegetables, biofortification, micronutrients, minerals, food security.



## Effect of seed priming with boron and its foliar application on okra productivity

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### ABSTRACT

Boron (B) the second most deficient micronutrient worldwide (next to zinc) is severely impacting the sustainability goals of food and nutritional security. Okra is a crop with diverse benefits, however, poor seed germination; a major constraint causes significant yield reduction. An investigation was carried out to evaluate the impact of seed priming with B and its foliar application on germination and crop productivity of okra. A lab study was done with seed primed using varied B concentrations (1.0%, 0.5%, 0.1%, 0.05%, and 0.01%), distilled water and durations (12, 24, and 36 h), with one control (unprimed seeds), to figure out the best three B priming concentrations and two priming durations to evaluate their performance under field conditions. Seeds primed with B @ 0.05% for 36 h duration registered significantly highest germination (93.0 %), followed by treatment comprising of seed primed with B @ 0.01% for 36 h (90.0 %). Based on lab experimentation results, seeds primed with B @ 0.1%, 0.05%, 0.01% and distilled water, for 24 and 36 h were selected for field experimentation in conjugation with foliar feeding of B. The results affirmed that seed priming with B @ 0.05% for 36 h duration along with the foliar feeding of B @ 0.034% significantly improved the yield of okra. Therefore, it can be concluded that seed priming is an economically viable alternative to alleviate the germination problem and improve yield of okra in the acid *Alfisols* of Himachal Pradesh.

**Keywords:** seed priming, boron, foliar application, okra, germination, yield



## Understanding Genetic Diversity of Sorghum Using Morpho-Biochemical Traits Through Cluster Analysis

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### ABSTRACT

The present investigation was carried out to characterize and to assess genetic diversity in 49 sorghum genotypes on the basis of fifteen morphological and biochemical parameters. The extent of genetic diversity was assessed with the help of  $D^2$  statistics. The  $D^2$  analysis grouped the 49 genotypes in ten different clusters which supports the existence of substantial genetic diversity among them. Cluster-I was the largest cluster with a total of 28 genotypes followed by cluster-II (12) and cluster-VII (2). Rests of clusters were having only one genotype each in it. The maximum inter-cluster distance between Cluster-VII and -VIII make their genotypes most diverse and suitable for hybridization programme. Further, Cluster-II was characterized with maximum intra-cluster distance followed by Cluster-I which indicates that certain genotypes can be used for hybridization with the other members of that cluster. Due to the presence of only one genotype intra-cluster distance in clusters was recorded to be zero. A dendrogram was developed with the help of Tocher method which revealed that genotype, PGN 66 from Cluster-I (26) and genotype, IS 40921 from Cluster-X (34) were most diverse and suitable to for a hybridization programme. Furthermore, with in clusters, genotype PGN 66 and GP-298 in Cluster-I and genotype GP-318 and PGN 9 were in cluster-II were most diverse. These genotypes are suggested to be most suitable for exploiting hybrid vigour and heterosis for forage sorghum improvement.

**Keywords:** Sorghum, Genetic diversity,  $D^2$  statistics, Inter and intra cluster, Hybridization



## Assessment of yield and yield components of corn (*Zea mays* L.) under two and three strip intercropping systems

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### ABSTRACT

Strip intercropping is a practice of growing erosion permitting crops and erosion resisting crops simultaneously on the same land in separate strips with the objective to protect the soil from erosion. To assess the effects of two crop and three crop strip cropping systems on maize yield and yield attributes, an experiment was carried out using three crops-corn, soyabean and sunflower by following Randomized Complete Block Design having three replications during 2011. In the study, the results revealed that, the chlorophyll content of corn leaves was maximum at intercropping of additive corn-soybean (100:20) followed by corn-soybean-sunflower-soybean (3:4:3:4), whereas minimum chlorophyll content of same cultivar was obtained at sole corn. And the yield attributes of maize viz. cob length, number of rows in a cob, number of grains in row, grain weight, grain yield and harvest index of corn were maximum at intercropping of corn-soybean (3:4) and corn-soybean-sunflower-soybean (3:4:3:4). But the highest grain weight was recorded under intercropping of corn-soybean-sunflower (3:4:3) along with intercropping of corn-soybean (3:4), and corn-soybean-sunflower-soybean. In this study, soybean had shown beneficial effect on yield and yield components of corn, whereas sunflower had shown adverse effect on corn yield, which falls in line with many research findings.

**Keywords:** Chlorophyll content, corn, intercropping, sunflower, yield

## Optimized protocol for efficient callus induction and regeneration of haploids via anther culture in cabbage (*Brassica oleracea* var. *capitata* L.)

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### ABSTRACT

Anther culture is a speed breeding technique widely used in *Brassicaceae* family including cabbage for development of inbreds within 2-3 years, which otherwise takes 6-7 years through conventional breeding approaches. There is a paradigm shift in choice of cultivars for commercial cultivations by the vegetable growers towards hybrid varieties. For development of high yielding hybrid varieties, there is need to develop genetically diverse highly homozygous inbreds lines. The hybrids varieties mainly identified for high yield and uniformity, fails to perform satisfactory, mainly because inbreds involved in the development are bred through conventional method as they are not completely homozygous. A shift from conventional breeding methodology to plant tissue culture technique is the most suitable approach for developing completely homozygous lines on large scale with shortest time. For the first time in India, we initiated systematic research work on anther culture technique in low chill requiring head cabbage and various important factors like bud size, developmental stages of microspore, heat/ cold shock pretreatments, medium used, plant growth hormones used for efficient androgenesis, etc have been studied and standardized in this study. Moreover, the success in development of haploid or double haploids become a futuristic speed up breeding technique in vegetable crop improvements.

**Keywords:** Haploids, androgenesis, anther culture, cabbage



**Effect of gamma radiation on seed germination and endurance of pomegranate (*Punica granatum L.*)**

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**ABSTRACT**

Mutation breeding is one of the alternatives to induce variation and to explore the possibility of getting useful pomegranate variants. However, the frequency of spontaneous mutations is quite low. Attempts have therefore, been made to accelerate its rate artificially. In fruit breeding, mutation induction has become an effective way of supplementing existing germplasm and improving cultivars. Choice of mutagen depends on the type of material treated, type of mutation desired, availability of mutagen and safety considerations. Gamma rays have shorter wavelength and greater penetrating ability. Hence, gamma rays bring about permanent genetic changes, some of which are likely to be useful for the improvement of crops. The present investigation has been planned to generate desirable pomegranate mutants having commercial significance as well as resistance against biotic factors. The variations attained can be analyzed at morphological and molecular levels. Pomegranate cultivars used for this investigation were; Kandhari Kabuli, Bhagwa and Daru. Objective of this experiment was to standardize the LD<sub>50</sub> doses of gamma irradiation for inducing variability in pomegranate by treating seeds with gamma radiation treatments viz., 0, 6, 9, 12, 15, 18, 21, 24 kR. Observations were recorded on days taken for germination, per cent germination and plant, shoot and leaf characters. The morphological data is statistically analysed to find out Analysis of variance (ANOVA) and genetic variability.

**Keywords:** Mutation, Pomegranate, Gamma rays, Germination



## EFFECT OF GAMMA RAYS ON DIFFERENT QUANTITATIVE TRAITS OF SOYBEAN JS335

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### ABSTRACT

Soybean JS-335 was treated with 200, 250 and 300 Gy doses of gamma rays to study the variability in  $M_2$  for the qualitative and quantitative traits. The experiment was conducted in the experimental farm of Samarth Agriculture College Deulgaon Raja, Buldana during *Kharif* and *rabi* 2017-18. The treated material along with untreated control planted in  $M_1$  generation and individual plants were harvested separately. Harvested seeds of individual plants from  $M_1$  generation were planted in non replicated field trial to rise  $M_2$  generation. Observations were recorded on different yield attributing characters like days to flowering, days to maturity, plant height, number of branches plant<sup>-1</sup>, length of primary root, number of pods plant<sup>-1</sup>, 100 seed weight and grain yield plant<sup>-1</sup>. In  $M_2$  generation days to flowering and days to maturity increased significantly in all the treatments. Plant height, number of branches plant<sup>-1</sup> and length of primary root reduced significantly in all the treatments. Number of pods plant<sup>-1</sup> and grain yield plant<sup>-1</sup> significantly increased in all the treatments and 100 seed weight significantly decreased in all the treatments as compared to control. The economical and morphological mutants were isolated from the variety of JS-335.

**Key words:** Soybean JS 335, gamma rays, mutation, quantitative traits





## Effect of moisture stress on wheat crop by IW/CPE approach on water requirement and water use efficiency.

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### ABSTRACT

Wheat is one of the most important cereal crops and staple food of nearly 35 per cent of the world population. In climatologically approaches, irrigation is scheduled on IW/CPE ratio. In IW/CPE approach, known amount of irrigation water is applied when cumulative pan evaporation reaches pre-determined level. The experiment was conducted in randomized block design with irrigation scheduling on climatological approach i.e. on IW/CPE ratios of IW/CPE=0.6, IW/CPE=0.8, IW/CPE=1.0, IW/CPE=1.2 and control treatment with six irrigations at critical growth stages of wheat. Seasonal water requirement of wheat was found to be highest (570 mm) under irrigation scheduling at control treatment (I<sub>4</sub>). Favorable soil moisture was maintained in the irrigation scheduling treatment of IW/CPE=1.2 (I<sub>4</sub>) throughout the growing period and it was always maintained in allowable depletion regime. However, soil moisture was inadequate in irrigation scheduling at IW/CPE=0.6 (I<sub>1</sub>). Highest water use efficiency was recorded in treatment I<sub>2</sub> which may due to lowest water use, followed by I<sub>3</sub>, I<sub>4</sub>, I<sub>1</sub> and I<sub>5</sub>. Irrigation scheduling at IW/CPE=1.2 (I<sub>4</sub>) recorded highest grain yield of wheat but it was at par with I<sub>3</sub>. Grain yield recorded in treatment I<sub>3</sub> (IW/CPE=1.0) was significantly higher than that in treatment I<sub>5</sub>(control) with saving of water of 13 %.

**Keywords:** Irrigation Scheduling, IW/CPE, Water requirement, Water use efficiency, Soil Moisture.



## Characterization of Seed Microbiome of Citrus Germplasm of NE Region

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### ABSTRACT

The North Eastern part of the country harbours different cultivated, wild and semi wild varieties of citrus contributing largely to the citrus industry. The microbiomes of these citrus species are studied for their role in maintaining plant growth and health. However, the citrus seed microbiome has not yet been explored for their use as bioinoculants in agriculture as a greener alternative for plant growth promotion. In this study, culturable microorganisms were isolated from surface sterilised seeds of different citrus species indigenous to the Northeastern region. The isolated microbes were analysed for the plant growth promotion and biocontrol properties including Indole acetic acid production,  $\text{Ca}_3(\text{PO}_4)_2$ ,  $\text{AlPO}_4$ ,  $\text{FePO}_4$  and  $\text{Zn}_3(\text{PO}_4)_2$  solubilisation, Zinc solubilization, HCN production, nitrogen fixation and siderophore production. Six isolated microorganisms were found to be positive for IAA production, twelve for phosphate solubilisation, nine for zinc solubilisation, and three for HCN production. Further, the molecular identification of the microbes positive for plant growth promoting traits were carried out based on 16SrDNA sequencing. The isolated microbes appear to be promising bioinoculants for improving plant performance and sustaining soil health.

**Keywords:** Citrus, Microbiome, Bioinoculant, Plant Growth Promotion, 16SrDNA



## VARIATION IN SEED SENSITIVITY TO ACCELERATED AGING AMONG SOYBEAN GENOTYPES

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### ABSTRACT

Seed deterioration during storage is an inexorable process which impedes the germination capabilities of the seed lots. The rate of seed deterioration is highly influenced by the storage environment (RH, temperature and oxygen) and also greatly varies among species and also between cultivars within the species. Under optimum storage conditions, seeds storage experiments take a longer time to show symptoms of ageing thus researchers use a moist experimental ageing test like the CD test and AA test to know the vigour status and storage potential of seed lots. Seeds of 15 soybean cultivars were subjected to a standard AA test (42° C & ~100% RH) for different storage durations. Soybean varieties showed large variation in their ability to tolerate harsh AA conditions. Aged soybean seeds showed loss in total germination (%) over storage time. The cultivar “EC 528623” was highly sensitive and recorded 86 per cent reduction in germination from its initial control at 7 days after ageing (DAA). Cultivar “EC 457464” and “EC 76759” showed highest germination of 45% and 7DAA. Seed germination in most of the tested cultivars was reduced to around 50 per cent from its initial value in 6 days of accelerated ageing. Thus, AA test could be used to study genetic variation for seed longevity in soybean using a panel of large diverse germplasm lines/accessions.

**Keywords:** Seed storability, accelerated ageing test, seed germination, soybean



## **Nutrient uptake pattern of different rice based cropping system under integrated farming system**

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### **ABSTRACT**

As the world's population grows, so does the demand for food, which leads to indiscriminate fertilizer use without considering soil health. Crop intensification is a method of fulfilling rising food demand by increasing the number of crops in a cropping system, exerting pressure on the soil to supply nutrients. Therefore, with an objective to study the nutrient uptake pattern of different cropping system, a field experiment was conducted at Agricultural Research Farm, Banaras Hindu University during 2019-2020. This experiment consisting of ten sequences *viz.*, rice- wheat-fallow (S<sub>1</sub>), rice- mustard (S<sub>2</sub>), *sesbania* (G.M.)\*rice-lentil- black gram (S<sub>3</sub>), *sesbania* (G.M.)\*rice- vegetable pea- black gram (S<sub>4</sub>), *sesbania* (G.M.)\* rice- mustard- black gram (S<sub>5</sub>), *sesbania* (G.M.)\* rice- mustard- green gram (S<sub>6</sub>), sudan fodder- *berseem*-cowpea fodder (S<sub>7</sub>), cowpea fodder- *berseem*- maize fodder (S<sub>8</sub>), high value rice-potato- lady's finger (S<sub>9</sub>), high value rice- capsicum- cowpea (green pods) (S<sub>10</sub>) was laid out in randomized block design with three replications. The experimental result showed that maximum nitrogen (443.6 kg/ha), phosphorus (146.8 kg/ha), and potassium (306.3 kg/ha) uptake was reported by sudan fodder- *berseem*- cowpea fodder, followed by cowpea fodder- *berseem*- maize fodder with 411kg/ha, 105.9 kg/ha, and 274 kg/ha nitrogen, phosphorus, and potassium, respectively. These treatments were significantly superior in terms of nutrient uptake compared to other treatments.



***Ulva fasciata* (Class: Chlorophyceae) – a resource as sea vegetable and their culture potential along Kerala Coast**

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**ABSTRACT**

Seaweeds are the rich source of agar-agar, algin, etc. and considered as “Sea vegetables” in south-east Asian countries. As per the previous research works, *Ulva* sps. have very high dietary fibre, essential amino acids, protein, Fe, I, Mn, Se, Ni, and vitamins. Present study was conducted along the rocky coastal regions of Varkala and Edawa of south Kerala for a period of one year. Samplings were also recorded from the seawalls, which provide an additional artificial habitat. These habitats along the south Kerala Coast is a rich habitat for *Ulva fasciata* and shows seasonal variations. During pre-monsoon, *U. fasciata* recorded a biomass of 800gm/m<sup>2</sup> whereas it was 4000gm/m<sup>2</sup> and 1800gm/m<sup>2</sup> during monsoon and post monsoon at Edawa. At Varkala, the biomass of *U. fasciata* during pre-monsoon was 100gm/m<sup>2</sup>, where as it was 4000gm/m<sup>2</sup> and 1100gm/m<sup>2</sup> during monsoon and post monsoon respectively. From the observations and analysis, it is concluded that the conditions during monsoon favours the abundant growth of *U. fasciata* and the growth of this species in seawalls indicates the possibility of culture in floating rafts. Since, *U. fasciata* is consuming as a vegetable in many countries, it can be recommended as a nutritious sea vegetable in Indian market.

**Key words:** *Ulva fasciata*, sea vegetables, dietary fibre, Kerala



## **An Analytical Study on Role of Tribal Women in Crop Based Livelihood Activities in Southern Rajasthan**

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### **ABSTRACT**

The tribal population is identified as the aboriginal inhabitants of our country. For centuries, they have been living a simple life based on the natural environment and have developed cultural patterns congenial to their physical and social environment. According to 2011 census, the Scheduled Tribes (STs) comprise about 8.6 per cent of India's population and tribal population in India constitutes over 104 million. Tribal women constitute half of the work force among tribals in India. They play an important role in their cultural, social, economic and religious ways of life and considered as an economic asset in their society. The present research is an attempt to see the information regarding role of tribal women in crop based livelihood activities in Rajasthan. The study was conducted in three districts of Rajasthan state namely Dungarpur, Udaipur, and Banswara with total 180 tribal women. Findings revealed that all the respondents independently participated in management of labor, application of manure and fertilizers, cleaning and drying in post-harvest management (100%). Majority of them independently participated in harvesting (83.33 MPS), insect and pest control through indigenous method (82.5 MPS), seed/variety selection (81.94 MPS) and land preparation (81.38 MPS). Jointly with family members in insect and pest control through chemical application (56.66 MPS), credit/loan (60 MPS), threshing (60.27 MPS), winnowing (61.11 MPS), retention for sale (62.22 MPS), management of cash earned from sale of produce (62.77 MPS).

**Keywords:** Tribal Women, Livelihood, Crop, Role, Analytical



## Comparison of yield and economics of the best management practices in rice crop

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### ABSTRACT

A field trial was conducted at CCS HAU, Rice Research Station, Kaul, Haryana to compare the different nutrient management practice in rice. The aim of the investigation was to study the effect of different management practices on the yield, soil nutrient status and nutrient uptake by rice crop. The experiment was laid out under Randomized complete block design with six treatments and four replications. The treatments were: T<sub>1</sub>: 100% RDF, T<sub>2</sub>: T<sub>1</sub>+FYM@10t/ha, T<sub>3</sub>: 125 of RDF, T<sub>4</sub>: 150%of RDF, T<sub>5</sub>: T<sub>1</sub> + Sampoorna @ 10 g/L, T<sub>6</sub>: Farmers practice (135 % RDN + RDP). The initial experimental soil was medium in organic carbon (OC) (0.5%), low in available nitrogen (147 kg N/ha), medium in available phosphorus (16 kg P/ha) and medium in available potassium (285 kg K<sub>2</sub>O/ha). The various treatments did not differ significantly with respect to their effect on pH, EC and OC of the soil. Available N, P and K status of the soil was significantly higher in the treatment where 150% RDF (174.5, 24.8 and 320.7 kg/ha, respectively) was applied as compared to 100 % RDF (158.9, 20.7 and 302.3 kg/ha, respectively). Significantly higher N, P and K uptake in grain and straw was observed in treatments *viz.* RDF + Sampoorna @ 10 g/L or 150% RDF or 125% RDF over RDF alone. The yield attributes (panicles/m<sup>2</sup> and grains/panicle) and grain yield of rice crop was significantly higher in 100 % RDF or RDF+FYM @ 10 t/ha over farmer's practice. Higher net return (Rs. 32727 and 31728 /acre, respectively) and B:C (2.88 and 2.85, respectively) was observed with RDF and RDF + Sampoorna@ 10 g/L.

**Keywords:** Farmers practice, Sampoorna, FYM, economics and rice yield



**Assessment of Genetic Variability for Seed Yield and Its Component Traits in a New Set of Germplasm in Finger Millet (*Eleusine coracana* L. Gaertn)**

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**ABSTRACT**

Genetic improvement of any crop depends on the selection which will be effective if variability is existing in that crop species for different characters. An experiment was conducted to unravel the genetic variability for seed yield and its contributing traits. A new set of 148 germplasm accessions obtained from IIMR, Hyderabad including 3 checks in finger millet was sown during *Kharif* 2019 at Zonal Agriculture Research Station, V. C. Farm, Mandya in Randomized Complete Block Design with two replications. Significance of MSS for traits under study indicated presence of adequate diversity and substantiates the worthiness of experimental material used in the study. Narrow difference between PCV and GCV showed less influence of environment on expression of traits under investigation. High heritability in conjunction with high GAM were registered for seed yield plant<sup>-1</sup>, 1000 seed weight, fingers ear<sup>-1</sup>, finger length, earhead length and productive tillers plant<sup>-1</sup> indicating the predominance of additive gene action. Seed yield plant<sup>-1</sup> showed significant and positive correlation with straw yield plot<sup>-1</sup>, days to 50% flowering, days to maturity, 1000 seed weight, finger length, peduncle length, plant height, and productive tillers plant<sup>-1</sup>. The findings revealed that accessions 5158, 6772, 2899, 4516, 6493, 5425, 5337, 6563, 5160, 6526, 5736, 5200, 5412, 6423 and 3376 were promising for the enhancement of the seed yield and can be used in future breeding programmes.

**Key words:** Finger millet, genetic variability, genetic parameters, correlation coefficients.





**Intercropping Bhringraj with *Grewia optiva* can boost the economy of mid-hill farmers:  
case study of north western Himalayas**

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**ABSTRACT**

The present study was carried out in the experimental farm of Department of Silviculture and Agroforestry, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during year 2019-20. The experiment was laid out in randomized complete block design. The treatments consisted of 10 different nutrient sources [T<sub>1</sub> : 100% FYM , T<sub>2</sub> : 100% RDF , T<sub>3</sub> : 100% vermicompost, T<sub>4</sub> : jeevamrut @ 5%, T<sub>5</sub> : 25% RDF + 75% FYM, T<sub>6</sub> : 50% RDF + 50% FYM, T<sub>7</sub> : 75% RDF + 25% FYM, T<sub>8</sub> : 50% RDF + 50% vermicompost, T<sub>9</sub> : 75% RDF + 25% vermicompost and T<sub>10</sub> : control (Nno fertilizer)] applied in both farming systems i.e. intercropping of *Eclipta prostrata* (Bhringraj), a medicinal plant with *Grewia optiva* and sole cultivation of Bhringraj to assess the profitability of the agroforestry system. The maximum net returns of Rs. 72,320 ha<sup>-1</sup> was observed in intercropping as compared to net returns of Rs. 38,465 ha<sup>-1</sup> from sole cultivation of Bhringraj under treatment T<sub>5</sub>. Therefore, large scale cultivation of Bhringraj intercropped with *Grewia optiva* can be more profitable to farmers in mid hills of north western Himalayas.

**Keywords:** Bhringraj, *Grewia optiva*, intercropping, economy, agroforestry system



## **A Comparative Study on Access of famers to National Food Security Mission**

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### **ABSTRACT**

National Food Security Mission is a massive programme by Government of India to ensure food security and nutritional security for the 1.3 billion population of India. Considering the significance of the mission a study was conducted to analyse the socio-economic transformations generated by National Food Security Mission (NFSM) in the states of Uttar Pradesh and Karnataka. 160 beneficiary farmers, 80 non-beneficiary farmers and 80 department personnel from both the states were personally interviewed to elicit the access pattern of beneficiary farmers of NFSM. Pattern of access of farmers to Agricultural Development was operationalized as freedom to seek, receive and impart information and ideas through any media or means subjected to sociological, psychological, economic and ecological parameters of the person concerned. Access involves approach, ability and ease of contact. Pattern of access scale was developed to measure the same. Access of farmers to NFSM before and after programme implementation was analysed for the states of Uttar Pradesh and Karnataka. Significant difference in access pattern was observed. Comparative analysis of pattern of access of farmers to NFSM between states of Uttar Pradesh and Karnataka revealed higher edge for Karnataka.

**Keywords:** Pattern of access, scale, beneficiary farmers, NFSM, comparison



## **Sustainable Agri-Food Systems: Guide Towards Healthy Nation**

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### **ABSTRACT**

Agri-food systems are a set of interconnected systems that include agricultural production, processing, distribution, marketing and consumption. The outcomes of these activities, including socioeconomic and environmental issues. With ever increasing population the concern about food demand in the coming decades are growing. The Food and Agriculture Organization (FAO) estimates that to feed a world population of 9.3 billion, we need to produce 60 per cent more food by 2050 to end hunger, therefore to achieve food security and improve nutrition by 2030, a Sustainable Food System (SFS), should be followed in a way that, it does not compromise the socioeconomic and environmental foundations for ensuring food security and nourishment for future generations. A sustainable food system ensures food security, affordable prices for all, and environmental, financial and social sustainability. Different tools and approaches have been developed by different organizations to assess the path taken to improve agri-food systems. The food system model consists of three pathways *viz.*, elucidation of the food system, recognition of hotspots and introspection of the results. These models are valuable and help to manage the existing knowledge about the functioning of the food system and ensure the implementation of the planned goals, although there are numerous challenges such as climate change, post-harvest losses, nutrient-poor foods and other knowledge gaps addressed. Various approaches such as Participatory System Dynamics, Hourglass Approach and Transition Support System (TSS) Approach help us to highlight the importance of applying a multi-stakeholder approach to improve a sustainable agri-food system and provide useful insights for the extemporization of agri- and winning food systems. Identifying and adopting an appropriate modeling approach in an intrinsic way will ensure that its essential results are maintained or improved over time and across generations helping governmental institutions and organizations to track growth towards sustainability and establish policies that are positive and promote transformations.

**Keywords:** Agriculture, Food system, Food security, Demography and Sustainability



## PRINCIPAL COMPONENT ANALYSIS OF SORGHUM LINES FOR ROOT-RELATED TRAITS UNDER TWO MOISTURE REGIMES

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### ABSTRACT

Sorghum [*Sorghum bicolor* (L.) Moench] is one among the important cereal crops, extensively grown in more than 150 countries including India. Drought is the major constraints in the production of sorghum, which affects numerous morphological and physiological activities in plants resulting in an extensive reduction in crop yield. Plant root-related traits influence water and nutrients absorption and play a major role in the balancing crop yield under water limited conditions. Due to the difficulties of measuring root-related traits underground for a large number of plants in field circumstances, little work has been done on root-related traits in sorghum. In this perspective, 52 genotypes comprising of 41 improved lines and 11 released varieties (landraces and elite cultivars) were tested for 10 root-related traits at the reproductive stage in Polyvinyl Chloride (PVC) pipes in the greenhouse with two replications under well-watered (WW) and water stress (WS) conditions. Principal component analysis revealed the total variance contributed by the PC1 was 68.9 and 12.1 % for PC2 under WW condition. In the WS condition, PC1 contributed 70.5 % and PC2 contributed 15 %. Root length, root dry weight, total root length, root weight density and root length density were the important traits in the PC1 under both the conditions. Based on PCA and comparison over the checks, four improved lines (STG 44, RL 167, RL 34 and RV 48) and two elite cultivars (Phule Suchitra and SPV 86) under water stress condition and one improved line, (STG 44) under well-watered condition were identified as best promising lines. In sorghum breeding programmes, the found superior lines can be exploited as donor parents for root-related characteristics.



## Non-structural sugars metabolism associated with dormancy regulation in white yam (*Dioscorea rotundata*) tuber

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**ABSTRACT** Storage sugars have been recognized as one of effective regulator of plant growth, since sugars act both as carbon and energy source, immediate substrates for intermediary metabolism and effective signaling molecules regulating diverse plant growth hormones and cellular activities. Yam tuber dormancy induction and duration has been postulated to be direct response to sugar deficiency that resulted from senescing of the yam vine (sugar source) and stoppage in supply of sucrose to the tuber (sugar sink). In this study, we integrated GC-MS based sugar metabolites with quantification of six non-structural sugars parameters (total sugar, starch, reducing sugars, non-reducing sugars, amylose and amylopectin) to determine the role of non-structural sugars in yam tuber dormancy regulation. Two white yam genotypes; one landrace and one improved genotype (Obiaoturugo and TDr1100873) respectively were used. Yam tubers were sampled from 42 days after 50% senescing till tuber sprouting at the following points; 42d, 56d, 87d, 101d, 115d and 143d, and both sugar metabolites and the six sugar parameters were determined at each sampling points. The results showed that total sugar was low at 42d and 56d in both genotypes and gradually increased to its peak at sprouting on 101d for landrace and 143d for improved genotype. The differences between to total sugar at 42d and sprouting stage are 41.7% for the land race and 37.8% for the improved genotype. while reversed trend was observed for starch and reducing sugars metabolism. The later increase in both starch and reducing sugars in both genotypes coincided with the commencement of dormancy releasing to complete sprouting stages. A total of 24 sugar metabolites were detected and 17 were differentially accumulated across the sampling stages. The KEGG pathways analysis revealed that low sugar responsive pathways (sucrose non-fermenting 1-related protein kinase-1 [SnRK1] and C/S1 bZIP) were induced during onset and through deep dormant stage. Whereas, high sugar availability responsive pathways (hexokinase-1 [HXK1], trehalose-6-P [T6P], and target of rapamycin [TOR]) were induced from the commencement of dormancy release to the complete sprouting occurred. This result provides insight into the non-structural sugars role in dormancy regulation in white yam tuber, and expanded our knowledge in molecular mechanisms involve in yam tuber dormancy regulation.

Keywords: Dormancy, yam-tuber, metabolism, sugars, regulation



## **Morphological, Phytochemical and Proximate Constituents in Cladodes of Prickly Pear (*Opuntia Spp.*)**

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### **ABSTRACT**

The morphological, phytochemical, and proximate constituents of twenty-three prickly pear (*Opuntia spp.*) accessions were studied. Cladode length, width, thickness, and weight, as well as plant height and spread, all varied. Cladodes were acidic and served as excellent water reservoirs. They were made of mucilage, which has a high capacity for retaining water and oil. Cladodes were found to be high in crude fibre and total carbohydrates, but low in true protein and crude fat. They were also rich in macro-minerals such as calcium and potassium, as well as microminerals such as ferrous and manganese, followed by zinc and copper. With these findings, it was concluded that young *Opuntia* accessions might be used as vegetables, while mature cladodes can be used as livestock fodder. Because it is a good growing crop in semi-arid areas, it could be a novel option for farmers in India to increase their income.

**Keyword:** cladode, mucilage, prickly pear, proximate composition



## **Selection of paddy straw cutting blade based on the effect of operational parameters on the cutting torque and stress analysis by finite element method**

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### **ABSTRACT**

A laboratory setup for simulating the cutting process of a chopper cum mixture of straw incorporation unit for *in-situ* management of paddy straw in the field. In this study mainly focused on the cutting unit of the said machine and had a set of counter rotating blades and studied the effect of crop and machine parameters like the blades type, rotational speed, forward speed of machine and days after harvesting (DAH) on cutting torque, and power requirement for cutting paddy crop. SMS serrated, cutterbar serrated and SMS plain blade were used for this study. Cutting blade rotational speed, forward speed and DAH were varied from 500 to 900 rev/min, 1 to 2 km.h<sup>-1</sup> and 0 to 10 days, respectively. Response surface methodology (RSM) with central composite rotatable design (CCRD) was used to find the optimum parameters. Cutting torque was significantly affected blade rotational speed, forward speed and DAH. A SMS serrated blade required less torque and power than the other two blade. Finite element method (FEM) analyzed the influence of cutting speed, torque and geometry of blade to determine the critical points and stress on the blades designed for paddy straw cutting with its factor of safety.

**Keywords:** Paddy straw, torque, power, FEM, structural analysis



## TREND ANALYSIS AND ECONOMICS OF RAPESEED AND MUSTARD PRODUCTION IN BEGUSARAI DISTRICT OF BIHAR

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### ABSTRACT

The study has been carried out with the objectives of analyzing the trend in area, production and productivity along with the cost and return from rapeseed-mustard production. Further the constraints faced by the farmers were also documented and ranked. Primary data was collected from 120 rapeseed-mustard growers of Begusarai District from a cluster of three villages each from two blocks through SRSWOR Technique and secondary data were collected from different published sources (Source: DES, Govt. of Bihar). A negative growth rate (CGR) in area (-0.05%) was observed while the growth in production and productivity of Rapeseed-Mustard during 1998-99 to 2018-19 in Bihar was positive and significant. Districts wise analysis also indicated that there was positive growth in the area, production and productivity. Study revealed that average total cost of cultivation of rapeseed-mustard was estimated as ₹ 63873 on sample farms and the average gross income obtained was ₹ 83747 per ha. The return to cost ratio was 1:1.39. Therefore, it is suggested that the improved variety of seeds and technology along with proper package and practices should be targeted in these areas to increase the supply. There is a need to step up investment in agricultural research, education, extension to reach among unreached section of society emphasizing quality of production and value addition. The outreach of most modern crop production technology may be facilitated up to the last farmer.

**Keywords:** Rapeseed-Mustard, Growth performance, Costs and Returns etc.





## **Direct Seeded Rice (DSR): A novel technology for enhancing water productivity**

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### **ABSTRACT**

Water scarcity and labour is becoming major concern for the productivity and sustainability of the rice-wheat cropping system. Water requirement for agriculture is likely to be exacerbated by the climate change and we need additional 2-3% water with every 1°C increase in temperature. The problem is further intensified with the timely unavailability of labour. Delay in transplanting beyond optimum time results in 7-16% loss in rice yield. Further, reduced labour availability is increasing the cost of transplanting. DSR is an alternate to manual transplanting as it results in labour and cost saving of 90-95 and 75-80% in sowing as compared to manual puddled transplanted rice. The yield of DSR is comparable with manual puddled transplanted rice. The water saving in DSR as compared to puddled transplanted rice depends on rainfall and number of rainy days in the season. The water use efficiency and energy productivity of DSR is better than puddled transplanted rice. The B: C ratio is also higher in DSR. Weed management is a challenge in DSR, however, can be managed if proper packages are followed. Therefore, DSR can be a viable solution under scarcity of labour and water but, there is need to study the long term effects of herbicides on soil, water and development of weed flora.

**Key words:** DSR, Labour, Puddled transplanting



## **Alternative Nutrient Management Practices to Improve Yield and Income from the Soybean-Wheat Crop Rotation Systems of Madhya Pradesh**

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### **ABSTRACT**

Soybean-wheat system is a widely adopted sustainable agricultural intensification practice in farmlands of Central Indian states. In the course of time, unscientific crop production practices limited the average yield of soybean crop from this legume-cereal crop rotation system to 1-1.3 t/ha. A farm field survey carried out in the Bhopal district of Madhya Pradesh revealed burning field residues as a regular practice in the region and nutrient management practices were not sufficient to sustain the soil fertility. To address these issues nutrient management interventions viz., integrated nutrient management using biofertilizers, enriched compost (IPNS) and soil test based nutrient management (STCR) were developed and evaluated in nine farmer fields for a period of three years. Results showed that interventions increased cost of cultivation by 9% but, with significant increase in crop yields compared to farmers' practice (FP). Yield increase for soybean crop was 24% (IPNS) and 21% (STCR), and that of wheat was 20% (IPNS) and 15% (STCR) compared to FP. Increase in net income for IPNS was 31% and that of STCR was 22% compared to FP. The results reaffirm that to ensure sustainable productivity and profitability from farming, it is essential to make use of on-farm resources and off-farm resources in optimum quantity.

**Key words:** Soybean-wheat system, Integrated nutrient management, Enriched compost



## **The effect of integrated farming systems on securing and balancing nutrition in the farm households of Western Plains of Uttar Pradesh**

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### **ABSTRACT**

Integrated farming systems has been recognized as nutrition sensitive interventions that have the potential to improve nutrition in developing countries. The study conducted in the cluster of 3 villages viz. Satheri, Bhangela and Sonta comprising of 1036 households of Khatauli block, Dist. Mujaffarnagar. Sugarcane-wheat/sorghum +livestock (dairy) was found to be prominent farming system, consequently households were found to have cereals, sugars and milk dominated diets fulfilling the macronutrient requirements of the individuals but deficient in several micronutrients. Around 90 % male children and 87 % per cent of female children < 5 years of age were found stunted whereas about 13% male children and 19% female children < 5 years of age found wasted. On an average, around 20.55 % households were found malnourished, out of them 15.92% households observed to be chronic energy deficient and obesity occurred in 4.63% households. In order to expedite the adopted cluster's knowledge and capacity in terms of securing and balancing nutrition through farming systems interventions viz. crop intensification through introduction of high yielding varieties along with IPM and INM practices in field crops, crop diversification through integration of pulses and oilseed crops, fertility and nutrition management in milch animals, round the year nutrition kitchen gardening through seasonal and exotic vegetables along with nutrition awareness programmes through *krishak melas/ mahila krishak goshtis* etc has been implemented. This leads to the improvement in per capita production in terms of nutrient yield viz a viz micronutrient diversity. Results of the study revealed that around 64.03, 108.78 %, 69.34%, 44%, 95.96%, 82.0% and 72.81% increase in nutrient yield in terms of different micronutrients viz. iron, thiamine, riboflavin, niacin, vitamin B6, vitamin C, vitamin A and zinc, respectively were observed. It indicates that farming system interventions are effective in terms of diversified supply of agricultural production thereby, contributing to nutrition security.

**Key words:** Nutrient yield, Integrated Farming System, Micronutrient, Western Plains, Uttar Pradesh



## Next Generation Sequencing based Gene Mapping for Salinity tolerance at seedling stage in rice (*Oryza sativa* L.) landraces

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### ABSTRACT

Rice is extremely vulnerable to salinity mainly at vegetative and reproductive stage. In this study, 160 rice landraces along with check varieties were evaluated for seedling stage salinity tolerance (ST) using hydroponic system at 50,100 and 150mM salt (NaCl) concentrations. This enabled us to quantify spectrum of response of rice landraces to ST and nine were found to be tolerant which can serve as donors for ST breeding. The whole genome shallow depth sequencing followed by SNP calling resulted in identification of 1,10,327 SNPs against Nipponbare genome representing one SNP at every 698,961 bases (SNP rate). Genome-wide association mapping enabled us to identify 534 SNPs significantly ( $P=0.00001$ ) associated with 14 traits correlated with ST. Among them highest association peaks were found with root  $\text{Na}^+/\text{K}^+$  ratio (44) followed by root  $\text{Na}^+$  (34) and shoot  $\text{Na}^+/\text{K}^+$  ratio (33). Majority of SNPs were identified on chromosome 1 where *saltol* QTL was previously identified and about 80 loci coded for retrotransposon (Ty3 gypsy/Ty1 copia subclass). The locus Os10g25010(*OsCML-8*) encoding calmodulin related calcium sensor protein reported previously is known to have positive role in ST. Two SNPs S3\_1833767 and S3\_1833798(*Os03g04020*) codes for expansin protein which are regulator of cell wall extension and abiotic stress response and nine SNPs encoding retrotransposon positioned in upstream of *Os08g16900* were identified. These SNPs may pave the ways for salinity tolerance improvement through molecular breeding.

**Keywords:** Rice, Salt tolerance (ST), Seedling stage, Hydroponic, Association mapping



## **Impact of Agricultural Diversification on Food Security in Puducherry U.T.**

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### **ABSTRACT**

Agricultural diversification denotes shift from low value to high value crops and increase in share of output in non-crop sectors like animal husbandry, forestry, fisheries, etc. The study analyzed the impact of agricultural diversification on income and food security of farm households in Puducherry district using primary data from 120 farmers selected by multi-staged random sampling method. Six villages each from Mannadipet and Ariyankuppam communes @10 farmers per village were chosen for the study.

In the sample, 85 per cent were marginal and small farmers. As per Simpson Index, 60.8 per cent were diversified farmers. About 52 per cent had mean SID between 0.41 – 0.60. Food Consumption Score was taken as index of food security. Overall, 50.8 per cent of sample households were food secured, 12.5 per cent had poor food consumption and 36.7 per cent had borderline food consumption. Logit model implied that diversification index, cattle ownership, age, education, farm size, number of extension visits, access to credit and household income were key determinants of agricultural diversification. About 60.3 per cent of diversified households were food secured against 36.2 per cent for non-diversified households. Income inequality was 0.48 and 0.53 respectively among diversified and non-diversified farmers. Income inequality was less among farmers with crop husbandry and or horticulture + animal husbandry.

Provision of training and extension services and mechanization to overcome labour scarcity would encourage diversification. Scattered small holding affects diversification negatively and the study suggests pooling of land.

**Keywords** Agricultural diversification, Simpson Index, Logit, Food security, Gini coefficient



## Employing Jeevamrutha for enhanced *Centella asiatica* production – a field study

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### ABSTRACT

Jeevamrutha (JA) is a traditional biodynamic microbial liquid formulation widely used by farmers in India. Various studies suggest the potential of JA in increasing soil and plant health. Considering this background, this study employs JA along with farmyard manure with an aim to improve the productivity and production of *Centella asiatica* under field conditions. With the help of a farmer at Bimanahalli village, Mandya district of Karnataka, *C. asiatica* cultivation was done by the application of farmyard manure (2 tons/acre) along with the 8<sup>th</sup> day harvested JA (1:100 dilution). Two methods of application were employed, namely root drench (drip irrigation) and foliar spray at every 15 days interval. In comparison to the control plot JA application was found to increase the yield from 102 kg dry weight/acre (control plot) to 120 kg dry weight/acre. The increase in yield was also supported by increased leaf area of plants. The average leaf area of plants grown in control plot was 12.024 cm<sup>2</sup>, while for the plants grown in JA treated plot was 16.796 cm<sup>2</sup>. Moreover, as an alternate source of income we facilitated the farmer while selling the product online by tying up with a start-up “Kavan Biosolutions”. The *C. asiatica* leaves were processed into powder and bits for use as supplement or as herbal tea. The product was designed in 100 g packs and sold at the rate of 100 INR/pack. This study highlights that the application of JA can increase the yield of *C. asiatica* and provide an alternative source of income for the farmer.



## Physical and nutritional changes during fruit development in Dragon fruit species grown in Assam

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### ABSTRACT

Dragon fruit is emerging as a new and high-priced fruit with nutritional benefits in the Indian market, and it is gaining popularity in North-eastern India. In the present study, physical (length, diameter, weight, volume, and peel per cent) biochemical (protein, carbohydrate), and proximate (crude protein, crude fat, crude fiber, ash and mineral content) data for the two-dragon fruit (*Hylocereus*) species *H. costaricensis* (red pulp) and *H. udantus* (white pulp) from the seven days after fruit set to fruit maturity were generated. Physical parameters such as length, diameter, weight, and volume of the fruit gradually increased, and the percentage of peel decreased throughout the development process. Hundred grams of fresh matured fruit of both *H. costaricensis* and *H. udantus* was found to an average of 0.47±0.03 g crude fat, 2.80±0.14 g dietary fiber, 4.34±0.04 g crude protein, 8.40±0.06 g total soluble sugar, 3.30±0.08 g reducing sugar, 0.39±0.02 g starch, 2.52±0.29 g total soluble protein, 316.42±1.24 mg potassium, 28.62±1.24 mg magnesium, 6.90±0.22 mg iron, 84.32±0.95 mg calcium, 9.91±0.38 mg sodium, 6.32±0.22 mg zinc, 0.37±0.01 mg copper and 0.56±0.03 mg manganese. The result of current study are expected to create awareness among consumers by providing scientific evidence of nutritional quality of both red and white pulped DF.

**Keywords:** Dragon fruit, *Hylocereus*, proximate analysis, Pitaya, Superfood, Exotic fruit



## Genome-wide linkage mapping of QTL/s for yield associated traits under different water regimes in wheat

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### ABSTRACT

Climate change has strong influence on the productivity of wheat. Drought stress is the major factor that reduces wheat grain yield. Therefore, breeding drought-tolerant wheat genotypes with relevant agronomic and adaptive traits by discovering the underlying candidate genes and alleles is vital for increasing grain yield (GY). In the present study, 210 F<sub>10</sub> RILs derived from the cross of Dharwar Dry/DPW621-50 were genotyped using Axiom 35K Wheat Breeders Array. Field trials were conducted at three locations i.e., Karnal, Hisar and Powarkhera over four consecutive years (2015-2019) under three contrasting regimes (drought, rainfed and irrigated). A high density linkage map was generated using 1134 polymorphic SNP markers. Four stable genomic regions on chromosomes 2B, 2D, 4A and 6B were identified, each with multiple tightly linked QTL (QTL clusters) associated with two to three yield components under water stress condition. The 2B QTL cluster was associated with grain yield, thousand-kernel weight and grains weight per spike which further explored for underlying candidate genes (CGs), followed by their evaluation based on Gene Ontology (GO) enrichment analysis. The genes were found to be involved molecular function (MF), cellular component (CC) and biological process (BP). Kompetitive allele-specific PCR markers for the four QTL clusters were developed and being assessed in diverse wheat panel. The identified QTL and the KASP (Kompetitive Allele-Specific PCR) marker developed for it will be highly valuable in fine-mapping the locus and in exploiting it for marker-assisted selection in wheat breeding programs.

**Keywords:** Wheat, Drought, 35K wheat SNP array, QTL





**Effect of soil nutrient management on the yield and yield attributes of French bean (*Phaseolus vulgaris*) in mid hills of Arunachal Pradesh**

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**ABSTRACT**

An experiment was conducted to analyse the effect of soil nutrient management on two varieties of French bean (*Phaseolus vulgaris*) varieties and improve the production and productivity of French bean crop in mid hills, Arunachal Pradesh during the Rabi season, 2021. Two French bean bush type varieties (Changlabi Local and Selection-9) were grown under 10 different fertilizer treatment combinations i.e., control, vermicompost (VC) @ 2.5tonnes/ha, VC+lime @400 kg/ha, 50% recommended dose of fertilizer (RDF), 50%RDF+lime, 50%RDF+lime+VC, 75%RDF, 75%RDF+lime, 75%+lime+VC and 100%RDF where RDF is 50:50:50 kg/ha NPK in three replication at Gori Farm, ICAR RC NEH, Arunachal Pradesh Centre, Basar. The results recorded 75%RDF+lime had highest yield followed by 100%RDF and 75%RDF+lime+VC irrespective of French bean variety. The yield attributes like pod length and weight was highest in 75%RDF+lime followed by 100%RDF and 75%RDF+lime+VC irrespective of French bean variety. Comparing between the French bean varieties, selection-9 had higher yield average, pod length and pod weight than Chalanglabi local. Application of RDF along with lime and vermicompost @ 2.5 tonnes/ha was most suitable for improvement of yield and yield attributes of French bean crop in the mid hills of Arunachal Pradesh.

**Keyword:** soil nutrient management, yield, yield attributes, French bean, Arunachal Pradesh



## Physiological Characterization and Molecular Mapping for $\gamma$ -oryzanol and its components in rice (*Oryza sativa* L.)

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### ABSTRACT

Oxidative stress predisposes the etiology of various non-communicable diseases (NCDs). Antioxidants protect cells from oxidative damage, averting the NCDs.  $\gamma$ -oryzanol, an antioxidant in rice, is a mixture of steryl esters of ferulic and caffeic acid. In current study, we explored the natural genetic variation for  $\gamma$ -oryzanol in 174 Indian rice accessions using RP-HPLC method. A significant genetic variation ranging from 7.9-76.54 mg/100g was recorded. 24-methylenecycloartanyl ferulate was recorded as a major constituent of  $\gamma$ -oryzanol (2.4-31.78 mg/100g) in brown rice, followed by campesteryl ferulate (1.39-11.78 mg/100g) and cycloartenyl ferulate (0.72-20.75 mg/100g). A genome-wide association study (GWAS) conducted using BLINK and FarmCPU model resulted in identification of 19 significant marker-trait associations (MTAs) explaining phenotypic variance ranging from 0.001-48.88%. Four MTAs each for 24-methylenecycloartanyl ferulate (chromosomes 5,7 and 12) and campesteryl ferulate (chromosomes 4,5 and 12) and one for total  $\gamma$ -oryzanol (chromosome-5) were identified. Additionally, spatio-temporal analysis of  $\gamma$ -oryzanol revealed existence of significant compositional variation between seed and non-seed tissues. In grain, bran exhibited maximum accumulation (107.53-129.67 mg/100g) followed by embryo (46.97-59.29 mg/100g), husk (5.23-37.79 mg/100g) and endosperm (9.78-14.33 mg/100g). Further, milling (58.44%) and cooking (47.18%) caused significant reduction which indicates the need for enhancing  $\gamma$ -oryzanol content in rice grain in biofortification programmes.

**Keywords:** antioxidants, brown rice, GWAS,  $\gamma$ -oryzanol, MTA, rice quality



## FARMING SYSTEM APPROACH FOR FOOD SECURITY AND SUSTAINED RURAL ECONOMY

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### ABSTRACT

Although India is currently self-sufficient in cereals, still millions of people are inadequately fed, as economic access to food could not be achieved due to poor purchasing power of the farmers. Natural resources degradation declines the food production of India. Increasing pressure of human and livestock population are the main causes of natural resource degradation. Intensive agriculture can increase food production without natural resource conservation. Agroforestry systems viz., Agrisilviculture, Silvipastoral, Agri-Silvi-Pastoral and other systems like aquaforestry, apiculture with tree species may increase food production with natural resource conservation and their efficient utilization. Agroforestry play an important role in countrys food security through diverse food production, natural resource conservation, improving nutrition, health and increasing economic income of rural poor people. Agricultural production more than tripled between 1960 and 2015, owing in part to productivity enhancing through Green Revolution technologies. Nevertheless, persistent and widespread hunger and malnutrition remain a huge challenge in many parts of the world. The current rate of progress will not be enough to eradicate hunger by 2030, and not even by 2050. The second Sustainable Development Goal (SDG 2) explicitly aims at ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture, simultaneously by 2030. To meet demand, agriculture in 2050 will need to produce almost 50 percent more food, feed and biofuel than it did in 2012 (FAO 2019). Agroforestry is a provider of crucial benefits such as; food and nutritional security, enhanced agricultural productivity, mitigation of climate change impacts and resilience of environmental functions. Hence, global focus on the use of agroforestry as a tool to achieve those objectives should be increased and refined due to its ample positive social and environmental benefits.

**Keywords:** Agrisilviculture, Silvipastoral, Aquaforestry, malnutrition, productivity.



**Comparison of combining ability based heterotic grouping methods and assigning a set of germplasm lines to existing testers in maize [*Zea mays* (L.)]**

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**ABSTRACT**

Heterotic grouping based on combining ability for grain yield would be useful in planning crosses in breeding programmes. The present study aimed at (i) heterotic grouping of the germplasm lines based on HSGCA and SCA-PY, (ii) identifying the good tester for discrimination of the inbred lines and (iii) determining the potential parental combinations based on the superior method. For this purpose, 20 lines representing different origins and three male were crossed in Line  $\times$  Tester mating design and 60 hybrids were produced. Analysis of variance exhibited significant general combining ability and specific combining ability effects for grain yield. Both additive and non-additive gene effects played role in controlling the inheritance of the traits. DMIL-021 and DMIL-031 were found to be best testers. Combining ability based heterotic grouping methods such as HSGCA and SCA-PY classified maize inbred lines into four groups. Six different potential parental combinations were determined based on the HSGCA method. These combining abilities based heterotic grouping study is an additional tool that breeders could use to identify the best parents for superior hybrids development.

**Key words-** Combining ability, L x T, Heterotic grouping, HSGCA, SCA-PY



## Mandarins of Northeast India and their contributions towards genetic diversity

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### ABSTRACT

Northeast India is the house of many citrus crops where mandarins are highly preferred. An investigation was conducted during the year 2018-21 by collecting mandarin genotypes from different parts of Northeast India (Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim) using morphological markers. Total of 38 genotypes were obtained from all the parts of northeast India. Maximum genetic diversity was contributed by the yield (33.47%) followed by titratable acidity (22.73 %). Minimum contribution was from the fruit length and fruit width (0.1 %). The cluster created by Tocher's method showed 6 clusters where maximum genotypes were seen in cluster 1 and minimum in cluster 5 and cluster 6. Inter and intra cluster distances show the diverse nature of the genotypes morphologically. Molecular markers using SSR showed wide diverse nature of the same genotypes. From the investigation it is shown that most of the genotypes of mandarin from northeast India are diverse morphologically and molecular level they are less diverse. This is because of the random occurrence nature due to wide cross pollination and huge gene pool in the mandarin growing areas.

**Key words:** Diversity, genotypes, mandarin, morphological, SSR markers



## **Gender dimensions and socioeconomic factors associated with pulse farming of**

### **Odisha**

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### **ABSTRACT**

For understanding the gender dimensions and socioeconomic factors associated with pulse farming of Odisha, status of pulse production, in different districts of Odisha, number of women and men engaged in pulse production activities, their work participation rate, area, production and productivity of pulses, area under irrigation, livestock population and ownership, population and other socio economic indicators, nutritional status of women and children, income distribution of farm households were mapped. Systematic mapping was done using different databases like census-2011, NFSM, NSSO etc. Gender disaggregation of the database revealed distinct factors with regard to women farmers with respect to high pulse growing districts, medium pulse growing districts, low pulse growing districts, combination of high, medium, low pulse growing districts, non pulse growing districts and overall Odisha scenario. Results revealed that seventy seven percent of the state is under pulse cultivation. However 21% of area is under high pulse cultivation mostly tribal dominated districts with high gap in literacy between men and women. In 31% of growing area has low pulse cultivation whereas in 22% area pulse cultivation is negligible. Though gap in WPR for male and female is narrower in agricultural sector, WPR of female is highest in high pulse growing areas. Status of women is more as farm laborer (62.3%) than cultivators (13.9%) compared to 33.3% men as cultivators. High pulse growing areas are characterized by more supply of cheap female laborers or tribal laborers. Rural areas of non pulse growing districts have more malnutrition (14.6%). This indicates that pulse farming contributes to nutrition as pulses grown by the family are mostly used for family consumption.



## **Wheat-Cucurbits Relay Cropping: Proficient and Profitable Crop Rotation for North-Western Plain Zones of India**

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### **ABSTRACT**

Under north-western plain zone of India, cucurbits are mainly grown during spring-summer season as a sole crop. However, a new agronomic intervention of sowing cucurbits like muskmelon, pumpkin, ashgourd, watermelon, bottlegourd, spongegourd etc. as relay crop in wheat has enabled the farmers to utilize wheat fields for production of these vegetables. Under north-western plains, generally, cucurbits are sown from January to mid March and harvesting is done from April to June. However, if the cucurbits (like muskmelon, watermelon) are sown after wheat harvest (March end to mid April), the flowering and fruit setting is delayed and coincides with early monsoon rains during June resulting in poor yield and quality of produce. Here, the adoption of relay cropping of cucurbits in wheat allows farmers to take a normal crop of cucurbits up to June. Under this technology, cucurbits are sown either by seed or seedling (during January-February) on channels prepared at a distance of 4.50 to 5.00 m (6-8 channels per acre) in wheat field. After sowing of cucurbits, the vines remains on the channels and after harvesting of wheat, vines are placed outside the channels for further spread. Afterwards, irrigation, fertigation and weeding etc. are done in channels only. This system allows the cucurbit vines to get protection from cold and frost risk during early growth stage (as the channel is covered with wheat crop on both sides); thus, enabling the farmers to get early crop. Under this relay technique, about 8 % yield reduction of wheat occurs owing to land used in preparation of channels; however, this yield loss is adequately compensated by obtaining a whole crop of cucurbits. In studies conducted at Karnal, rice-wheat-muskmelon rotation resulted in wheat equivalent yield of 222.60 q/ha in comparison to 132 q/ha under rice-wheat rotation, respectively. The relayed cucurbit rotations (wheat-muskmelon, wheat-pumpkin, wheat-ashgourd, wheat-watermelon, wheat-cucumber, wheat-bottlegourd, wheat-spongegourd etc.) have proved profitable as compared to sole wheat crop. This type of relay system provides vast scopes for utilizing area available under wheat fields for expanding cultivation of cucurbitaceous vegetables up to June in north-western plains. Thus, adoption of this technique has been helpful in increasing the production of cucurbits and is being widely adopted by small and marginal farmers. This relayed cropping system is highly remunerative, climate resilient and ensures efficient utilization of resources in terms of time and space. Keeping in view the benefits, this technology needs to be popularized for national food and nutritional security. This paper reviews the research work carried out on growing of relayed crops in wheat under north-western plain zones of India.

**Key words:** cucurbits, relay, wheat, muskmelon, rotation



**Correlation studies for pod yield in yard long bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt)**

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**ABSTRACT**

Correlation analysis is an easy tool providing information that selection for one trait lead to the progress of other positively correlated traits. Correlation helps to evaluate the degree of association between two characters and the viability of indirect selection. The objective of this research was to estimate the genotypic, phenotypic and environmental correlations and to analyse the direct and indirect effects of yield components on yield plant<sup>-1</sup>. The experimental design was in randomized blocks with 7 treatments (4 parents and 3 hybrids) and 3 replications. Yield plant<sup>-1</sup> had significant positive phenotypic and genotypic correlation with pod weight, followed by pods plant<sup>-1</sup>, length of terminal leaf, days to first flowering, seeds pod<sup>-1</sup>, pod length, crop duration, keeping quality and days to harvest while no significant correlation with hundred seed weight and length of lateral leaf. Path coefficient analysis provides a more realistic understanding of the relationship as it partitions the correlation coefficients into the direct as well as the indirect effects of the variables. Among the various characters pods plant<sup>-1</sup> exerted the highest positive direct effect on yield plant<sup>-1</sup> followed by length of terminal leaf, days to harvest, crop duration and pod weight while pod length, days to first flowering, seeds pod<sup>-1</sup> and keeping quality expressed negative direct effect on yield plant<sup>-1</sup>. Pods plant<sup>-1</sup> could be considered as the most important yield trait for enhancing the yield in yard long bean because of its high, positive correlation and direct effect with yield plant<sup>-1</sup>.

**Keywords:** Correlation analysis, Direct effect, Pods plant<sup>-1</sup>, Yard long bean





**BER BASED HORTI-AGRI PRODUCTION SYSTEM FOR LIVELIHOOD  
SECURITY OF FARMERS IN HOT SEMI-ARID REGION OF WESTERN  
RAJASTHAN**

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In recent years, the semi-arid region is expanded by 10% and the newly formed semi-arid region is expanded by 4% of in Northern India. Globally, hot semi-arid regions are characterized by reduction in annual rainfall, increased aridity, high salinity, crop failure and high evapotranspiration that can have impact on the ecosystem. Due to these adverse conditions, population of arid and semi-arid regions depend on rainfed agriculture. In the recent past, horticulture based agroforestry has been gaining significant attention especially perennial fruit crops play an important role in improving production and also ensuring livelihood security of farmers. So that, one hectare model has been developed based on ber (var. Gola) with the spacing of 12m x 6m as main component and intercropped with green gram, cluster bean and okra during *Kharif* season and mustard, fenugreek and cabbage during rabi season. The recorded total system productivity under one-hectare ber based production system for cluster bean, mung bean and okra are 3292.76 kg/ha, 4874 kg/ha and 7623.8 kg/ha respectively during *Kharif* season and mustard, methi and cabbage are 3417.4 k/ha, 4590.8 kg/ha and 13812.5 kg/ha respectively during *rabi* season. The highest system productivity recorded in ber+ okra-cabbage system (31627.7kg/ha) and minimum was in sole ber. for five years. Maximum profit was obtained from ber+ okra-cabbage system (B:C ratio 1.80). Organic carbon and NPK of soil increased with cultivation of intercrops along with ber rather than sole fruit crops. The study resulted that the incorporation of horticulture component in farming system can give a hope of sustainable livelihood and improved farm income. Therefore, horticulture-based farming system model of self-sustenance of the farm with assured income for transitional plain of Luni Basin was developed.

**Keywords:** Ber, Horti-agri production system, Hot semi-arid, Rajasthan



## **Nutritional and Therapeutic properties of Traditional Rice Varieties of Southern Tamil Nadu: A Review**

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### **ABSTRACT**

Rice (*Oryza sativa L.*) is a vital and most common food staple in many Asian continents and is consumed by a significant sector of the worldwide population. India stands second in the production of rice next to China. *Black Kavuni* is a rice variety type native to Tamil Nadu, cultivated in certain pockets of Thanjavur, Tirunelveli, and Kanyakumari districts, and is basically of two types *viz.*, Black Kavuni and Red Kavuni. Foods which consist of antioxidants are black in colour or dark purple. It is also rich in fibre, protein, carbohydrates, B vitamins, and minerals like potassium, sodium, calcium, and micronutrients like iron and zinc, respectively. Therefore, consuming black rice in your regular diet can prevent many non-communicable diseases (NCD) like the occurrence of cancer cells, atherosclerosis, hypertension, diabetes, osteoporosis, asthma, and digestive health, reducing stroke risk levels in women. Thus, traditional rice varieties can be incorporated along with the white rice varieties in new product development to enhance the nutritional status of the growing population to combat lifestyle disorders.

**Keywords:** Black Kavuni, Traditional Rice Variety, Nutritional Profile, Non-Communicable Disease, Novel Food Product



## DELVING UNREALIZED POTENTIALS OF CHICKPEA GERMPLASM FOR NODULATION AND YIELD TRAITS

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### ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the ancient edible legume crops having high nutritional and economic significance. Root nodule symbiosis is the most successful metabolism-dependent symbiosis on the earth. In spite of being the most important grain legume in tropical and subtropical countries, the research on chickpea nodule development is scarce. Keeping this background in view, we conducted a study on root nodulation in chickpea. During 2020-21, an association panel consisting of 300 genotypes, extracted from the pool of ~ 2000 genotypes, was planted at 4 locations. The analysis of variance for 300 genotypes revealed significant differences of genotypes. The estimates of phenotypic and genotypic coefficients of variability were high for most of the traits indicates predominance of additive gene action. Based on the results obtained from the whole genome resequencing of chickpea genome, the trait data and high-throughput SNP genotypic data was used for genome-wide association study (GWAS) 9 SNPs significantly associated with root nodulation trait were identified and need further validation for conversion of markers to be utilized in marker assisted breeding programs. The genotypes which are highly diverged for nodulation traits could be utilized as parents in chickpea for high nitrogen fixation and yield improvement.

**Keywords:** Chickpea, nodulation traits, global chickpea germplasm, MAS



**Influence of planting technique and plant growth regulator on maize (*Zea mays* L.)  
under excess soil moisture stress**

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**Abstract.**

Waterlogging is one of the major constraints limiting maize (*Zea mays* L.) production, especially in the Indian subcontinent. A field experiment was conducted during the *khari* season 2020 at G.B. Pant University of Agriculture and Technology, Pantnagar, in a factorial randomized block design with three replications. The aim of the experiment was to evaluate the effect of planting techniques (ridge and flat) and exogenous application of plant growth regulators i.e.  $\gamma$ -amino butyric acid (GABA) (1 and 2mM) + nitrogen (30kg/ha) on morphological (Plant height, leaf angle, crop lodging) and remote sensing parameter normalized difference vegetation index (NDVI) in maize under ponding conditions (30 DAS for 7 days). Ridge system maintained aerobic condition in root zone and provided a good rhizosphere under saturated soil condition, exhibited significant influence on crop lodging and leaf angle (12% and 41 °), with respect to horizontal compared to flat technique (16% and 39 °). Combination of GABA (2mM) + N showed pronounced effect on plant height (186cm) and NDVI (0.77), however, both of these were statistically similar in planting techniques. Research findings of this study revealed that GABA has a pronounced effect in alleviating excess soil moisture stress but in the perspective of crop lodging and leaf angle, planting techniques (ridge) was more beneficial.



**Trait Association and path-coefficient studies in segregating generations of blackgram  
(*Vigna mungo* L. Hepper)**

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**ABSTRACT**

The Fabaceae family's blackgram is a self-pollinated ( $2n=22$ ) short-duration *Kharif* legume crop with *V.mungo* var. *silverstris* as its ancestor. Its loaded with abundant macro and micro nutrients, besides from that, due to the crop's narrow genetic base, poor ideotype, non-availability of high yielding varieties, cultivation in harsh and marginal lands with poor management practises, and vulnerability to various biotic and abiotic stresses, the crop's yield potential has remained low and stable over time. In light of this, the goal of the study was to generate wider adaptable and high producing genotypes by determining nature and size of the relationship between yield and related attributes in 24 genotypes including crosses, parents and checks for eleven agro-morphological characters during *Kharif* 2018 and 2019 at CSK HPKV Breeding farm, Palampur (H.P.). According to correlation analyses, seed yield per plant demonstrated a substantial and positive relationship with pods per plant, biological yield, pod length, plant height, and 100 seed weight whereas biological yield and pods per plant had the most beneficial direct and indirect effects on the total connections between yield and other component attributes in  $F_2$  and  $F_3$  the generations that could be indicated as the best selection indices on a priority basis, which would be beneficial in improving genotype performance for efficient breeding programme.



## POTENTIAL OF CROP DIVERSIFICATION IN ATTAINING FOOD AND NUTRITIONAL SECURITY: A REVIEW

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### ABSTRACT

In India, more than 85% of land holdings is dominated by small farmers who face day to day increasing challenges of land degradation, decreasing soil fertility, increasing incidence of droughts. Crops often fail in the events of prolonged drought which leaves farmer under huge debt trap. Due to the production of less remunerative crops the farmers fail to meet their family nutrition demands. In such situations, crop diversification has been providing large-scale boost to Indian agricultural economy in terms of food and nutritional requirements. Crop diversification is a shift from less profitable and sustainable cropping system to more profitable and sustainable cropping. It is the shift from regional dominance of one crop to production of number of crops, to meet ever-increasing demand of cereals, pulses, vegetables, fruits, oilseeds, fodder and grasses. Crop diversification increases smallholder farmers' income and nutrition security while giving them access to a range of diet. Inclusion of legumes and genetically fortified varieties of crops in diversified cropping systems is the need of the hour to the problem of malnutrition prevailing in the country.



## **Deciphering formal and informal seed sector contribution in seed sufficiency in kalyana Karnataka**

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### **ABSTRACT**

Seed, being the principal input in determining productivity, seed replacement should be enhanced by using certified/quality seeds other than farm saved seed which is the major challenge to be dealt with. A survey based study has been taken in Raichur district of Karnataka state to analyze the contribution of formal and informal sectors with respect to the use of quality seed for crop production. In Raichur district two blocks were selected randomly and from each selected block, five villages were selected through random sampling.

From each selected village, ten farmers were selected through random sampling for survey to obtain data and information as per the questionnaire (Total 100 farmers). Only samples of farm saved seed of each crop from every surveyed farmer were collected and tested for basic seed quality parameters viz., seed germination (%), physical purity and moisture content (%), seed health test as per ISTA rules. It is observed from the data that majority of the cotton farmers were cultivating bt-cotton hybrids and the only source of seed is private seed companies. With respect to redgram, 95% area is covered by TS-3R variety and Department of Agriculture is major source of seed. Where as in sorghum, variety M 35-1 has covered maximum area in two blocks. In paddy, BPT-5204 variety is dominating one which is spreading through private seed source. In rabi crops, chickpea variety JG-11 has covered maximum area and Department of Agriculture is major source of seed to farmers. Significant variation has been observed with respect to quality of farmer saved seeds. More percentage of seedlings with primary infection was noticed in the abnormal seedlings category. 33% of the farmer saved seeds were below the Indian Minimum Seed Certification Standards for physical purity. There is no significant change in crops was observed during last ten years. Majority of the farmers are using jute bags for storing their farm saved seeds.

**Key words:** Seed replacement rate, Formal sector, Informal sector, Seed quality



### **An overview on fast-track fruit breeding**

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#### **ABSTRACT**

Climate change, the proliferation of exotic pests, the need to use fewer chemicals, and the need to improve fruit quality are just a few of the issues the tree fruit sector is dealing with. The creation of better varieties is more important than ever to solve these difficulties. However, the process of breeding fruit trees has remained a laborious, tedious one for decades. These drawbacks and weaknesses of traditional breeding are addressed by the fast-track approach, which shortens the breeding period. Different fruit crops have benefited from the use of micro-propagation techniques such as somaclonal variants, somatic hybridization, embryo rescue, and double haploidy to create new and better cultivars. Additionally, the only effective way to regenerate genetically altered cells is by micro-propagation. The use of genetic engineering in horticulture crop development for biotic and abiotic stress tolerance and produce quality enhancement has a wide variety of applications. Numerous horticultural crops have had different genes added to them for protection against bacterial and fungal diseases as well as for stimulating early blooming. As a result, this cutting-edge breeding technology has the potential to improve upon and integrate with current breeding programmes as well as to revitalize and advance tree breeding more broadly.

**Keyword:** Fast track, somaclonal, embryo rescue, genetic engineering, haploidy





## Methodological Issues in the Assessment of Sustainable Livelihood Framework

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### ABSTRACT

Sustainable livelihood framework provides important insights about the reality of different dimensions of livelihood. Moreover, it has been applied in social research to assess the livelihood condition of people or to evaluate any livelihood generation activities. Sustainable Livelihood Analysis (SLA) has since the 1990s become the dominant approach to the implementation of development interventions by a number of major international agencies. It is defined in terms of the ability of a social unit to enhance its assets and capabilities in the face of shocks and stresses over time. SLA first seeks to identify the important assets in livelihood, their trends over time and space as well as the nature and impacts of shocks and stresses (environmental, economic and social) upon these assets. Following this, and after taking cognisance of the wider context (e.g. political, legal, economic, institutions, infrastructure etc.), interventions are designed to address any vulnerability and enhance livelihoods perhaps by diversification of income streams. Thus SLA could be said to be a practical framework for evidence-based intervention and has much logic resting behind it, especially in a world undergoing rapid change and where resources to support development interventions are inevitably limited. Given the existence of several social organizations applying their methodology, with each one having its own expectations; the different approaches that have been developed to achieve a better perspective of sustainable livelihood are discussed in this paper in terms of their objectives and goals. Furthermore, a comparative analysis of the approaches is carried out. It can be concluded that despite the different approaches by each organization to achieve SL, all have a common objective: the development of human groups in situations of social disadvantage and the eradication of poverty.

**Keywords:** Sustainable livelihood, asset, poverty eradication, diversification



## Study of generation means and gene actions for yield traits in brinjal (*Solanum melangena* L.)

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### ABSTRACT

The experiment was conducted at COA, Vellayani; laid out in compact family block design with three replications consisting six generations (P 1, P 2, F 1, F 2, B 1 and B 2) of the cross Wardha local × Surya. Generation mean analysis was done for thirteen yield related characters. Results showed that additive gene effects (additive, additive x additive) were important for fruit girth, fruit volume, number of fruits per cluster, yield per plant, which suggests direct selection would improve the traits; non additive gene actions (dominance, additive x dominance and dominance x dominance) were recorded for fruit length, days to first flower, days to first harvest, calyx length, fruit volume, number of fruits per plant, number of primary branches and plant height indicated that recombination breeding could improve these traits

**Keywords:** brinjal, GMA, generation means, gene actions, transgressive segregants

## Socio-economic impact of beekeeping trainings on the livelihood status of rural population in Chamba District of Himachal Pradesh

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### ABSTRACT

The present investigation was conducted during 2019 and 2021 at development block Tissa, District Chamba, Himachal Pradesh to evaluate the effectiveness of beekeeping training programmes in terms of need-based, theoretical and practical aspects. The results showed that majority of the trainees were in age group of 45–55, with higher secondary education and from agriculture and allied sector. Further 66 % respondents rated the training excellent whereas, 32 % rated as very good and 12 % per-cent as good. While majority of respondents (50 %) rated their willingness for scientific application techniques as very good, for communication (46 %) and behaviour (41 %) with trainee were rated as very good while program schedule (53 %) was rated as excellent. Further it was noticed that most of the trainees (38.29 %) benefitted by acquiring new skills, followed by beekeeping at home (30.86 %), started an enterprise (13.14 %), employment in bee farms (9.71 %) and increased self confidence (8 %). While 24.24% of trainees showed their enthusiasm for pollination in apple growing areas, 42.34 per-cent of trainees showed their keenness for honey production. It was evident that every trainee recognized that beekeeping significantly improved the socio-economic status of rural population.

**Keywords:** Beekeeping, Socio-economic status, Training, Employment



**Combined application effects of different oilcakes with Farm Yard manure on both mulberry and silkworm**

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**ABSTRACT**

A study was conducted during 2018-20 at Department of Sericulture, Forest College and Research Institute, TNAU, Mettupalayam research farm with eight treatments and three replications to study the application of oilcakes and assessment of their impact on both mulberry and silkworm on existing mulberry variety V1 (*Morus alba* L.). The treatments were imposed on three different categories viz., single application, combined and integrated formation with Farm Yard Manure. It was found that the integrated application of FYM @ 5 t/ha + neem cake + pongamia cake + Mahua cake (T8) performed economically and significantly better than the rest of the treatments with mulberry growth parameters viz., shoot length, number of leaves per branch, number of branches per plant and yield parameters like internodal distance, length and 100 leaves weight. Similarly, effects have been observed on post-harvest soil nutrients status. This study was also extended to check its adverse effect on silkworm rearing of (CSR2 X CSR27) X (CSR6 X CSR26) silkworm (*Bombyx mori* L.). Silkworm rearing performance reveals that the mulberry leaves with above nutrient combinations do not harm single larval and cocoon weight, shell weight, shell ratio and cocoon yield, respectively.

**Keywords:** Oilcakes, Farm Yard Manure, Mulberry, Silkworm B:C ratio

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## A STUDY ON INNOVATIONS IN AGRICULTURAL PRODUCTION FOR POVERTY ALLEVIATION

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### ABSTRACT

In the developing world, agricultural production is crucial, particularly in Asia, where the next population explosion is expected. Global food production must expand by 70 per cent to feed everyone today and in the future. There are more than 608 million family farms around the world, occupying between 70 and 80 per cent of the world's farmland and producing around 80 per cent of the world's food (Food and Agriculture organization of the United Nations, 2015). Small holder farmers are disproportionately affected by poverty, hunger and malnutrition. Currently, three-quarters of small holder farmers live in poverty and rely on small fragments of land. They have been unable to optimize their land usage due to a lack of agricultural technology and innovation required for reclamation of the soil, pest and disease resistant varieties, drought tolerant varieties, labour problem, non-availability of certified seeds and lack of awareness about the required support price and other recent techniques for higher production. Agricultural innovations bring solution to all these problems. These agricultural innovations include indoor vertical farming, farm automation, modern greenhouses, artificial intelligence, drones, some other ICT enabled devices for communication which paves way for increased agricultural production and alleviates poverty. The most efficient method to decrease poverty and hunger throughout the world, bridge the food gap and improve communities is to share and develop agricultural ideas with these small holder farmers. It is critical to understand the importance of investing and teaching smallholder farming communities. Based on the information, an attempt was made to study about the innovations in agricultural production for poverty alleviation.

**Keywords:** Innovation, Poverty, Small holder farmers, Global food production

### Information Processing Behaviour of rice growers under Seed Village Programme in District Baramulla (J&K)

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### ABSTRACT

The present study regarding the information processing behaviour of rice growers under seed village programme was carried out in five purposively selected Sub Divisions of Baramulla district, having Seed Village Programme under rice crop. Data were personally collected by researcher through well structured interview schedule. The majority of the rice growers from all the five sub-divisions were a medium level of information processing behaviour and the majority of the medium level of information processing behaviour of the rice growers were found in sub-division Pattan (71.42%), followed by sub-division Rohamma (70.00%), sub-division Baramulla (69.87%), sub-division Sopore (68.14%) and in sub-division Tangmarg (58.33%). However, the overall information processing behaviour of the rice growers (69.03%) from all the five sub-divisions was of medium level.

**Keywords:** Information, Processing, Behaviour, Rice, Growers.



## Assessment of performance of bhendi hybrids in Dharmapuri district of Tamil Nadu

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### ABSTRACT

Bhendi (*Abelmoschus esculentus* L. Moench) is an important vegetable crop occupying an average area of 1200 hectares in Dharmapuri district. Krishi Vigyan Kendra of Dharmapuri district assessed the performance of the bhendi hybrids TNAU bhendi hybrid CO 4 and Arka Nikita. Field trials were conducted in ten farmers' field in Belrampatti village, Palacode block of Dharmapuri district. The observations *viz.* growth and yield parameters such as plant height, number of branches, days taken for first harvest, number of fruits per plant, fruit characteristics, yield per hectare were recorded. The days taken for first harvest was early in Arka Nikita (42.50 days) compared to CO 4 (45.20 days) and the private hybrid (48.00 days). The length of fruit was the highest in CO 4 (12.33 cm) followed by the private hybrid (11.12 cm). The yield was highest in CO 4 (16.20 t/ha) and Arka Nikita recorded the lowest fruit weight (15.40 kg/ha). In bhendi increase in size and weight of fruits will not directly indicate that the variety or hybrid is the best. Since bhendi is preferred as a tender fruit increase in size was always not a favorable criteria for selection of variety. In this context, both CO 4 and Arka Nikita had the positive balance between the fruit size and tenderness.

**Key words:** Bhendi, *Abelmoschus esculentus*, CO 4, Arka Nikita, on farm trial



## **Exploring Genetic Diversity in Pearl millet [*Pennisetum glaucum* (L.) R. Br.] Germplasm lines for yield and micronutrients**

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### **ABSTRACT**

Pearl millet is an important coarse grain hardy crop. Pearl millet grown for dual purpose as grain and fodder and cultivated widely from well irrigated areas to the most arid regions of the world in Asian and African countries. The genetic diversity estimation and identifying superior genotypes constitutes first step in any crop improvement programme. An investigation entitled “Exploring genetic diversity in Pearl millet germplasm lines for yield and micronutrients” was carried out during *Kharif* 2017. The observations were recorded for nine morphological and three quality parameters to assess the character association in sixty pearl millet germplasm lines. The traits studied were dry fodder yield per plant, grain yield per plant, grain Zn content, 1000 grain weight, panicle diameter and plant height. Analysis of variance revealed sufficient variability for all the quantitative traits under study. The GCV and PCV estimates were high for dry fodder yield per plant, grain yield per plant, grain Zn content, 1000 grain weight, panicle diameter and plant height. High heritability coupled with high genetic advance was observed for traits viz. grain yield per plant, dry fodder yield per plant, grain Zn content and 1000 grain weight indicating the important role of additive gene action.

**Key Words:** Genetic Diversity, GCV, PCV, Pearl Millet, Breeding



## Popularization of Navara rice among the Small farmers of Ernakulum District of Kerala through Front Line Demonstration

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### ABSTRACT

In order to popularize rice (*Oryza sativa* L.) among small farmers in Kerala's Ernakulam district, Krishi Vigyan Kendra, ICAR- Central Marine Fisheries Research Institute, held a demonstration on five traditional farmer's fields in 2014-15. The experiment was done with the nearly extinct traditional medicinal rice variety Navara. This type is unique in that it is the only rice that is grown naturally. It has a high nutritional value and is high in minerals such as potassium, sodium, calcium, and micronutrients such as iron and zinc. Navara rice variety was used for demonstrations from July to September. The demonstration variety navara produced 38.6 q/ha and the local variety produced 40 q/ha, respectively. The popularise crop generates an average income of INR. 77200, while native crop varieties generate an average income of INR. 81400. The programme has a cost-benefit ratio of 1.27 and 1.32. The cost-benefit ratio for local crop varieties and navara rice is lower than for local varieties, but this variety has the most valuable medicinal quality, therefore farmers are more intrested for Navara rice. Following that, ten farmers in the district began cultivating the navara variety with technical assistance from KVK.

**Key words:** FLD, Navara Variety, Rice Paste and Rice



## Development of potential seed priming methodology for vigour enhancement in rice

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### ABSTRACT

Seed priming is a unique vigour enhancement technique that involves hydration of seeds, plentiful enough to initiate pre-germination metabolic events, but insufficient for germination *senso stricto* to happen. Seed priming not only helps the farmers to enhance crop yield by synchronized germination but also acts as a medium for infusing stress tolerance using various metabolic agents. However, the success of priming at the field level is lower, because lack of crop specific standardized methodology. The prolongation of the lag phase during imbibition without losing the desiccation tolerance is critical in confirming the best priming treatment. In this context, several experiments were carried out by altering the water availability during imbibition using different conditions viz., direct soaking of seed in water, slow availability by placing seed on blotter paper saturated with 10ml, 8ml and 5 ml of water; decreasing the water potential of surrounding medium to -1 MPa and -1.2 MPa using appropriate concentration of PEG. Priming invariably enhanced the germination and vigour compared to control in all the treatments and the increase in priming duration enhanced the vigour in all the treatments. The area under cumulative germination curve (153.1) and time for 50% germination (31.8 h) could identify the priming with -1 MPa PEG as better than other methods. Seed priming increased the number of normal seedlings, and speed of germination which improved the germination % and seed vigour indices.

**Key Words:** Priming, Direct Soaking, Blotter, Osmopriming, Vigour index





## Development of a Stabilized Tobacco Population for Varied Nicotine Content

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### ABSTRACT

Tobacco (*Nicotiana tabacum* L.) is reported to be an excellent source of phytochemicals viz. nicotine, solanesol, seed oil, edible proteins (green leaf) that have pharmaceutical, agricultural and industrial uses. Nicotine and nicotine like compounds may slow down or ameliorate the symptoms of certain diseases like Tourette's syndrome, Alzheimer's disease, Parkinson's disease, Ulcerative Colitis and Attention Deficit Disorder (ADD). Pure nicotine is being used in the production of Tobacco Cessation Products (TCP) such as chewing gum, nicotine patches, nicorette tablets. Higher nicotine genotypes are essential in tobacco for nicotine extraction and production of high nicotine tobacco products. Low nicotine genotypes are required for the making of low nicotine tobacco products. Hence, in the present study, an attempt was made to develop a stabilized tobacco population for varied nicotine content for diverse applications.

A population of 249 Recombinant Inbred Lines (RILs) were developed from a cross between Candel, a high nicotine tobacco line and Nisnicotinony-121, a low nicotine line. All the 249 RILs along with parents were phenotyped for nicotine content for five years (2012-17) and the data was statistically analysed. Candel recorded a mean nicotine content of 2.69% in contrast to Nisnicotinony-121 with 1.51% nicotine. The mean nicotine content of the population found to be distributed normally with the values ranging from 0.65 to 2.96%. The RIL entry 72 recorded highest nicotine content of 5.27% during 2015-16. Line 132 recorded higher mean nicotine value (2.96%) than parent Candel (2.69%). 96 entries recorded lower nicotine values than Nisnicotine-121 (1.51%). The developed population can be used in breeding programmes for the development of low and high nicotine lines, identification of closely linked markers to nicotine trait and mapping of the nicotine trait in identified linkage groups.

**Keywords:** Tobacco, Nicotine, RILs, mapping population, phenotyping



## **Double haploidy: a futuristic speed breeding approach in vegetable crops**

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### **ABSTRACT**

Due to increasing population and more food requirement, scientific development plays a significant role and has a potential to improve health status of masses. Crop improvement through conventional methods is a long time (6-7 years) and tedious process. Researcher these days are working on different ways and means for speed breeding (2-3 years) which include shuttle breeding programme, androgenesis, gynogenesis, microsporogenesis, chromosome elimination techniques, etc. for shortening the breeding process. There is a continuous demand for high yielding hybrids varieties of vegetable crops which are having highly desirable uniformity along with superiority in other horticultural and quality traits vis-a-vis resistance to biotic and abiotic stresses. Double Haploidy (DH) system offers opportunity for the development of stable inbred lines commercially with complete genetic purity by shortening the breeding process. It offers 100% homozygous and true breed lines which accelerate the speed of breeding programme. DH technology in development of inbred lines depends upon different factors like flower parts development stage, culture media, genotypes, donor parent growth condition and haploid detection methods, etc. Moreover, for the success of DH technology, sophisticated structures like phytotron facilities proves to be very useful.

**Keywords:** Double haploidy, Androgenesis, Gynogenesis, Microsporogenesis



## Resource Optimization for Increasing the Productivity of Blackgram Intercropped in Coconut Gardens

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### ABSTRACT

The population upsurge decreases the availability of land for cultivation and it necessitated the inclusion of crops in the interspaces especially short duration crops like pulses. Coconut or otherwise called kalpavriksha occupies more than 40 per cent of cultivable area in Kerala and offers an opportunity for intercropping due to their wider plant to plant spacing and with their active root zone confining only to 25 per cent of the available land area. Morphological and physiological parameters of intercrops vary considerably due to the prevailing partial shaded condition in the coconut garden and hence affecting the yield. A field experiment was undertaken at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala to identify suitable varieties of blackgram intercropped in coconut gardens. The field trial was conducted during *Rabi* 2019-20 in coconut garden (7.6 m x 7.6 m), having a light intensity equivalent to 50 per cent of that under open condition with 15 treatments and three replications. Seeds of 12 promising blackgram varieties collected from different research stations of south India (Sumanjana, DU 1, DBGV 5, VBN 5, VBN 6, VBN 8, Rashmi, CO 6, TAU 1, TAU 2, Blackgold and AKU 15) and three cultures (Culture 4.5.8, Culture 4.5.18 and Culture 4.6.1), were raised in microplots. Light intensity and photosynthetically active radiation (PAR) were recorded at monthly intervals. The light intensity during the entire cropping period ranged from  $(44.1 \pm 2.26)$  klux to  $(45.73 \pm 2.89)$  klux. PAR recorded the highest value of  $(9.89 \pm 0.12)$   $\mu$  moles  $s^{-1} m^{-2}$  at 2 MAS and decreased to  $(4.70 \pm 0.43)$   $\mu$  moles  $s^{-1} m^{-2}$  at harvest. Varieties and cultures showed varied response in the intercropped situation. Among the varieties and cultures screened, DBGV 5, VBN 5, Sumanjana, CO 6 and VBN 6 which performed better in terms of yield per unit area epitomised the optimum efficient utilization of resources under partial shaded coconut garden.



## Genetic Mapping of QTL in Plant Breeding: an innovative method & future prospects

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### ABSTRACT

Dissecting the genetic architecture of complex traits is an ongoing challenge for geneticists. Linkage mapping and association mapping, two complementing methodologies for genetic mapping have led to successful dissection of complex traits in many crop species. Both of these approaches detect quantitative trait loci (QTL) by identifying marker–trait associations. Identifying a gene or QTL within a plant genome is akin to finding a needle in a haystack. The availability of DNA markers and powerful biometric methods has led to considerable progress in QTL mapping in plants. Outstanding examples include: quantitative resistance to the rice blast fungus, grey leaf spot of maize, potato late blight, soybean cyst nematode and tomato bacterial wilt. The most obvious applications of QTL analysis seem to be marker-assisted selection in breeding and pre-breeding and QTL cloning. However, other areas are expected to benefit significantly from QTL analysis. These are: the understanding of complex traits such as plant–pathogen interaction, plant genomics, connecting proteins and regulatory elements with known functions to QTL by candidate gene analysis and germplasm augmentation through characterization that permits its efficient exploitation. Failure had to be faced by the researcher because the DNA region discovered for phenotypic variation was much wider, and needed to be focused down by applying more dense markers in that area to acquire the required and correct results. To effectively use high-throughput genotyping, adequate population design, advanced statistical techniques, and precision phenotyping have become critical in the era of next-generation sequencing.

**Keywords:** bulked-segregant analysis; linkage map; marker-assisted selection; molecular markers; quantitative trait loci



## Genetic variability for grain Ca and Mg content in pearl millet

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### ABSTRACT

Fifty pearl millet genotypes were evaluated in randomized block design at experimental field of Bajra section, CCS HAU, Hisar during *Kharif* 2020. Grain yield was significantly and positively correlated with dry fodder yield / plant and 1000-seed weight suggests that direct selection of these characters will be effective for improvement of grain yield. Grain Ca and Mg content exhibited negative and non-significant correlation coefficient with grain yield / plant indicates that grain minerals can be improved without compromising on grain yield / plant. Higher magnitude of correlation coefficients between Ca and Mg content, suggest that both these traits can be simultaneously improved. The path coefficient analysis showed the maximum positive direct effect on grain yield by dry fodder yield / plant followed by plant height, panicle length. Therefore, in order to increase grain yield, effective selection can be accomplished for the characters having high direct effects. The germplasm lines *viz.*, HMC-94-2, GP-69, GP-80, GP-70 and HMC-283 with high grain yield / plant (>30g) along with moderately high grain Ca (>160 mg/kg) and Mg (>1600 mg/kg) content were identified in study. These high yielding germplasm lines with moderately high level of minerals confirm the possibility of breeding for biofortified hybrids which are required for sustainably alleviating 'hidden hunger' specially in agriculture-based countries like India.

**Key words:** Pearl millet, Correlation, Grain Ca Content, Grain Mg content



## Technological Status of mung bean growers in Jabalpur District of Madhya Pradesh

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### ABSTRACT

Mung bean (*Vigna radiata*) is one of the most essential pulses crops. Mung bean is consumed as whole grains, sprouted form as well as daal in a variety of ways in homes. In Madhya Pradesh, during twelfth plan (2012-2017) the total area covered under mung bean was 2.51 lakh ha with 1.16 lakh tonnes of total production and productivity was 464 kg/ha as according to the annual report of directorate of pulses development(2016-17). However, the state lacks an average increase in yield when compared to the others states like Rajasthan, Maharashtra, Karnataka, and Gujarat which showed an increase in pulses production. Keeping this in mind the investigation was carried out during 2019-2020 to learn about the technological status posses by mung bean growers in the Kundam block of Jabalpur district, Madhya Pradesh. 120 farmers were selected from 12 villages of Kundam block with the help of a random sampling method. The study aims to find farmers' knowledge, adoption, and technological gap regarding improved mung bean production technology. The data were collected with the help of a pre-structured interview schedule and the collected data was carefully examined, classified, quantified, and tabulated. The study revealed that the mung bean growers had poor knowledge about seed and sowing management, field preparation management, high-yielding varieties, weed management, and insect and disease management. In the context of the adoption of improved crop production technology, it was observed that the majority of mung bean growers (52.50%) had a medium adoption level followed by 40.83 per cent had a low adoption level and only 6.67 per cent had high adoption level about mung bean production technology. Whereas in the case of technological gap it was revealed that 45.84 per cent of mung bean growers had a high technological gap followed by 37.50 per cent had a medium technological gap and 16.66 per cent had a low technological gap. It was observed that a very high technological gap was observed regarding the use of seed and sowing management, harvesting, insect and disease management, and weed management in mung bean cultivation.



## THERMOCHEMICAL ORGANIC FERTILIZER FOR SOLID WASTE MANAGEMENT AND SUSTAINABLE AGRICULTURE

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### ABSTRACT

Solid waste management is a serious problem for developing countries as the generation of waste is increasing at a rapid and alarming rate. A major part of solid waste generated is organic in nature, which can be recycled to produce organic fertilizers and can be used for crop production. A technology that could rapidly and successfully manage solid waste is the need of the hour. Such a technology for rapid conversion of waste to organic fertilizer employing thermochemical degradation has been developed by Sudarmaidevi *et al.*, 2015 at Kerala Agricultural University. Fresh biodegradable waste was ground to uniform consistency in the grinder unit of the KAU Suchitha waste processing machine and was boiled at 100 °C in the reactor unit after adding a reagent 1 *viz.*, very dilute hydrochloric acid @ 50 ml kg<sup>-1</sup> waste for 30 minutes followed by addition of reagent 2 *viz.*, dilute potassium hydroxide 100 ml kg<sup>-1</sup> waste for 30 min under ambient pressure. Processing was completed within one hour and thermochemical organic fertilizer (TOF) was produced. Coir pith @ 40 g kg<sup>-1</sup> waste and charcoal powder @ 30 g kg<sup>-1</sup> were added and sun dried to reduce the moisture content and fortified with mineral nutrients. Thermochemical organic fertilizer thus produced have high TOC content (43.88 %) than other commonly used organic fertilizers. Fertilizing value of thermochemical organic fertilizer was improved by fortifying it with external source of nutrients. Fortified thermochemical organic fertilizer (F-TOF) is an enriched organic fertilizer and has C: N ratio < 20. A study was carried out in tomato – amaranthus cropping sequence for two seasons to compare the effect of thermochemical organic fertilizer in enhancing the soil carbon pools and crop productivity in *Ultisols* in comparison with commonly used organic fertilizers. The treatments of field experiment were T<sub>1</sub> – FYM + POP recommendation of NPK, T<sub>2</sub> - FYM + soil test based recommendation of NPK (STBR), T<sub>3</sub>–ordinary compost + STBR, T<sub>4</sub> - vermicompost + STBR, T<sub>5</sub> – microbial compost + STBR, T<sub>6</sub>–unfortified thermochemical organic fertilizer (TOF) + STBR, T<sub>7</sub> - fortified thermochemical organic



fertilizer (FTOF)+ STBR, T<sub>8</sub> - F-TOF alone and T<sub>9</sub> - absolute control. In the study, it was found that thermochemical organic fertilizer is very effective in enhancing soil carbon pools such as TOC, labile carbon, water soluble organic carbon, microbial biomass carbon and recalcitrance organic carbon content in the soil. In the first and second cropping sequences highest yield for tomato (40.97 and 45.01 t ha<sup>-1</sup>, respectively) and amaranthus (24.62 and 26.89 t ha<sup>-1</sup>, respectively) was obtained from the treatment T<sub>7</sub> which received fortified thermochemical organic fertilizer along with STBR. The enhanced crop yield was mainly due to the increase in the soil carbon pools and fortification of thermochemical organic fertilizers with nutrients which were deficient in the soil. Thermochemical organic fertilizer is suitable option for tropical regions where faster decomposition of organic matter occurs due to high temperature. Application of thermochemical organic fertilizer maintains the SOC pools for longer duration in tropical soils due to their recalcitrance nature and fortification with nutrients that are deficient soil enhances crop yield and sustains higher crop productivity.

### **Principal Component Analysis (PCA) and hierarchical clustering in Tobacco (*Nicotiana tabacum* L.) for Yield and yield attributing traits.**

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### **ABSTRACT**

In the present study, multivariate statistical analysis techniques like principal component analysis (PCA) and hierarchical clustering were used to evaluate resources of variation among 246 genotypes of tobacco for six major yield and yield-related traits. The hierarchical clustering indicated that all the genotypes were clustered into eight major groups. The cluster III had the maximum genotypes with 49 genotypes with highest intra cluster distance and cluster IV and VIII showed maximum inter cluster distance indicating that characterized tobacco genotypes has high potential for various breeding goals. Principal component analysis and genotype by trait biplot analysis showed that the first four components accounted for 94.75 per cent of the total variation, with principal component (PC1) accounting for 55.96 per cent and PC2 for 20.97 per cent of the total variation. Our results conclude that the high yielding genotypes with other yield attributes identified in this study would offer valuable genetic material for breeding elite tobacco varieties.

**Keywords:** Tobacco genotypes, PCA, Rotated component matrix, Eigen value.





## **Interactive effects of conservation tillage, potassium and magnesium nutrition on root parameters, leaf area index and grain yield of cowpea**

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### **ABSTRACT**

Nutrient deficiency is one of the major constraint in growth, yield as well as quality of cowpea leading to nutritional disorder, lower production, productivity. Currently, deteriorated soil health, low input application, increasing labour cost, scarce labour, has become the major constraint in production of this catch crop. Cowpea, a minor pulse crop in Indian context, is the widely cultivated pulse crop in rice-fallows of Kerala under poor nutrient management and conventional tillage practice either in *rabi* or summer. In this scenario the present study was conducted in Kerala for two years, to study the response of cowpea under three tillage practices *i.e.*; zero tillage (ZT), minimum tillage (MT), and conventional tillage (CT), with five combinations of potassium (@ 12 kg/ha, 20 kg/ha, 40 kg/ha) and magnesium sulphate (@ 60 kg/ha and 80 kg/ha). It was observed that, ZT produced longer roots, and highest root spread with poor nodulation in the crop. Application of K: MgSO<sub>4</sub> @ 40:80 kg/ha resulted in highest LAI, Interaction effect was also significant and application of K: MgSO<sub>4</sub> @ 40:80 kg/ha under zero tillage registered highest LAI. Higher grain yield was recorded under minimum tillage along with application of K: MgSO<sub>4</sub> @ 40:60 kg/ha.

**Key words:** Conservation tillage, cowpea, magnesium sulphate, potassium, yield, LAI



## Marker assisted selection for strong culm strength associated with lodging resistance in rice

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### ABSTRACT

Rice (*Oryza sativa* L.) is an important staple food, predominantly in south east Asian countries. Lodging resistance is a complex trait and influenced by many interacting agro-morphological traits. Fertilizer application results in tall rice plants that are prone to lodging, resulting in lower plant yields. Modern varieties even though possess high yield lacks such properties besides susceptible to lodging. Improved White Ponni (IWP) is a popular rice variety that has good palatability in Tamil Nadu but prone to lodging. Hence, current research was focused to introgress strong culm in IWP background. Fourteen markers reported for *SCM2*, (strong culm strength) (Ookawa, 2010) were employed for polymorphism survey and found three markers, (RM5509, RM19391, RM19398) that are polymorphic. Further, hybridization was carried out between IWP and *Habataki*, and F<sub>1</sub>S were raised. True F<sub>1</sub>S were identified using polymorphic SSR markers and were further subjected to marker assisted backcross breeding.

**Keywords:** Rice, Culm strength, Lodging resistance, Land races, Marker assisted selection



## **Effect of Drip and Micro Sprinkler Fertigation Levels on Yield and Water Use Efficiency of Turmeric + onion intercropping system**

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### **ABSTRACT**

Field experiments were conducted in farmer's field at Thondamuthur, Coimbatore during 2015-16 and 2016-17 to study the effect of drip and micro sprinkler fertigation on yield and water use efficiency of turmeric + onion intercropping system. The study included two fertigation levels (100% RDF and 75% RDF), three irrigation levels (120% PE, 100% PE and 80% PE) and two methods of irrigation (drip and micro sprinkler). The experiments were laid out in a randomized block design (RBD) with three replications. Surface irrigation (5 cm depth) + soil application of fertilizers at 100% RDF was the control. The results revealed that higher yield of turmeric and onion was noticed under drip irrigation at 120% PE + fertigation with 100% RDF which is statistically on par with micro sprinkler irrigation at 120% PE + fertigation with 100% RDF. The increased Water Use Efficiency (WUE) was to the tune of 29.06 to 48.11 kg ha-mm<sup>-1</sup> under drip irrigation system and 20.45 to 34.18 kg ha-mm<sup>-1</sup> under micro sprinkler irrigation system during 2015-16. During 2016-17, WUE under drip irrigation system was 29.05 to 47.57 kg ha-mm<sup>-1</sup> and under micro sprinkler irrigation system was 25.66 to 33.48 kg ha-mm<sup>-1</sup>. The minimum WUE of 17.87 kg ha-mm<sup>-1</sup> and 15.50 kg ha-mm<sup>-1</sup> during 2015-16 and 2016-17, respectively were recorded under surface irrigation with soil application of 100% RDF.

**Keywords:** Yield, Drip, Sprinkler, Fertigation, Water Use Efficiency, Turmeric



## Phenylalanine ammonia-lyase of *Ocimum sanctum*: A key enzyme of phenylpropanoid pathway

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### ABSTRACT

Oxidative deterioration of nutritional components in our food decreases nutritional quality and can be prevented by addition of antioxidants. Safety of commonly used synthetic antioxidants is still questionable. At high dose, these synthetic compounds may cause adverse health issues. Therefore, use of natural phytochemicals as antioxidants has risen globally. Holly Basil (Tulsi; *O. sanctum*) accumulates high level of phenolic compounds possessing antioxidant activity. Enhancing accumulation of these compounds in plant tissues requires understanding of their biosynthesis and regulations. Phenylalanine ammonia-lyase (PAL) is a key enzyme of phenylpropanoid biosynthesis. PAL from *O. sanctum* (OsPAL) was isolated, characterized and studied at gene expression level. OsPAL had 711 amino acid residues with MW around 77.16 KDa and predicted pI 6.16. Molecular modeling and docking analysis showed homotetramer structure of OsPAL. Phylogenetic analysis showed the OsPAL was closely related to PAL from *O. basilicum* and *Perilla frutescence*. Further, gene expression analysis showed higher transcript accumulation of the OsPAL in both field grown plant and in-vitro callus tissue under methyl jasmonate elicitation. MeJ elicitation accumulated higher total phenolics both in the field grown leaves and the callus rendering higher antioxidant activity. Our study may be useful in metabolic engineering towards higher phenolic production in Tulsi.

**Key words:** Phenylalanine ammonia lyase, Tulsi, Callus



## Evaluation of eggplant parental lines for biochemical compounds and antioxidant activity

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### ABSTRACT

Eggplant is the third most consumed edible Solanum, which is widely grown in India as well as worldwide owing to the variability and diversity present with respect to shape, colour and biochemical properties. The importance of eggplant as a nutritionally rich crop is gaining momentum which is evident as it is ranked among the top ten vegetables for the superoxide scavenging activity. It is also regarded as a model crop for carrying out studies for enhancement in quality. Therefore, the present investigation was carried out at the Division of Vegetable Science, ICAR-IARI, New Delhi to characterize the anthocyanins present in the parental lines of eggplant as well as to evaluate the antioxidant potentiality. The anthocyanins in the flesh of the eggplant fruits were characterised by HPLC coupled to a photodiode array (PDA). Anthocyanin profiling in the ten parental lines of eggplant showed high predominance of the anthocyanin Nasunin [Delphinidine-3-(p-coumaroylrutinoside)-5-glucoside]. A promising parental line NDB-25 was found to be highest for all the biochemical traits evaluated *viz.*, anthocyanin (96.6 mg/100 g), total phenolics (86.72 mg GAE/100 g), CUPRAC (73.63 mg/100 g) and FRAP (81.40 mg/100 g). Therefore, the lines identified with high bioactive compounds can be further used by the breeder in enhancing the nutritional quality of eggplant as well as help the breeder in making selections for identifying and developing varieties/hybrids with better nutritional quality.

**Keywords:** Eggplant, anthocyanin, FRAP, CUPRAC



**ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION FOR MORPHO-CHEMICAL TRAITS IN BREAD WHEAT (*Triticum aestivum* L.).**

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**ABSTRACT**

The present investigation was carried out at the Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar using forty-four diverse bread wheat genotypes. These were sown and evaluated under timely sown condition, in a randomized complete block design with four replications during *Rabi* 2019-2020. In the present investigation, 11 morphological and 2 biochemical traits were analysed. The analysis of variance revealed significant variation among the genotypes for all the studied characters indicating the presence of adequate amount of variability among forty-four genotypes. High heritability associated with high genetic advance as per cent of mean was found for the number of tillers per meter, the number of grains per spike, grain yield per plant, leaf area per plant, and peduncle length indicating the traits were simply inherited in nature. Higher values of genotypic correlations than their corresponding phenotypic correlations were recorded for all the studied characters. The path coefficient analysis revealed that the harvest index recorded the highest direct effect towards grain yield per plant, followed by plant height, the number of grains per spike, and protein content. It can be summarized that for improving the grain yield in wheat; more attention should be given to harvest index, grain yield per spike, protein content, days to heading, and spike length while making the selection for developing high yielding wheat genotypes under timely sown condition.



## **Assessment and Promotion of Diversified Agricultural Technologies for Raising Farm Income**

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### **ABSTRACT**

Transfer of improved agriculture technologies to the farmers' fields is the cornerstone for transformation of the farming sector. The sound transfer policy makes it imperative to assess and test the technologies repeatedly at the local farmers' field. It calls for a systematic and planned programme of development, creating an enabling environment for all the stakeholders to participate as well as the change agencies to converge and collaborate in the process of change. IARI, New Delhi, a premiere institution in developing crop technologies, is implementing National Extension Programme in partnership with University of Agricultural Sciences, Dharwad (Karnataka) for promotion of improved crop technologies in the jurisdiction area of University for higher crop productivity and income to the farmers in the region. As per a study estimate, only 30% of the scientific knowledge reaches the actual field. The present study has been carried out to assess the efficacy of IARI crop technologies in promoting higher productivity and income from the farm sector.

IARI, New Delhi has been assessing and promoting some of the developed crop technologies in wheat, spinach (palak), pea and carrot in the jurisdiction area of UAS Dharwad. Improved varieties of some of wheat HD 2932 has been tested at the farmers' fields at multiple locations, Agriculture Extension Education Center Dharwad and KVKs (Bagalkot, Vijaypur, Mudhol) under UAS Dharwad regularly for 3 rabi seasons during 2014-2015 to 2016-17. Likewise, during the same period, spinach (all green) was demonstrated at the farmers' fields in different locations, AEEC Dharwad and KVKs (Bagalkot, Hanumanammatti, Mattikoppa and Dharwad). Besides, pea (Pusa Pragati) and carrot (Pusa Rudhira) were demonstrated at select locations during 2013-14 to 2015-16. Farmers were purposively selected for laying out demonstrations and it was regularly monitored by the experts from UAS Dharwad and IARI, New Delhi. Review workshops were organized regularly before each season to discuss the crop performance and plan subsequent activities.



As many as 7 demonstrations conducted on wheat HD 2932 during 3 seasons, resulted in average yield of 24.4 to 33.5 q/ha in 2015-16 and 2014-15, respectively with corresponding increase in crop yield of -0.52 to 19.6 percent in 2015-16 and 2014-15. The average net income from the crop accrued was to the tune of Rs 37858 and Rs. 68800 per ha in 2016-17 and 2014-15, respectively. Spinach (all green) was demonstrated at 9 locations during 2014-15 to 2016-17. The crop performed very well, exceeding the local check from 13.34 to 19.40 per cent in productivity. The highest yield realized was 110.95 q/ha in 2014-15 with the maximum net profitability of Rs. 70,464 per ha. The b/c ratio was also the highest (2.57) in this year. Pea (Pusa Pragati) was demonstrated at 6 locations during 2 rabi seasons 2014-15 and 2015-16. The crop performed well, producing highest yield of 47.60 q/ha in 2015-16 with an increase in yield of 19.99 per cent over local variety and the highest net income of Rs. 46733 per ha in 2014-15. Carrot (Pusa Rudhira) was demonstrated at 2 locations during rabi 2013-14 and 2014-15. The crop performed well with an average yield of 184.8 q/ha and net income of Rs. 94430 per ha.

It may be concluded that through Institutional convergence of IARI, New Delhi and UAS Dharwad, potential crop technologies in wheat, spinach, pea and carrot was successfully assessed and promoted among the farming community in the region, resulting in higher productivity and profitability for the farming community.

**Key Words:** Assessment, Demonstration, Crop performance, Net profitability





## UPGRADED CHICKPEA

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### ABSTRACT

The aim of all science in Agriculture is to improve the productivity of the crops. That was possible by green revolution but there were some drawbacks. The farmers mistook the green revolution, and they thought the excess application of fertilizers led to higher yield. That is partially true but which may take to increase in quantitative character of crops. Still, the qualitative character declines led to a significant deterioration in the health of the soil and people. Over the years, various illnesses such as cancer, thyroid and neurological disorders have greatly threatened mankind. It was said that many health disorders are due to the indiscriminate usage of chemicals in agriculture. This is the right time to use "biotechnology and new breeding methods". Agricultural biotechnology includes a range of tools, including breeding techniques, which alter living organisms or parts of living organisms. It has great potential to bring breakthroughs- in agriculture. In India, chickpea is one of the chief pulse crops, rich in protein, but the production and productivity level of chickpea is very low, and India is importing large amount of chickpea from our neighboring countries. So, the concept of "upgraded chickpea" leads to a more significant change helping to decrease the imports of chickpea from our neighboring countries. Using gene alteration or by special breeding technique by we can double the yield of chickpea that, is the concept "upgraded chickpea". In this concept, the floral biology of the plant is altered by gene alteration using Bio-technology. It is not easy to change or double the yield through biotechnology or special breeding technique, but once it is achieved, it plays a vital role in the country's growth. The central concept of this "upgraded chickpea" is the doubling of the current productivity of the crop, which also increases the yield. At the same time, there should not be deterioration in the quality and nutrient content of the chickpea. Also, the physical property of grain should not be altered or degraded.

**Keywords:** Biotechnology, New breeding technology, Doubling yield, Upgraded chickpea.



## Genetic variability of determinate F<sub>4</sub> progenies for yield attributes of Indian bean

[*Lablab purpureus* (L.) Sweet]

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### ABSTRACT

The experiment was conducted with fifty-five F<sub>4</sub> progenies along with two checks of Indian bean (*Lablab purpureu sL. Syn. Dolichos lablab L., 2n=22*) to evaluate genetic variability among eleven characters during late *Kharif* season, 2018-19 at Navsari Agricultural University, Gujarat. Significant variation was observed among all the traits investigated except days to maturity and pod length as well as within progenies of cross B, cross C and cross D. Seed yield per plant, pods per plant, racemes per plant, pods per raceme, pod weight and pod width showed high estimates of GCV and PCV. High heritability coupled with high genetic advance expressed as percentage of mean was noted for pod width and pod weight showing role of additive gene action and less effect of environment. Seed yield per plant had positive and highly significant association with days to maturity, plant height, racemes per plant, pods per raceme, pods per plant, pod width, pod weight and seeds per pod. Also pod weight and pods per plant had higher magnitude of positive direct effect on seed yield per plant and hence, advancement in seed yield could be brought by pod weight and pods per plant.

**Key words:** Genetic variability; heritability; correlation and path



## **CROP GENETIC BIOFORTIFICATION USING TRANSGENIC APPROACHES**

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### **ABSTRACT**

Malnutrition is the major problem affecting more than half the world's population and is considered to be the major problem. This offers to seek the approaches either for alleviating the deficiencies in food crops or by improving the unbalanced diets. Therefore, biofortification is the avenue to achieve the wide adoption and feasibility by all sorts of the farming community. It is the process of breeding nutrients into food crops and provides a sustainable, long-term strategy for delivering micronutrients to rural populations in developing countries. The current methods like supplementation and food fortification of staple food with minerals and vitamins can meet the ample nutritive status. Though these methods are not feasible for each nutrient especially iron nor viable due to recurrent cost, hence the developing technology is the genetic bio-fortification of crops which is the self-targeted and non-recurrent approach. The main advantage of this method is quick and accurate in terms of developing nutrient denser crops without any recurrent investment as compared to different strategies.

**Keywords:** Biofortification, Malnutrition, Minerals, Nutritional security and Transgenics



## Hybrid rice seed quality as influenced by storage duration and containers on newly developed hybrids and parental lines

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### ABSTRACT

Superior quality seeds are the seeds of the green revolution, it has been assertively and emphatically shown that 15-20% increased yield could be achieved by the use of good quality seeds alone. Good quality seed production depends on complex conditions evoking the most favorable interactions between the genetic makeup of the seed and the environment, under which it is produced, harvested, processed, and stored. With the aforementioned factors in mind, the present investigation has been undertaken to observe the potentials of newly developed rice hybrids and parental lines and observed its seed quality after harvesting in 2021 at Seed Testing Laboratory, Department of Seed Science and Technology, GKVK, Bengaluru. The seeds of parental lines and newly developed hybrids stored in super grain bag (C<sub>2</sub>) combined with cloth bag. Higher seed quality parameters recorded in super grain bag. Among A, B, R and hybrids maximum seed germination, root length, shoot length, total dehydrogenase activity, were noticed in A<sub>1</sub> (75.83 %, 14.82 cm, 12.22 cm, 0.384 OD value, respectively), B<sub>7</sub>(74.17 %, 13.44 cm, 11.71 cm, 0.332 OD value, respectively), R<sub>13</sub>(79.50 %, 14.17 cm, 13.61 cm, 0.429 OD value, respectively) and H<sub>1</sub>(80.10 %, 15.51 cm, 14.53 cm, 0.502 OD value, respectively). Whereas, lower seed quality was noticed in cloth bag at 10<sup>th</sup> month of storage period. Among all the 12 hybrid combinations, the seeds of KCMS57A × MSN36xTetep-35 stored in super grain bag performed well throughout the storage period.

**Key words:** Quality seed, Germination, Root length, Shoot length, Total dehydrogenase activity



## Genetic variability analysis for agro-morphological and seed yield component traits of soybean (*Glycine max* (L.) Merrill) genotypes under mid hill zone of Himachal Pradesh

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### ABSTRACT

A study with 21 soybean genotypes including three checks was conducted in *Kharif* 2021 at Experimental Farm of Genetics and Plant Breeding, CSK HPKV Palampur to determine the genetic variability, heritability and genetic advance for 13 agro-morphological and seed yield component traits for selection criteria in a breeding program. The experiment was laid out in RBD design with plot size of  $3 \times 1.35=4.05 \text{ m}^2$  and replicated three times. The results of analysis of variance revealed significant variation among the genotypes for these traits, indicating that the planting materials were genetically divergent from each other. The estimates of genetic variability showed that phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits explaining the important role played by environmental factors in the expression of the traits. High PCV coupled with moderate GCV values were detected for harvest index (27.93%, 11.84%) portraying the presence of sufficient genetic variation for selection in these traits. High heritability estimates coupled with high genetic advance (as % of mean) were observed for plant height and 100-seed weight which could be ascribed to the predominance of additive gene effects and high selective index and therefore, selection pressure could profitably be applied on these characters for genetic improvement in soybean.

**Keywords:** Variability, Soybean, Heritability, Genetic Advance, PCV, GCV



**Genotype × environment interaction analysis in linseed (*Linum usitatissimum* L.) for oil content across production systems in the North-Western Himalayas**

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**ABSTRACT**

Since prehistoric times flax has been a leading source of oil and fibre until the early twentieth century and still remains a crop of considerable economic importance. In the last two decades, flaxseed has gained popularity and has been the centre of high interest in the area of diet and disease research due to its unique nutrient profile mainly omega 3 acid present in its oil which lowers the level of triglycerides in the blood, thereby reducing heart disease. Therefore, keeping in view of increasing demand of linseed due to its numerous health benefits and non-edible purposes mostly in the form of oil there is consistent need for creation of stable cultivars with high oil content. Also, in Himachal Pradesh, India as it is either sown on poor marginal land *viz.*, under low input production system or is broadcasted in standing paddy crop, 15 -20 days before its harvest popularly known as *utera* or *paira* system. Therefore, keeping the importance of linseed as oil crop under both conventional and ZBNF farming system the present study was undertaken to identify stable linseed genotypes for oil content across sixteen environments (sites-production systems-years) in the North-Western Himalayas. In the present investigation performance stability of the genotypes could be examined and identified for the trait oil content. No genotype was identified as stable as per Eberhart and Russell model (1966) however; AMMI biplot model provided a clear distinction among the genotypes with respect to their yields and stability along with an understanding about the environments. However, few genotypes were found to be stable in their response for oil content across all sixteen environments. The most stable genotypes with above average performance identified were KL-257 and Nagarkot. These genotypes could be potential source of stability alleles and could be utilized in breeding programmes in that respect. The most unstable genotypes identified using AMMI stability model were Bhagsu and Surbhi although both showed above average oil content. As a result, it is suggested that they be used as breeding resources for particular adaption in the respective environments.

**Keywords:** Linseed, G x E interaction, stability, oil content



**Evaluating the performance of basmati and red rice genotypes for grain yield and quality potential traits under natural blast epiphytic conditions in west hill Himalayas**

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**ABSTRACT**

Basmati rice is popular for its grain quality traits but its yield and quality reduced due to attack of blast fungi *Pyricularia oryzae*, whereas red rice are nutraceutical rich and also confers resistance against blast pathogen. We have evaluated 30 basmati and red rice genotypes with three replications for 20 yield contributing and grain quality traits along with scoring of leaf and neck blast at RWRC, Malan, Kangra. ANOVA revealed that mean sum of squares due to genotypes were highly significant for all the traits indicated presence of sufficient genetic variability for all studied traits. Among the studied attributes, the highest heritability value was observed for spikelets per panicle followed by grains per panicle, days to 50% flowering, 1000 grain weight and protein content. It's suggested the importance of additive gene action for the inheritance of these attributes. The *per se* performance revealed that among basmati genotypes namely RP 4594-36-26-39-16-22-8-7-3, Vallabh Basmati-24 and RP 4594-55-49-76-42-53-20-15-8 and red rice genotypes Deval and HPR 2800-1 were the best for yield and other yield contributing traits. PCA was performed to estimate the relative contribution of different traits for total variability. First seven components were found with more than 1 eigen value. The PC1, PC2 and PC3 contributed 21.51, 17.81 and 13.02 per cent of variability, respectively. Several selected genotypes of basmati and red rice from this evaluation are can be useful as donors/parents for future breeding programme for the improvement of grain yield and quality traits.

**Key words:** PCA, Mean performance, LSD, Grain quality, Basmati, Red rice



## Relation between leaf pigment status and boron concentration in the leaves of coconut palms (*Cocos nucifera* L.)

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### ABSTRACT

Boron is an inevitable micronutrient for coconut nutrition. The amount of boron in the different palm components of an apparently healthy palm is 321.63 mg/palm. Deficiency of boron is rampant in the coconut growing humid tropics due to the deficient status in the soil, increased crop uptake and removal, non replenishment of the nutrient lost through crop removal and unscientific nutrient management practices with no emphasis on the application of boron. Major symptoms of boron deficiency in coconut are leaf fasciation, button shedding, inflorescence necrosis, longitudinal nut splitting and hen and chicken syndrome. However it has been observed that boron deficient palms have a dark green colour prior to the exhibition of symptoms especially the leaf fasciation and button shedding. Based on this field observation, a field investigation to understand the relation between total chlorophyll as well as that of the foliar boron concentration was conducted with coconut varieties West Coast Tall (WCT) and Malayan Green Dwarf (MGD). The total nutrient contents and the pigments concentration in the healthy and the deficient WCT and MGD palms were statistically compared using paired t test. The average boron concentration in the healthy WCT palms were 13.86 mg/kg where as the boron deficient palms had a concentration of 7.11 mg/kg. The Mg content in the healthy and boron deficient WCT palms were 0.176 and 0.218% respectively. The boron concentration in the index leaf samples of MGD were greater than that of the WCT palms. In MGD palms, the concentration of boron in the healthy and boron deficit palms were 34.6 and 25.1mg/kg respectively. The magnesium concentration in the healthy and boron deficient MGD palms were 0.138% and 0.157% respectively. The average total chlorophyll concentration in the boron deficient and healthy WCT palms were 1.08 and 0.88 microgram/litre whereas in the MGD palms the total chlorophyll content in the boron deficient and healthy palms were 0.634 and 0.506 microgram/litre respectively. The results of the preliminary investigation indicated the greater pigment accumulation and its expression in the boron deficient palms as compared to that of the non deficient palms. This in turn can enable the farmers to adopt appropriate strategies for the management of boron deficiency in tandem with that of soil and leaf analysis, before the yield decline due to the advancement of the deficiency.

**Key words:** boron, coconut, magnesium, chlorophyll





## Assessment of Molecular Diversity Analysis in Rice (*Oryza sativa* L.) Accessions using SSR Markers

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### ABSTRACT

Rice is a primary staple food for more than half of the world's population and more than 75% of Indian population. Chhattisgarh state is one of the major parts of India having richest rice biodiversity with wide genetic diversity. To make advances in rice molecular design breeding, it is important to understand the genetic background and phenotypes of germplasm lines, to know superior alleles of the breeding material. An attempt was made to identify the marker trait association for grain features with SSR markers and to identify the genetic diversity and population structure in rice germplasm. In this study, 25 microsatellite markers were used for measuring allelic diversity of 42 diverse panel. The total 66 alleles were observed for all the markers of which 65 by highly variable SSR markers. The maximum allele number recorded for the marker was with an average of 2.6 alleles per locus. Out of 25 markers 12 markers showed highly PIC value. Result of UPGMA cluster diagram mean of 67% level of similarity showed 42 accessions into 10 distinct clusters. Maximum cluster II had 13 genotypes followed by cluster IV, X, III and IX consisting of eleven, six, three and two genotypes, respectively. We expect that the results obtained through this study will be valuable for future breeding programmes. While genotype IC459797 showed the highest genetic similarities with IC461616 at the level of 98%. Cluster I found the high dissimilarities at the level (37%) of genotype IC386986. With the aid of microsatellite markers and clustering data, different distantly related rice genotypes may be combined by inter crossing, for instances, IC207184 x IC300326, IC459220 x IC 124560 and IC389453 X IC124546 from different clusters to get hybrid varieties with the highest heterosis.

These accessions were showing wide genetic divergence among the constituent in it and may be directly utilized in hybridization programme for improvement of yield related traits

**Keyword:** *Oryza sativa* accessions, Molecular diversity, SSR, PIC



## **Food and Nutritional Security of farm households: An economic analysis in Rural-Urban interface of North Bengaluru**

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### **ABSTRACT**

The factors that influence food and nutritional security of the households are examined in this research. This research is unique in the sense that, it identifies the specific areas in which farm households can enhance their food and nutritional security. Villages around the Bengaluru city were chosen at random and divided into three gradients: urban, transition and rural. A total of 260 farm households were included in the study, with 60 from the urban and 100 from the transition and rural gradients, respectively. Households in the urban gradient had higher food security in terms of calorie adequacy ratio, diet diversity, and composite food security than those in the transition and rural gradients. The probit model revealed that, among other things, education, household size, family income, and outstanding family debt had a substantial impact on farm households' food and nutrition security. A growing number of organizations are collecting this type of data, thus the methods and analysis in this study will be useful to them. To increase rural food security, adequate infrastructure and small-scale industries are required to generate job and income opportunities in agriculture and off-farm activities.

**Key Words:** Nutritional security, food security, Poverty alleviation, Rural-Urban interface, Farm households



**Assessment of Agricultural Water Productivity for Small Scale Irrigation Schemes under Drip and Furrow Methods at Hormat-Golina Small Scale Irrigation Scheme, East Amhara Region, Ethiopia**

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**ABSTRACT**

This scheme have two types of irrigation systems. Drip and furrow irrigation types were practicing at Hormat-schemes, but water productivity of this irrigation type were not evaluated yet. Thus, the aim of this paper was to evaluate the water productivity under drip and furrow irrigation systems. The well discharge capacity were determined by regular field measurements. Under drip irrigation method crop water productivity resulted were 1.53, 1.02, 1.06 and 2.24 kg/m<sup>3</sup> for chickpea, garlic, onion, and watermelon respectively. Whereas, under the furrow irrigation method, the crop water productivity resulted were 0.52, 0.66 and 1.52 kg/m<sup>3</sup> for chickpea, onion, and watermelon, respectively at the season. Moreover, the economic water productivity under drip irrigation method has resulted as 0.34, 1.29, 0.41 and 1.20 \$/m<sup>3</sup> for chickpea, garlic, onion, and watermelon respectively; and also 0.14, 0.25 and 0.85 \$/m<sup>3</sup> for chickpea, onion, and watermelon respectively under furrow irrigation system at the first season. Based on these results drip irrigation system is the advisable method for such irrigation schemes, and also it is the water saver irrigation mechanism in water scarce area.

**Key Words:** Water productivity, Drip, Furrow, Ethiopia.



## **Analysis of Maize yield in several parts of Africa under One Acre Fund Scheme**

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### **ABSTRACT**

Maize is one of the important cereal grown in Africa, occupying 25% of land area. Under one acre fund scheme, farmers grown SC Duma 43 maize variety owing to its very early maturity and drought resilient in wider adaptations. Optimal application of compost and micro-dosage fertilizer application technique were practised in this scheme. The cropping took place in June to September 2020 across various parts of central Africa. The crop duration is 90-120 days. Compost is applied at a rate of 5t/ha at initial ploughing. In the conducted area, 60% of cultivated area were treated with NPK application, 10% with NP application, 8% with NK application, 12% with no fertilizer application and remaining area with no sufficient data. The average yield obtained from recorded data of 3500 farmers is 5.89t/ha. The actual yield with respect to effective agronomic practices records to 6.75t/ha. The experiment thus attains an efficiency of 87.25% by reducing the recommended dosage, which shows comparatively less yield under normal cultivation. By this scheme both input and labour cost were saved at a rate of 30-35%.

**Keywords:** Sustainability, Fertigation, Yield Efficiency, Cost reduction.



**Title: Nutritional and Anti-nutritional Profile of Lentil (*Lens culinaris* Medik.)  
Cultivars of Assam and West Bengal**

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**ABSTRACT**

Lentil (*Lens culinaris* Medik.) is a potential pulse crop for nutritional security due to having protein and other essential nutrients like minerals and vitamins for all diet types irrespective of all income groups. Nutritional and anti-nutritional profiling of lentil cultivars of Assam and West Bengal were studied from seed flour. Biochemical constituents *viz*, starch (44.80-52.70g %), crude protein (21.59-36.00g %), soluble protein (19.05-35.82g %), crude fat (0.50-1.42g %), crude fibre (0.71-1.12g %), ash content (2.17-2.84g %), minerals (AAS analysis except P) *i.e.*, Ca (24.11-29.60 mg %), Na (25.50-26.62 mg %), Fe (6.00-7.26 mg %), P (274.57-305.72 mg %), K (749.49-768.50 mg %) and ascorbic acid (4.08-4.40 mg %) were estimated on dry weight basis here. Protein fractionation found as albumin (9.05-17.86 g %), globulin (54.12-63.84 g %), glutelin (13.77-26.62 g %), prolamin (1.91-3.99 g %) on dry weight basis. UHPLC analyses of B vitamins shown good results. Anti-nutritional factors like phenol (0.12-0.20 mg/g gallic acid equivalent), tannins (5.29- 7.52 mg/g), phytic acid (8.41-9.37 mg/g), saponin (2.78-4.87 mg/g) content were calculated on dry weight basis. As per this biochemical study all those selected cultivars are good enough nutritionally and could be recommended for human consumption.

**Keywords:** Lentil, Pulse, Nutritional security, Protein, Micronutrients.



## Gene interaction and linkage study of various qualitative traits in safflower

(*Carthamus tinctorius L.*)

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### ABSTRACT

This experiment was undertaken during *rabi* season to explore the gene interaction pattern of various qualitative features in safflower. Parents with differing qualities were chosen, and five distinct crosses were created. F<sub>1</sub> generation of the crosses were investigated for traits such as petal colour, bract type, capitulum form, stigma colour, and faded petal colour in order to determine their inheritance pattern. Plants were raised in bulk in the F<sub>2</sub> generation to determine their distinct segregation ratios. The segregation ratio was calculated using the Chi-square test. Petals colour was segregated in 9Red:7Yellow, 15Yellow:1White, 15Red:1Yellow whereas bract shape were segregated as 15Lanceolate: 1Ovate, 9Narrow lanceolate: 7Broad lanceolate, 9Long lanceolate: 7Short lanceolate, 3Lanceolate:1Extra narrow ovate were recorded. For capitulum shape segregation ratio were recorded as 15Beak shape: 1Big flat and for stigma colour it was 15Yellow:1Red. Faded petal colour was segregated in 15Dark red: 7Off yellow. After that, linkage was estimated by method of minimum discrepancy. Various linked traits were found such as petals colour and bracts type for the cross RSS 2016-7 x RVS 12-13 and RSS 2016-7 x RVS 12-13. Another linked trait was capitulum shape and stigma colour for the cross EC-755686 x A-1, also the capitulum shape and bract type were linked.

**Keywords:** Segregation, Qualitative traits, Gene interaction, Linkage



**Socio-economic impact and constraint analysis of improved vegetable technologies on farming community in state of Uttar Pradesh, India**

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**ABSTRACT**

Development of appropriate technologies through basic, strategic and need based research is very important for betterment of farmers to cope up with challenges of nutritional and food security in declining natural resources situation. Impact assessment of technology used to add value on it and justify investment over it. The present study was conducted in Ghaziabad and Hapur district of Uttar Pradesh, India with a total sample of 200 vegetable farmers. Three vegetable technologies namely Pusa Rudhira, Pusa Naveen and Pusa Sharad were selected for impact assessment. The adopter farmers had higher benefit cost ratio than non-adopters. The expenditure on higher living standard components was more after adoption of technology than the before. The social status of the adopters was also upgraded after the technology adoption. Among the various categories of economic and technological constraints, unawareness of credit facilities and insufficient knowledge of extension workers was found to be most severe respectively.

**Keywords:** Impact assessment, Benefit Cost ratio, Constraints, Technology and Adoption.



## The effect of Integrated Farming Systems on securing and balancing nutrition in the farm households of Western Plains of Uttar Pradesh

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### ABSTRACT

Integrated Farming Systems has been recognized as nutrition sensitive interventions that have the potential to improve nutrition in developed countries. The study conducted in the cluster of 3 villages viz. Satheri, Bhangela and Sonta comprising of 1036 households of Khatauli block, Dist. Mujaffarnagar. Sugarcane-wheat/sorghum +livestock (dairy) was found to be prominent farming systems, consequently households were found to have cereals, sugars and milk dominated diets fulfilling the macronutrient requirements of the individuals but deficient in several micronutrients. Around 90 % male children and 87 % percent of female children < 5 years of age were found stunted whereas about 13% male children and 19% female children < 5 years of age found wasted. On an average, around 20.55 % households were found malnourished, out of them 15.92% households observed to be chronic energy deficient and obesity occurred in 4.63% households. In order to expedite the adopted cluster's knowledge and capacity in terms of securing and balancing nutrition through farming systems interventions viz. crop intensification through introduction of high yielding varieties alongwith IPM and INM practices in field crops, crop diversification through integration of pulses and oilseed crops, fertility and nutrition management in milch animals, round the year nutrition kitchen gardening through seasonal and exotic vegetables alongwith nutrition awareness programmes through *krishak melas/krishak*, *mahila krishak goshtis* etc has been implemented. This leads to the improvement in per capita production in terms of nutrient yield viz a viz micronutrient diversity. Results of the study revealed that around 64.03, 108.78 %, 69.34%, 44%, 95.96%, 82.0%, 72.81%, and in nutrient yield in terms of different micronutrients viz. iron, thiamine, riboflavin, niacin, Vitamin B6, Vitamin C , Vitamin A and Zinc respectively were observed. It indicates that farming system interventions are effective in terms of diversified supply of agricultural production thereby, contributing to nutrition security.

**Key words:** Nutrient yield, Integrated Farming System, Micronutrient, Western Plains, Uttar Pradesh





## **Analysis of Resource Use Efficiency and Constraints of Gram Production in Gadchiroli District**

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### **ABSTRACT**

The present study entitled “Analysis of Resource Use Efficiency of Gram Production in Gadchiroli District” was undertaken in three tehsils. Three villages from each tehsil were selected. From each village 10 farmers i.e. 90 farmers were selected randomly. The primary data were collected by personal interview method in pre-designed schedule regarding different resources, essential fertilizers and constraints faced by the farmers in production of gram.

The results revealed that at overall level, the regression coefficient of human labour and machine charges, seeds and nitrogen and phosphorous was significant at one, five and ten per cent level, respectively. Which indicated the major contribution of these variables in output. The regression coefficient of plant protection, potash and bullock labour for gram production were found non-significant which indicated less influence of such variables on the output. Marginal value of product to factor cost ratio of all the variable was less than one. This indicates excess use of these inputs. Hence increasing these inputs are not significant in the gram production. In the constraints faced by farmers in production of gram, destruction due to wild animals (87.78 %) ranked 1<sup>st</sup> and Infestation of Insects and pests (84.44 %) ranked 2<sup>nd</sup>.

**Keywords:** Regression coefficient, Marginal value product, Resource use efficiency, Constraints



## Study of pollen-pistil interaction in interspecific crosses of flax

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### ABSTRACT

Utilization of wild species in crop improvement is marginal because of their inherent low crossability with the cultigen. An understanding of the biological nature of possible incompatibility systems impeding hybridization was assessed in interspecific crosses in *linum* by studying pollen-pistil interaction. Observations were made on pollen germination on stigma surface and pollen tube growth in self- & cross-pollinated *L. usitatissimum*, *L. bienne* & *L. grandiflorum* pistils as an indicator of barrier operating in wide crosses. Pollen germination and tube growth were studied *in vivo* after 2 to 48 hours after pollination (HAP) by observing the pollinated pistils under fluorescence microscope. Pollen germination was ranged from 76 to 92% and 71 to 92% in self and cross-pollinated pistils respectively. Pollen germination occurred within 2 HAP, irrespective of self or cross-pollinated pistils. In interspecific crosses between *L. bienne* X *L. usitatissimum* and *L. grandiflorum* X *L. usitatissimum* pollen tube reached to mycropyle within 4 and 2 HAP respectively but starts penetrating micropylar region within 6 and 4 HAP. In the reciprocal cross *L. usitatissimum* X *L. bienne* and *L. usitatissimum* X *L. grandiflorum* pollen tube reached to mycropyle within 4 HAP but starts penetrating micropyle within 10HAP. Viable seeds were produced in *L. bienne* X *L. usitatissimum* in both ways, however, in *L. usitatissimum* X *L. grandiflorum* crosses, non-viable seeds with degenerated embryos were seen inside the successfully developed capsules which indicates presence of post-fertilization. The study suggests that embryo rescue technique needs to be implied to produce interspecific hybrids to exploit *L. grandiflorum* as trait donor in flax breeding programmes.

**Keywords:** Hybridization, interspecific crosses, *L. usitatissimum*, *L. bienne*, *L. grandiflorum*, pollen-pistil interaction



## Evaluation of Germplasm of Sesame Genetic Resources for Resistance to Phyllody

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### ABSTRACT

Sesame (*Sesamum indicum* L.), is an important oilseed and ancillary food crop grown in the tropics and subtropics. It is produced mainly in India, Myanmar, Tanzania, China, Sudan, Pakistan, Ethiopia, Egypt, Paraguay, Uganda, Nigeria, Niger, Thailand, and Turkey for its high-quality nutritional seeds and oil. Sesame is suitable for various cropping systems, but the major factors that limit its cultivation are seed shattering and susceptibility to diseases. Among the diseases, phyllody is the most devastating disease (80-100 yield loss) of sesame caused by phytoplasmas which are cell wall-less bacteria that inhabit the phloem, and naturally transmitted by jassids. In India, wild relatives of *S. indicum* viz., *S. indicum* subsp. *malabaricum*, *S. mulayanum* (progenitor), *S. prostratum*, *S. laciniatum* are naturally distributed. Besides, exotic species such as *S. alatum* and *S. radiatum* got naturalized here. Screening of 228 accessions belonging to *Sesamum indicum* (65), *S. malabaricum* (37), *S. mulayanum* (40), *S. radiatum* (20) and interspecific crosses (66) against phyllody was carried during 2021 - 2022 at NBPGR Regional Station, Vellanikkara. Phyllody and its associated symptoms appeared on 30 days old plants in few (14) accessions and maximum incidence (about 70%) occurred at harvest. Accessions namely IC199437, IC219868, IC263336, IC263354, IC263355, IC277411, IC280376, IC312565, IC397212, IC409051 and IC436744 of *S. indicum*, IC623402 of *S. radiatum* and IC199437-5, IC199437-12 and IC199438 of inter-specific crosses were found free from phyllody and associated symptoms based on visual scoring. DNA isolated from symptomatic plants of different species has shown positive to PCR with universal phytoplasma specific universal primer pair SN910601 (5'gtttgatcctggctcaggatt3') and SN011119 (5'tcgccgtaattgcgctcctt3'). Pairwise sequence comparison and phylogenetic analyses of 16S rRNA gene sequences classified them with aster yellows (16SrI) and peanut witches' broom (16SrII) phytoplasma groups. Further virtual RFLP analysis of 16S rDNA sequences allowed finer classification of the phytoplasma strains into 16SrI-B and 16SrII-D subgroups in the *Sesamum* species.

**Key words:** Sesame, Phyllody, 16S rRNA Sequences, Aster Yellows, Peanut Witches' Broom



**Stage specific switch in uptake of nitrogen from ammonical form to nitrate form in rice  
(*Oryza sativa*)**

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**ABSTRACT**

Rice plant prefers ammonical form of nitrogen which is predominantly available under the puddled condition. At the early stage, rice is grown under aerobic condition where nitrate form of the nitrogen is easily available. As plants absorb ammonical form and metabolize, it releases excess hydrogen ion into the soil and creating acidic environment. While plant uptake nitrate it releases  $\text{OH}^-$  ion into soil and higher pH can be seen in medium. We evaluated rice plant with three different nitrogen treatments under hydroponic condition. The pH of the root exudates was recorded upto 30 days of sowing. We found that under ammonical form of nitrogen pH of the root exudates has decreasing trend and in nitrate treatment pH tend to increase while in mixed form of nitrogen, initially pH increases up to 22-24 days then after it start decreasing. This suggests that rice plant prefer nitrate form of nitrogen in the initial period of growth and development and then it switches to the ammonical form of nitrogen for uptake. This is the stage when rice is usually exposed to anaerobic conditions with agronomic, soil and water management where ammonical form of nitrogen is predominant, indicating the evolutionary significance of stage specific switch.

**Keywords:** Nitrate, Ammonium, Aerobic condition, Hydroponics, pH



## **Sustainable transformation of agriculture and food production system in alleviating poverty**

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### **ABSTRACT**

The future we want the importance of supporting developing countries in their efforts to eradicate poverty and promote empowerment of the poor and people in vulnerable situations, with a view to achieving the internationally agreed development goals, was reaffirmed. Several policy directions were identified, including the need to increase sustainable agricultural production and productivity globally, while the diversity of agricultural conditions and systems was noted. It is hard to exaggerate the role the agriculture plays in human development. From providing basic sustenance to employing millions of farmers worldwide, agriculture is a fundamental part of almost all societies and economies. Yet, agricultural systems must adapt, even transform, to meet a growing number of challenges and constraints. This transformation is crucial for achieving many aspects. Two thirds of the world some billion is hungry. Both rural and urban poor spend more than half of their incomes on food. Ensuring sustainable agricultural development is one of the critical components in global efforts for poverty alleviation, including maintaining sufficient food supply at a price affordable to the poor, marginalized and most vulnerable people, and maximizing the contribution of the production and trade of agricultural commodities to the sound development of local, national and regional economies and livelihoods. To ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate.. The research community has a long history of and many achievements in supporting robust agricultural development. National Agricultural Research Systems in individual member States have played key roles in this endeavour, especially in facilitating the application of different levels of terminologies, as adapted to specific national and local conditions. They now, however, face the new challenge of adjusting their focus to upcoming challenges, such as coping with climate change in impact, integrating economic, social and environmental dimensions and achieving the sustainable development goals, while simultaneously dealing with insufficient investment in research and development Transformative changes are needed in all countries, but the priorities and timing of implementation will differ according to local contexts. Simplistic, universal prescriptions or recommendations will not work; instead, successful models are flexible and built on local knowledge.

**Keywords:** alleviation, vulnerable, robust, impact, transformative, flexible



## Custom Hiring Service Centers- Need of a developing Agriculture: a Review

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### ABSTRACT

Indian farming is going through a continuous shift from reliance on human power and animal power to mechanical power on the grounds that rising expense for upkeep of livestock and developing shortage of labors. Further, utilization of mechanical power has an immediate bearing on the efficiency of harvests separated from decreasing the drudgery and working with idealness of farming activities. Consequently there is serious areas of strength for taking homestead motorization. Notwithstanding, the homestead power appropriation is very lopsided across the States, wherein the most noteworthy utilization of mechanical power is in the request for 3.5 kw/ha in Punjab and less than 1kw/ha in States like Bihar, Orissa, Jharkhand and so forth. Mechanical power is generally consumed in large land property and is still past the span of little/minor possessions which is around 80% of the all out land property. This is because of the way that the little/peripheral ranchers, by temperance of their monetary condition can't possess ranch apparatus all alone or through institutional credit. Hence to bring ranch apparatus accessible inside the span of little/minor possessions, aggregate proprietorship or Custom Hiring Centers needs to advanced incredibly. This model plan is ready to exhibit the banks that supporting for foundation of Custom Hiring Centers are a monetarily practical unit.

**Keywords:** Farm mechanization, agricultural economy, power, custom hiring



## BIOFORTIFICATION THROUGH CONVENTIONAL BREEDING APPROACH

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### ABSTRACT

The green revolution increased yield, but at the sacrifice of quality. Serious social and health issues are caused by micronutrient deficiency. Therefore, intensifies critical anxiety throughout the world. Bio-fortification refers to the process of increasing the micronutrient content of food crop through selective breeding, genetic modification or the use of enriched fertilizers. Developing biofortified crops also improves their efficiency of growth in soils with unavailable mineral composition. Conventional plant breeding increases the essential nutrients of foods through the improvement of cultivars by the conservative manipulation of plant genomes within their natural genetic borderlines. Foods that have been biofortified through this process are more likely to be accepted by a wide section of the global population than food that has been biofortified by transgenic methods. There are many methods for breeding biofortified crops without transgenic technologies such as single-seed descent method, marker-selected breeding and genomic selection method. A major advantage of using conventional breeding method to biofortify foods is that the public widely accepts this process. There is a need to identify the nutrient rich cultivars within the existed germplasm so that targeted nutrients can be incorporated into the crop to enhance the nutritional status.

**Keywords:** Biofortification, Conventional breeding, Single seed descent, Marker selection, Genomic selection



## **Crop geometry optimization for sugarcane-pulse based intercropping in a new planting technique of the sustainable sugarcane initiative**

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### **ABSTRACT**

Field experiments were carried out at the Sugarcane Research Station, Tamil Nadu Agricultural University (TNAU), Sirugamani, during the (first plant crop) 2016-17 and (second plant crop) 2017-18 growing seasons to optimize crop geometries for different intercrops grown under a new planting technique of the sustainable sugarcane initiative. The experiments were set up in a strip plot design that was replicated three times. Four crop geometries and four sugarcane-based intercropping systems were assigned to the main plot and sub-plot, respectively. The intercrops were grown in an additive series, with three rows of sugarcane planted at a row spacing of 150 cm and four rows planted at a row spacing of 180 cm. During the experimentation period, the crop received an average of 730.3 mm of rain. The soil at the experimental site was a well-drained clay loam with low available nitrogen, moderate available phosphorus, and high available potassium. The recommended drip fertigation schedule for SSI was followed by using a surface drip irrigation system. The response of various crop geometries to SSI planting methods was evaluated by recording observations on cane yield and yield attributing parameters at harvest. The results of the study revealed that better growth and yield parameters, cane equivalent yield were recorded under 150 cm double row planting of sugarcane with sunnhemp (M<sub>2</sub>S<sub>4</sub>).

**Keywords:** Sustainable Sugarcane Initiative (SSI), Growth, Yield parameters, yield.





## **Analysis of Resource Use Efficiency and Constraints of Gram Production in Gadchiroli District**

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### **ABSTRACT**

The present study entitled “Analysis of Resource Use Efficiency of Gram Production in Gadchiroli District” was undertaken in three tehsils. Three villages from each tehsil were selected. From each village 10 farmers i.e. 90 farmers were selected randomly. The primary data were collected by personal interview method in pre-designed schedule regarding different resources, essential fertilizers and constraints faced by the farmers in production of gram.

The results revealed that at overall level, the regression coefficient of human labour and machine charges, seeds and nitrogen and phosphorous was significant at one, five and ten per cent level, respectively. Which indicated the major contribution of these variables in output. The regression coefficient of plant protection, potash and bullock labour for gram production were found non-significant which indicated less influence of such variables on the output. Marginal value of product to factor cost ratio of all the variable was less than one. This indicates excess use of these inputs. Hence increasing these inputs are not significant in the gram production. In the constraints faced by farmers in production of gram, destruction due to wild animals (87.78 %) ranked 1<sup>st</sup> and Infestation of Insects and pests (84.44 %) ranked 2<sup>nd</sup>.

**Keywords:** Regression coefficient, Marginal value product, Resource use efficiency, Constraints.



**Effect of Different Fertility Levels on Growth and Yield of Zero Till Direct Seeded Rice (*Oryza sativa* L.)**

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**ABSTRACT**

Rice is one of the most important staple food crop and it is essential to the nation's food security. Due to water and labour shortages, as well as weather changes, production of conventional puddled transplanted rice is severely constrained. Zero till Direct-seeded rice (ZT-DSR) is a feasible alternative to conventional puddled transplanted rice with good potential to save water, reduce labour requirement, mitigate greenhouse gas emission and adapt to climatic risks. The experiment was conducted at the Agriculture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP, India during *Kharif* season of 2019-20. The experiment was laid out in Randomised Block Design with four replication and 5 treatment *viz.*, T<sub>1</sub> (control); T<sub>2</sub> (75 % RDF+5 Kg Fe+5 Kg Zn); T<sub>3</sub> (100% RDF); T<sub>4</sub> (100 % RDF+5Kg Fe+5Kg Zn) and T<sub>5</sub> (125 % RDF). The soil of experimental site was sandy loam in texture. The different fertility levels in ZT-DSR significantly enhanced the growth and yield parameters. Treatment receiving 100% RDF+ Zn 5kg ha<sup>-1</sup>+ Fe 5kg ha<sup>-1</sup> was recorded higher plant height (121.23 cm), no. of tillers (192 per MRL) at 90 DAS, no. of grains per panicle (170.70), grain yield (4.54 Mg ha<sup>-1</sup>), straw yield (6.72 Mg ha<sup>-1</sup>).

**Key word:** Growth, Nutrient levels, Rice, Yield, Yield attributes, ZT- DSR



## **Morphological Characterization of land races of rice (*Oryza sativa* L.)**

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### **ABSTRACT**

Recent agreements within the framework of the World Trade Organization have sparked an increase in interest in the descriptive identification of plant varieties in the context of intellectual property rights. The requirements of these activities vary, for example, the varietal registration process requires that a description of a newly bred variety be produced and compared to all existing varieties of common knowledge. 31 landraces (29) including checks (2) collected from OFRC, KSNUAHS, Navile, Shivamogga were utilized for the present study. These landraces were raised in RCBD replicated thrice and evaluated for 38 morphological traits during *Kharif* 2021. The local landraces exhibited sufficient genetic variation for most of the traits. Out of 38 descriptors studied, five characters (Leaf auricle, male sterility, shape of ligule, leaf collar & leaf ligule) were found monomorphic, while rest of the characters showed polymorphic variations among the landraces. The genetic potential of the landraces for the desired traits can be utilized in hybridization programme to achieve promising genotypes.

**Key words:** Morphological, characterization, DUS, land races, rice



**Transcriptome analysis in okra for identification of differential transcripts/genes and variants for bhindi yellow vein mosaic virus (BYVMV)**

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**ABSTRACT**

In this study, Pusa Bhindi-5 (DOV-66) was taken as BYVMV resistant parent and Pusa Sawani as BYVMV susceptible parent. The paired-end Illumina reads were generated from BYVMV resistant and susceptible parents under control and infected conditions. *de novo* transcriptome assembly was used for the identification of differentially expressed genes (DEGs). A total of 8710 unique DEGs were obtained from the four comparison sets (resistant-control vs. resistant-infected, susceptible-control vs resistant-control, susceptible-control vs susceptible-infected, susceptible-infected vs resistant-infected) with defined parameters (FDR and P-value <0.05 and log2fold change > 2) using the EdgeR. Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analysis revealed that from a total of 7052, 69, 2223 and 322 DEGs obtained 683, 6, 264, 23 transcripts were assigned to one or more pathways under four comparison sets. We identified a total of 4190, 23, 1241 and 140 transcription factors (TFs) in 7052, 69, 2223 and 322 DEGs obtained from four sets of comparisons. Based on the *de novo* assembled transcripts, a total of 1,06,224 putative SSRs were identified. A total of 1005237 raw variants were detected in the resistance variety while in the susceptible variety 717336 raw variants were detected.

**Keywords:** Transcriptome, okra, bhindi yellow vein mosaic virus (BYVMV), SSR



## **Proteomics: A new approach for finding new resistant genes in castor in response to wilting**

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### **ABSTRACT**

Castor wilt caused by *Fusarium oxysporum* f. sp. *ricini* is one of the devastating diseases among the castor growing states in India which adversely affect the plant population and its production drastically. It is need to understand the resistance and susceptibility in castor which would facilitate the development of new control strategies and the identification of plant factors necessary for resistance response. Proteomics approach is fast, robust and more reliable technique in study of host-pathogen interaction in castor and identification of genes which are directly correlated to the plant against wilting whereas genomics and transcriptomics whose omics data are large in number and required more time to analyze large sophisticated datasets. Additionally, 2D-gel in combination with MS, an advanced high throughput technique in proteomics used to identify and characterize proteins to know in depth role and functions of the protein. Proteins are effectors of biological function and their levels are not only dependent on corresponding mRNA levels but also on host translational control and regulation. Therefore, proteomics is always a method of choice for quick identification of novel proteins expressed during biological events. This will also help to understand the translational status, post-translational modification, biological function and location where it synthesized in the cell. Thus, the proteomics would be considered as the most relevant data set to characterize a biological system.

**Keywords:** *Fusarium oxysporum*, 2D, MS.



**Screening of linseed germplasm collection conserved in Indian National Genebank for drought tolerance and identification of trait specific promising accessions**

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**ABSTRACT**

The Indian National Genebank (INGB) at National Bureau of Plant Genetic Resources, New Delhi, conserves the base collection of linseed with around 2800 accessions. The entire collection of linseed germplasm was screened for drought tolerance in augmented block design including eight check varieties (T-397, Shekhar, Sheela, Sharda, Kartika, JLS95, JLS67, and LSL93) during *Rabi* season 2020-21 at NBPGR farm, IARI, New Delhi. The whole set was sown under both irrigated and rain-fed conditions to identify promising trait specific accessions with least yield penalty under moisture scarcity. Various phenological, physiological and agronomic traits were recorded in both the environments. Wide range of variation was observed for early plant vigour index (EPV; 0.01-0.46), Normalized difference vegetation index (NDVI; 0.09-0.67), days to 50% flowering (48.13-133.50), Chlorophyll concentration index (CCI; 41.10-94.04), plant height (15.69-107.67 cm), technical plant height (6.90-81.22 cm), number of primary branches (1-14), number of capsules/plant (10-560), seed yield/plant (0.16-25 g), thousand seed weight (1.1-11.7 g) and days to maturity (114-166 days). Promising accessions were identified for various traits such as days to 50% flowering: IC0118906, IC0499042, EC0022866, IC0096648, IC0118906, IC0499042 (<55 days); EPV: IC0526017, IC0305055, IC0597275 (>0.50); NDVI: IC0118867, IC0096567, EC0001550-B, IC0096634, IC0525923, EC0006160 (>0.69); CCI: IC0096494, IC0356279, IC0525940, IC0591125 (SPAD reading >90), seed yield per plant: IC0498794, IC0498736, IC0385336, IC0498744, IC0498706, IC0053298, IC0498548, IC0499134 (>15 g). The whole set was also evaluated at three locations during *Rabi* 2021-22 to understand G x E interaction and develop reference set for drought tolerance on the basis of multilocation and multiple year performance. This reference set is expected to provide expedited access to genetically diverse germplasm for linseed breeding for drought prone areas.

**Key words:** diversity, drought tolerance, flax, genebank, India, linseed germplasm, screening



**Additive gene action with complementary epistasis adequately accounts for transgressive segregation in interspecific crosses of flax for seed coat colour**

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**ABSTRACT**

Yellow seeded flax is often looked for introducing golden oil extraction and targeted in breeding programmes. Its wild progenitor, *L. bienne* (pale flax), has potential to broaden the narrow genetic base of flax. The objective of this work was to determine the mode of gene action for seed coat colour in the interspecific progeny of flax. Reciprocal interspecific crosses were performed: T397 X EC993389 and T397 X EC993391, of which EC993389 and EC993391 are yellow seeded pale flax, and T397 is brown seeded cultivated flax. F<sub>1</sub> seeds within both crosses were identical to maternal parent, while F<sub>2</sub> resulted in an intermediate phenotype, consistent with the maternal effect. These assumptions were validated with all the seeds obtained by growing 50 F<sub>1</sub> plants (bearing F<sub>2</sub> seeds) with no segregation for seed colour. However, segregation was observed on 804 and 599 F<sub>2:3</sub> seeds in crosses T397 X EC993389 and T397 X EC993391 in 9:7 expected ratio of two broad classes of brown and yellow colour, validated with chi-square test. Nature of gene action was inferred with the help of measures of skewness (> 0) and kurtosis (< 3) indicating additive gene action with complementary epistasis. Such interaction adequately accounted for extracting desirable transgressive segregants for yellow seed coat colour.

**Key words:** Additive gene action, complementary epistasis, flax, interspecific crosses, maternal effect, transgressive segregation



## MARKER ASSISTED SELECTION FOR MAPPING POPULATION OF F<sub>5</sub> GENERATION AGAINST CHICKPEA WILT

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### ABSTRACT

Marker assisted characterization of the 40 chickpea genotypes of F<sub>5</sub> generation were selected for screening from four mapping population of different crosses JG 62 (susceptible) X JAKI 9218 (resistant), PG 04305 (resistant) X JG 62 (susceptible), PG 07101 (resistant) X JG 62 (susceptible) and JG 62 (susceptible) X AKG 1001 (resistant). 10 genotypes from each population were selected. Using two molecular markers previously linked to disease resistance/susceptibility, a marker-assisted characterization of 40 chickpea genotypes differing for *Fusarium* wilt reaction was carried out. The validity of an Allele Specific Associated Primer (ASAP) marker associated to susceptibility (CS-27F/R<sub>700</sub>) and two Sequence Tagged Microsatellite Site (STMS) markers linked to resistance (TA-59<sub>258</sub> and TA-96<sub>275</sub>) were used. The results indicates that the ASAP (CS 27F/CS 27R) marker is linked to susceptibility alleles, and susceptibility dominant over resistance. The ASAP marker (CS27F/R) was used to screen all 40 genotypes and found no amplified product of 700 bp in any of them. Resistance is linked to the STMS markers TA-59 and TA-96, which cause amplification in resistant genotypes. In *cicer* sp., the amplification sizes of TA-59 and TA-96 were 258 and 275 bp respectively and that amplification was observed in each of the 40 genotypes.

**Keywords:** *Cicer arietinum* L., *Fusarium oxysporum* f. sp. *ciceri*, ASAP, STMS, Varietal genesis progression.





## Sustainable Agriculture and Women Farmers of Hilly Areas in Uttarakhand

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### ABSTRACT

Women are the main restorer of traditional knowledge and majorly contributing in all kinds of farming activities. Women, in particular, play an important role in promoting sustainable farming methods based on traditional knowledge. In order to achieve agricultural sustainability, women awareness and knowledge be addressed. Lack of awareness make it difficult to increase in productivity, reduce poverty and hunger. In light of this, the current paper examined the knowledge and awareness of women farmers of the area about sustainable agriculture. A sample of 100 women farmers from hilly villages from the district Thailsain is selected from random sampling technique. An semi-structured interview schedule is used for the collection of data and mixed form technique is used for analysis of data. Results showed that there is lack of awareness about the different governmental and non-governmental institutions helping in organic farming. Moreover, the main source of foremost knowledge and information on benefits of organic farming includes natives of local area and village 'Mahila mandals'(Women Groups). It is recommended that there is need of increase in knowledge and awareness among women farmers about every perspective of sustainability.

**Keywords:** women farmers, organic farming, traditional farming, sustainable agriculture, uttarakhand, hilly areas.



## Sustainable Agriculture and Women Farmers of Hilly Areas in Uttarakhand

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### ABSTRACT

Agriculture is main source of livelihood in the hilly terrain of Uttarakhand. High dependence on traditional mode of farming, very little use of chemical, fertilizers and pesticides proves very significant to become an 'Organic State'. Women are the main restorer of traditional knowledge and majorly contributing in all kinds of farming activities. Women, in particular, play an important role in promoting sustainable farming methods based on traditional knowledge. In order to achieve agricultural sustainability, women awareness and knowledge be addressed. Lack of awareness make it difficult to increase in productivity, reduce poverty and hunger. In light of this, the current paper examined the knowledge and awareness of women farmers of the area about sustainable agriculture. A sample of 100 women farmers from hilly villages from the district Thailsain is selected from random sampling technique. An semi-structured interview schedule is used for the collection of data and mixed form technique is used for analysis of data. Results showed that there is lack of awareness about the different governmental and non- governmental institutions helping in organic farming. Moreover, the main source of foremost knowledge and information on benefits of organic farming includes natives of local area and village 'Mahila mandals'(Women Groups). It is recommended that there is need of increase in knowledge and awareness among women farmers about every perspective of sustainability.

**Keywords:** women farmers, organic farming, traditional farming, sustainable agriculture, uttarakhand, hilly areas.



## Effect of nano zinc and silicon on performance of paddy in southern hill zone

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### ABSTRACT

An experiment was conducted in B<sub>1</sub> block of Agricultural and Horticultural Research Station (AHRs), Bavikere, which lies on 75°51' E longitude and 13°42' N latitude to investigate the effect of zinc and silicon nanoparticles on performance of rice. The experiment was laid in randomized block design consisted 12 treatments replicated thrice. The treatment details are seed treatment of nano zinc and silicon, foliar spray of zinc and silicon nanoparticles, combination of both seed treatment and foliar application, at 40 DAT foliar spray of EDTA ZnSO<sub>4</sub> (0.5%), potassium silicate (0.5%), ZnSO<sub>4</sub> soil application @ 25 kg ha<sup>-1</sup> and rice hull ash @ 2 t ha<sup>-1</sup> along with RDF were compared with the control. Application of both zinc and silicon nanoparticles (T<sub>6</sub>) as foliar @ 40 ppm each @ 40 DAT registered significantly higher no. of filled grains/panicle (100.5), less no. of chaffiness (05.0), test weight (24.82 g), per cent increase in protein content (10.33%), per cent increase in starch content (7.88%), grain yield (6034 kg/ha) and straw yield (6693 kg/ha). Treatment receiving foliar spray of zinc nano particles alone @ 40 ppm at 40 DAT recorded closer results and was statistically on par except for starch content.

**Key words:** Rice, Nano zinc and silicon, Foliar application, SEM



## BIOFORTIFICATION USING NANOTECHNOLOGY

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### ABSTRACT

Nutrient deficiency in food crops is seriously affecting human health, especially those in the rural areas. Nanotechnology may become the most sustainable approach to reducing this challenge. There are many ways of fortifying the nutrients in food such as using of drug dietary diversification and industrial fortification. Nanotechnology offers several types of scientific applications and advancements in agricultural sectors. It serves as the latest technology for precision agriculture whereby strategies are formulated and channelled towards meeting with food demands of the increasing human population. Due to their small particle size, high surface to volume ratio, and superior optical qualities, nanomaterials have specific characteristics. Among other things, these characteristics give nanofertilizers options for plant development, nutritional security, and a variety of farming techniques. Biofortification is a process by which the edible plants can be enriched with necessary nutrients for human health against malnourishment. A novel biotechnological technique for enhancing crops with necessary nutrients in the form of nano-particles to supplement human food with balanced diet is called nano-biofortification. Nano-biofortification can be achieved by applying the nano-particles of essential nutrients as a foliar application or nanofertilizers in soils or waters. An effective weapon against malnutrition may be the nano-biofortification method.

**Keywords:** Biofortification, Nanotechnology, Nano-biofortification, Nanofertilizer, Nano-particles



## Development of transgenic ridge gourd (*Luffa acutangula*) against Tomato Leaf Curl

### New Delhi Virus (Geminiviridae: Begomovirus)

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#### ABSTRACT

Ridge gourd is cultivated in tropical, subtropical, and few in temperate regions of the world. They are a rich source of essential vitamins and minerals around the world, contributing to an essential part of the diet for humans. Unfortunately, the production of this crops has been severely affected by diseases, in particular those caused by viruses that have a high economic impact. Among them, *Tomato leaf curl New Delhi virus* (ToLCNDV), a member of the genus *Begomovirus*, family Geminiviridae, is one of the most important viral diseases infecting the ridge gourd. The isolates of ToLCNDV are transmitted by the whiteflies (*Bemisia tabaci* (Gennadius)) and causes ridge gourd yellow mosaic disease (RgYMD) in ridge gourd. This study mainly aims at the process of development of transgenic ridge gourd to confer resistance against ToLCNDV using coat protein-mediated resistance (CP-MR), movement protein-mediated resistance (MP-MR), movement protein-mediated resistance (REP-MR) strategy. The total DNA from infected leaves of ridge gourd and viral protein gene was amplified using CP, MP, REP specific primers respectively. The purified CP, MP, REP gene was successfully cloned to pTZ57R/T vector. These genes were then moved into plant expression vector pBI121 (for CP), PB4NU (for MP), impact vector (for REP) with the help of the pET32a vector. The gene construct of these vectors were transformed into *Agrobacterium tumefaciens*. Finally, the *Agrobacterium tumefaciens* will be used to transform the ridge gourd varieties Arka Prasanna and Naga-F1 to check for the cross protection against TOLCNDV.

**Keywords:** Ridge gourd, TOLCNDV, Coat Protein-mediated resistance, Movement protein-mediated resistance, Movement protein-mediated resistance pTZ57R/T vector



**“Farmer FIRST and DBT Biotech-KISAN Hub Programmes: An role model PAN India initiatives towards Alleviating Poverty”**

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**ABSTRACT**

Under Farmer FIRST programme, a cluster of five tribal villages namely Bakla, Kharaha, Bamhani, Kurraha and Kharri in the Kasdol block of Baloda Bazar district, Chhattisgarh were adopted and promising interventions disseminated through five modules namely crop based module, livestock-based module, enterprise-based module, horticulture-based module and NRM based module. Total 634 tribal farm families benefitted under this programme. Under each module, interventions were selected based on matrix ranking and agro-ecosystem analysis. Based on the results obtained, various interventions such as goat farming using breeds such as Sirohi, Jamnapari and Barbari, backyard poultry farming with Kadaknath breed, oyster mushroom production, Farmer Communication Centre (FCCs), low cost *Azolla* production, nutritional home garden, drudgery reduction equipment for women farmers through Custom Hiring Centers (CHCs), Agro Processing Centers (APCs), low-cost poly house with drip and poly-mulching for vegetable production. In economic terms, additional income of Rs. 12,054 per farm family has been generated through the introduction of crop, livestock, horticulture, enterprise and NRM based modules. As a whole, the sum of Rs. 118.75 lakhs were generated by the farming community from different enterprises. As a social impact, nearly 36 per cent of seasonal migration of farmers were reduced from the adopted villages by this initiative. Interestingly, FFP initiatives empowered 34 per cent of farm women and attracted 20 per cent of rural youth towards agriculture initiatives. Overall, 24 to 30 per cent of increase in knowledge were observed among tribal farmers in the selected technologies. Drudgery of women farmers were reduced through village level CHCs. In addition, nutritional level of farm families was enhanced through nutritional home gardening. Total 54 agricultural interventions were introduced and sustained in the farmer's field. Overall, 347 capacity building programmes organized and 8417 tribal farmers benefitted. Under DBT Biotech-KISAN Hub, three aspirational districts namely Korba, Rajnandgaon and Mahasamund selected and 72 hectares of land covered under biofortified rice cultivation, rice fallow pulse and vegetable production with poly-mulch and drip system and 150



(80 additional) farm families were benefitted. Total 29 technological interventions introduced at farmer's field which includes 9 units of low-cost shade net house to promote cucumber and tomato production. In addition, three FPGs and One FIG (vegetable, goat and biopesticides) formed. As a special effort, 1486 cc (worth of Rs.1.48 lakh) of native *Trichogramma spp.*, (*Trichogramma japonicum* and *Trichogramma chilonis*) has been produced and distributed to farmers. About 297.76 ha of crops covered during *Rabi/Kharif* under this initiative and 740 farm families benefitted. The sum of total Rs. 56.17 lakhs/- of additional income generated (Rs. 37,420/farm family). As a capacity building programme initiative, total 122 trainings, 57 demonstrations, 21 field day programmes organized. As a total, 9,622 farmers benefitted under various capacity building initiatives. It is evident from the above desirable impacts that the farmer FIRST and DBT Biotech-KISAN hub programmes proved as successful role model initiatives in the socio-economic upliftment of tribal farmers and contributed significantly in alleviating poverty among resource poor small and marginal farmers.

**Keywords:** FFP, Biotech-KISAN Hub, Tribal farmers, FCC, APC and Income

### **Genetic Dissection of Coloured Flesh in Potato**

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### **ABSTRACT**

Biological pathways consists of a series of interactions among molecules in a plant cell that leads to a certain product or change in a cell. Genetic pathways are the one of the most common pathways. Among different genetic pathways, biosynthetic pathway regulates the production of different colour producing pigments like anthocyanins and carotenoids in the tuber flesh of potato. Each biosynthetic pathway is controlled by various genes and each gene affects the pathway in different way by producing an end product. To find out the role of a particular gene in a particular pathway, genetic dissection is studied. Genetic dissection is an experimental approach used to investigate each and every step of biosynthetic pathways. It is required to define the role of individual gene and also to identify mutations in a biosynthetic pathway. As potato is a highly heterozygous crop having different populations containing novel genes and alleles which can be involved in carotenoid and anthocyanin biosynthesis in the tuber flesh, it is a complex process to understand the interaction of different alleles that regulate flesh pigmentation in potato tubers. Genetic dissection of every step of carotenoids and anthocyanin biosynthesis pathway can help in obtaining the knowledge about genes involved and their inheritance pattern.

**Keywords:** Potato, genetic dissection, anthocyanin, carotenoid.



## A STUDY ON SOCIO-ECONOMIC PROFILE AND AWARENESS OF RURAL WOMEN TOWARDS ENVIRONMENTAL SANITATION PRACTICES

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### ABSTRACT

Sanitation in the most of the villages in India presents a dismal picture. Insanitary conditions endanger public health by causing numerous diseases and the spread of epidemics. Information Education and Communication (IEC) are critical components of the government of India's Nirmal Bharat Abhiyan programme. The current study contributes to a better understanding of rural women's awareness towards environmental sanitation practices. Study was conducted in Dharwad district of Karnataka with a sample size of 650 rural women. Data was gathered via personal interviews and evaluated using mean, standard deviation, frequency, percentage, and the t-test. Results from the study indicate that, maximum per cent of the respondents belonged to nuclear family and small farmer group and were having low level of income. Majority of the respondents were living in tiled roofed houses followed by thatched houses and were having mud floor for their houses. The results in the study also revealed that, more than half of the respondents had medium level of awareness regarding personal hygiene, menstrual hygiene, animal management, plastic usage, pesticides, polluted environment, bio fertilizers. Whereas respondents had high level of awareness regarding house sanitation, toilets and bathroom sanitation, water management, health effects respectively. Awareness generation among rural women households about the adoption of better environment sanitation practices lies at the root of rural sanitation drive in the country.

**Keywords:** Sanitation, Information Education and Communication, Environment, Rural women.





***In vitro* conservation of banana cv. Nanjanagud Rasabale: Effect of growth retardant on growth and storage**

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**ABSTRACT**

Nanjanagud Rasabale (AAB, silk subgroup) once leading cultivar of Mysore district is now failed to revive its GI tag, the major bane of cultivar is highly susceptible to panama wilt. Hence, there is need for conservation of this elite cultivar from threat of extinction. Plant germplasm can be conserved by different approaches one of the valuable biotechnological approaches is *in vitro* conservation. *In vitro* studies were undertaken to come out with effective protocol of conserving plantlets through slow growth process by adding different growth retardants. Growth retardants such as ancymidol, paclobutrazol, abscisic acid, DMSO at three different concentration each were supplemented to media. Among different treatment combinations MS medium containing DMSO 2.25 mg/l + 8% agar + 3% sucrose was found to be most effective by prolonging the period of successive subculturing and enabled mid to long term conservation of plants.



## **Bio-utilities of Quantum Dots in CRISPR/Cas9: Functionalisation of Q-Dots on Reporter Plasmid for Delivery in Plant Tissue**

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### **ABSTRACT**

A proof-of-concept will be identified for the loading of the plasmid DNA on quantum dots. The quantum dots will be treated with compounds to develop designer functional groups that will help in coating or adsorption of plasmid DNA on the surface of the Qdots. The loading of the DNA molecule on Qdots will be identified through gel electrophoresis analysis. The plasmid DNA-Qdot Nano-complex will then be incubated with the callus tissue suspension derived from different explants for delivery of the target plasmid DNA or reporter gene. The immature embryos extracted/ obtained from the wheat inflorescence will also be incubated with the plasmid DNA-Qdot Nano-complex. The comparative transformation efficiencies for both the callus suspension and immature embryos will be evaluated. The occurrence of the plasmid DNA will be validated through PCR technique. The unloading of the plasmid DNA payload will also be determined through fluorescence microscopy or fluorospectroscopy techniques. The change in the fluorescence emission signal of the Qdots pre and post unloading of the plasmid DNA will be quantified. The nano-delivery of the plasmid DNA coding for the Cas9 endonuclease and single guide RNA will be performed in callus tissue/ immature embryo. The transformation and genome editing efficiencies will then be determined by performing the T-Endonuclease Assay.

**Keywords:** Quantum dots, Fluorospectroscopy, T-Endonuclease assay



## **Mitigating Fe-Toxicity in Plants through Molecular Genetics Approaches.**

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### **ABSTRACT**

Abiotic stresses are currently a major problem-imposing factor in Agri-food sectors in our country. Presence of macro and micro nutrients in toxic concentrations will hamper the yield of the plant. Iron toxicity is a major problem in the red-lateritic zone of West Bengal, Jharkhand and Bihar. Fe-resistant varieties may be developed to mitigate this acute problem. Breeding technologies such as gene cloning allows precise selection of desired gene pertaining to Fe-resistance in cereal crops using PRGEB31 and JD633 vector system. We will be screening out the recombinants by culturing them simultaneously in a controlled and Fe-rich media. Positive recombinants will be screened and transformed into plants through microinjection method or we will be relying on a robust, reproducible agrobacterium-mediated transformation system in immature embryos. The successful T<sub>1</sub> generation will be screened for the desired trait and subsequent T generations can be developed that have the putative trait.

**Keywords:** PRGEB31, JD633, Agrobacterium-mediated transfer, T generation



**ECONOMIC STUDY OF PADDY CROP AT BALODABAZAR-BHATAPARA  
DISTRICT OF CHHATTISGARH STATE**

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**ABSTRACT**

The research work was conducted with a view to analyze the cost and return of paddy in Balodabazar-Bhatapara district of Chhattisgarh state of India. For study total 160 farmers were considered, which includes marginal (73), small (40), medium (29) and large (18) farmers. The primary data for paddy crop was collected from the sampled farmers by personal interview and well designed schedule. Secondary data like area, production and productivity were collected from agriculture statistics and commissioner land record Govt. of Chattisgarh, District survey report, directorate of economics and statistics and other authentic sources. Cost concept (CACP) analytical tool used for cost and return analysis. The study analyzed that average size of farm found to be 1.82 hectares, average net cropped area observed to be 2.15 ha./farm and cropping intensity 122.79 per cent. The average yield of paddy was 45.07 quintal per hectare. The average cost of cultivation for paddy was Rs. 40513.07 per ha. Gross and net return estimated was Rs. 85845.39 per ha and Rs. 45332.31 per ha, respectively. The input: output ratio was 1: 2.11 and benefit cost ratio 1: 1.11 per ha. Marketable surplus of produce observed was 2100.40 (87.94%) qt./farm and produce sold to the PACS and mandi.

**Keywords:** paddy cost and return, cost concept, income:output ratio, benefit:cost ratio.



## AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MAJOR CROPS IN BEMETARA DISTRICT OF CHHATTISGARH

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### ABSTRACT

An attempt has been made in this study to determine the economic analysis of production and marketing of major crops in Bemetara district of Chhattisgarh state. The present study was conducted in Bemetara and Saja block of Bemetara district of Chhattisgarh state under the three major crops viz. paddy, Soybean and Chickpea. For the study a sample of hundred and fifty farmers from different categories of land holdings were selected randomly from four villages namely Ninwa, Baiji, Mohagaon, and Pendrakala. Primary data is collected by directly interviewing the crop growers of the sampled households with the help of well-prepared questionnaire for the production and marketing year 2017-18. Exponential method is used to analyse the growth rate of area, production and productivity under major crops in Chhattisgarh and Bemetara district. The simple mean and average method was used to work out the cost of cultivation, cost and return and marketable surplus of major crops. The production and productivity of soybean is significant at 3.18 per cent and 1.73 per cent rate in the state while the area under chickpea is significant at 3.14 per cent. The per hectare cost of cultivation of paddy at sampled farm is estimated Rs. 56264per ha., Rs 54761per ha., Rs 58083per ha. and Rs. 57963per hectare, respectively. The benefit cost ratio is estimated to be 1:1.64 at marginal farms, 1:1.74 at small farms, 1:1.78 at medium farms and 1:1.75 at large farms. The overall per hectare operating cost and fixed cost for soybean cultivation is estimated as Rs.13321and Rs. 7220respectively. The benefit cost ratio of soybean is estimated to be 1: 0.76, 1:0.78, 1:1.24 and 1:1.40 at respective size of land holdings in sampled farms. The overall cost of cultivation of chickpea is estimated as Rs.24972. per hectare with benefit cost ratio of 1:0.52. The overall marketable surplus of paddy, soybean and chickpea at sampled household is observed as 111.70, 26.55 and 28.39 quintals per farm, respectively.

**Keywords:** Economic Analysis, Production, Paddy and Soybean.



## IDENTIFICATION OF QTL FOR FATTY ACID COMPOSITION AND YIELD IN LINSEED

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### ABSTRACT

Linseed, with its high concentration of omega-3 fatty acids and antioxidant compounds has emerged as a valuable nutraceutical crop. For the identification of quantitative trait loci (QTL) for fatty acid and yield a study was conducted by Kumar, S. *et al* (2015) using a recombinant inbred line (RIL) population consisting of 243 individuals obtained from a cross between Canadian varieties Bethune and Macbeth. The genetic map was made up of 15 linkage groups constituting of 691 markers in total including 329 single nucleotide polymorphic (SNP) markers and 362 simple sequence repeat (SSR) markers, with a marker density of one marker for every 1.9 cM on average. A total of 20 QTLs related to the 14 characteristics were reported, discovering three QTLs for oleic acid and stearic acid, two for linoleic acid and iodine value, and one for palmitic acid, linolenic acid, oil content, seed protein, cell wall, straw weight, thousand seed weight, seeds per boll, yield and days to maturity. Cell wall, straw weight, seeds per boll, yield and days to maturity QTL were all found on linkage group 4. Proteins involved in cell wall and fibre formation, fatty acid biosynthesis, as well as their metabolism and yield component characteristics, were discovered in the candidate gene areas underlying the QTL.

**Keywords:** QTL, Linseed, Fatty Acids, SSR Markers



**Deciphering the dynamics of starch granule bio-genesis for improved starch quality and gene to metabolite correlation in rice (*Oryza sativa* L.)**

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**ABSTRACT**

Rice is an excellent source of starch and based on starch digestibility, categorized into, rapidly digestible starch, Slowly digestible starch and resistant starch (RS). Starch biosynthesis involves starch synthesizing (SS), branching (BE) and debranching (DBE) enzymes. Isoforms of these enzymes play crucial role in the regulation of starch biosynthesis. Enzyme activity assays, expression of starch biogenesis genes, and correlation with metabolites (starch, amylose, amylopectin, RS) in contrasting RS rice genotypes- NJ72 and Ananga during endosperm development (3, 8, 13, 18, and 23 days after anthesis; DAA) were studied. RS content increased with endosperm maturation in Ananga (0.06-0.38%) than NJ72 (0.016-0.1%). RS showed positive correlation with amylose and starch. Activities of enzymes were maximum at 13DAA except Isoamylase (ISA). Ananga showed 1.25 fold upregulation of *Granule bound starch synthase I (GBSSI)* compared to NJ72 (18DAA). NJ72 showed higher expression of *Starch synthase I (SSI)* suggesting its major role in amylopectin synthesis, while starch branching enzyme, *SBEIIa* showed least expression. *Pullulanase 2 (PUL2)* was predominantly expressed followed by *ISA1*, while *ISA3* showed minor role as a debranching enzyme (DBE). The *GBSSI* expression was positively correlated with amylose and RS content while SS, SBE, and DBE were positively correlated with amylopectin content.

**Key words:** Rice, Starch biogenesis, Endosperm; Genes, metabolites, Resistant starch;



**COMPARATIVE ANALYSIS OF PERFORMANCE OF DIFFERENT FODDER  
CROPS UNDER PIGEONPEA BASED INTERCROPPING SYSTEM (1:2)**

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**ABSTRACT**

India stands first in milk production in the world, but average milk yield is very low (5 litres per animal) compared to developed countries (24 litres per animal). Deficit of green fodder is one of the main reasons for low milk yield along with other factors like imbalanced nutrition, good quality fodder *etc.* In pigeonpea growing areas of north Karnataka there is an acute shortage of fodder crops is faced. Most of the farmers depend on the pigeonpea for their livelihood. But, as fodder shortage has become one of the major problems of pigeonpea growing area there is a need to grow fodder crops without affecting the yield of pigeonpea. Hence, improving cropping system can be a probable solution. Intercropping short duration fodder crops in pigeonpea may yield good fodder yields as well as grain yields. Hence the present investigation was carried out to analyse the performance of different fodder crops under intercropping system with pigeonpea. The results of the experiment revealed that intercropping fodder horsegram with pigeonpea was found to be more beneficial and productive.

**Key words:** Cropping system, fodder, intercropping and pigeonpea





## **Biotechnological approaches to improve nutritional quality of maize**

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### **ABSTRACT**

Maize is a staple food along with rice and wheat and provides food security to millions of people all around the globe especially in sub-Saharan Africa, Latin America and the Caribbean. In India, in terms of production and area maize comes after rice and wheat, but has higher productivity per unit area as compared to rice and wheat, so the increased production can help in food security especially in lower income families. With the advancement of processing industry the consumption of maize has been increased significantly but maize is deficient in certain essential amino acids (lysine and tryptophan), vitamins and minerals, which are essential for proper growth and development. The nutritional quality of maize can be increased using biofortification of quality protein, essential minerals and vitamins and it will help in fight against hidden hunger and malnutrition. A lot work has been done to improve the quality of maize protein using mutants like opaque-2, but less work is focussed on to increase the vitamins and mineral content. Over the years the advancement in several molecular techniques, like QTL mapping, sequencing, use of molecular markers (marker assisted selection) and genome editing which precisely edit the gene sequence have been developed. These technology reduced the time and efforts required for increased production and nutritional quality of the maize. Genes from minor millets which have higher content of mineral and climate resilient genes can be transferred to maize to secure food and nutritional quality in changing climate.

**Keywords:** Maize, QPM, Nutrition



## **Speed Breeding**

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### **ABSTRACT**

In recent years, there has been a fast increase in global population, which is expected to reach 9.9 billion by 2050. A 70 per cent increase in demand is also expected for food, animal feed, and fibre. The security of the world's food supply is a concern in this 2050 outlook. Future generations' needs won't be fulfilled by conventional breeding techniques, thus breeders and farmers are constantly under pressure to increase crop production and create new crop types that are better in both quality and yield. Therefore, in order to meet the rising need, crop generation must be advanced quickly. The method expedites generation development, which reduces breeding costs and time. Compared to the 1 to 2 generations per year accomplished with traditional selection methods, speed breeding produces 3 to 9 generations annually. As a result, speed breeding leads to faster production of homozygous and stable genotypes, resulting in accelerated development and release of new varieties. The major components for setting up fast breeding conditions in an existing growing chamber are light, photoperiod, temperature, and humidity.

**Keywords:** Speed breeding, conventional breeding, homozygous, PAR etc.



## EFFECT OF SUBSURFACE DRAINAGE ON TSS AND SAR IN SALINE VERTISOL UNDER TBP COMMAND AREA

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### ABSTRACT

A study was conducted to ensure the impact of subsurface drainage system on salt affected soils in the TBP command area, Karnataka. The mean values of Total Soluble Salts (TSS) and Sodium Adsorption Ratio (SAR) of pre-drainage soil samples was 3.82 to 6.32, and 8.23 to 14.41, respectively, while it was reduced in post-drainage soil samples *i.e.*, 2.30 to 4.90 and 5.46 to 12.19 for TSS and SAR, respectively. The concentration of TSS and SAR of post-drainage soil samples was reduced in all the depths than that of corresponding depths in pre-drainage soil samples by leaching effect and draining of water from the field, thus indicating the positive effect of SSD in removal of salts throughout the profile soil depth.

**Keywords:** Subsurface drainage system, Total Soluble Salts and Sodium Adsorption Ratio



## Next Generation Sequencing based Gene Mapping for Salinity tolerance at seedling stage in rice (*Oryza sativa* L.) landraces

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### ABSTRACT

Rice is extremely vulnerable to salinity mainly at vegetative and reproductive stage. In this study, 160 rice landraces along with check varieties were evaluated for seedling stage salinity tolerance (ST) using hydroponic system at 50,100 and 150mM salt(NaCl) concentrations. This enabled us to quantify spectrum of response of rice landraces to ST and nine were found to be tolerant which can serve as donors for ST breeding. The whole genome shallow depth sequencing followed by SNP calling resulted in identification of 1,10,327 SNPs against Nipponbare genome representing one SNP at every 698,961 bases (SNP rate). Genome-wide association mapping enabled us to identify 534 SNPs significantly( $P=0.00001$ ) associated with 14 traits correlated with ST. Among them highest association peaks were found with root  $\text{Na}^+/\text{K}^+$  ratio(44) followed by root  $\text{Na}^+$ (34) and shoot  $\text{Na}^+/\text{K}^+$  ratio(33). Majority of SNPs were identified on chromosome 1 where *saltol* QTL was previously identified and about 80 loci coded for retrotransposon(Ty3 gypsy/Ty1 copia subclass). The locus Os10g25010(*OsCML-8*) encoding calmodulin related calcium sensor protein reported previously is known to have positive role in ST. Two SNPs S3\_1833767 and S3\_1833798(*Os03g04020*) codes for expansin protein which are regulator of cell wall extension and abiotic stress response and nine SNPs encoding retrotransposon positioned in upstream of *Os08g16900* were identified. These SNPs may pave the ways for salinity tolerance improvement through molecular breeding.

**Keywords:** Rice, Salt tolerance (ST), Seedling stage, Hydroponic, Association mapping



## Evaluation of heterotic effects in single cross maize (*Zea mays* L.) hybrids for quality traits under drought stress environments

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### ABSTRACT

Any maize improvement programme for abiotic stress aims at exploiting hybrid vigour for high yield and quality which necessitates high degree of heterosis for these traits. The present experiment was performed on 45 single cross hybrids (developed by crossing 15 inbreds with 3 testers in Line×Tester mating design) with 3 checks to evaluate heterotic effects for quality traits in a RBD with 3 replications, over three environments - optimal (E1), drought stress at tasseling stage (E2) and drought stress at grain filling stage (E3) environments, during *spring* 2021, at Rajasthan College of Agriculture, Udaipur. The perusal of data revealed that most of the hybrids exhibited significant and positive heterotic effects for all the three quality traits over the environments. The hybrids EI-11-3×EI-586-2, EI-2448-1×EI-586-2, EI-2448×EI-586-2, EI-2518-1×EI-586-2, EI-2188-2×EI-2156, EI-2448×EI-2156, EI-2188-2×EI-670-2 and EI-2448×EI-670-2 for grain protein content, and EI-03-3×EI-586-2 and EI-2448-1×EI-2156 for grain starch content denoted significant and positive mid-parent, better-parent and economic heterosis over the environments, while EI-08×EI-586-2, EI-Q-212×EI-586-2, EI-561-1×EI-2156, EI-2518-1×EI-2156 and EI-561-1×EI-670-2 possessed significant positive mid-parent and better-parent heterosis over the environments for grain oil content and economic heterosis in only E1 environment. Therefore these hybrids should be subjected to multi-location testing in breeding programmes aimed at quality enhancement.

**Keywords:** Mid-parent heterosis, Better-parent heterosis, economic heterosis, maize, drought stress, quality traits.



## **Mixed fruit cropping system – a key to sustainable sapota cultivation**

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### **ABSTRACT**

The declining cultivable land resources to meet the growing demand of fruits necessitates more sustainable and environment friendly alternative production systems. Fruit based cropping systems by including multiple fruit species in unit area, not only utilizes the land resources efficiently, but also provide multiple services to the ecosystems, majorly through carbon sequestration. Though India being the largest producer of sapota fruits globally, there has been a continuous decline in area and production of sapota since 2014-15. One of the major reasons for this tapered production is lower income generation from lesser productive orchards. As sapota plantations under traditional systems of wider spacing becoming senile after a few years, farmers are shifting to alternate remunerative crops. In order to find out a profitable sapota based mixed fruit cropping system, studies were conducted in 20 years old sapota orchard at ICAR-IIHR during 2015-2021, wherein the intercrops were raised in double rows at a spacing of 2 m x 2 m in the interspaces of sapota trees spaced at 10 m x 10m. Five years' evaluation revealed acid lime as the suitable intercrop as compared to guava, pomegranate, fig and custard apple. Acid lime plants could establish well in the interspaces of sapota neither affecting the sapota yield, nor the soil nutrient status, realizing higher net returns (Rs.41950/-), IRR (116%) and cost: benefit ratio of 1: 86. Thus, introduction of additional fruit crop in existing senile sapota orchards could enhance the productivity, with additional benefits of improved land use and pollinator diversity, making a sustainable production system.

**Key words:** Sapota, Acid lime, Mixed fruit cropping system, Sustainable



## Phenotypic characterization and genetic variability in greengram

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Greengram (*Vigna radiata* (L.) Wilczek) is an important short duration pulse crop in India, mainly cultivated in arid and semi-arid regions across the country and contributes nearly 15% to the total pulses production. Characterization for qualitative traits distinguishes the accessions more prominently and helps in the identification of genotypes/cultivars. Genetic improvement of any crop depends on the magnitude of genetic variability present in the breeding material. The estimates of genotypic and phenotypic coefficient are necessary for understanding the influence of environment on different traits. The present investigation was carried out during *Kharif* season 2019-2020 with seventy eight genotypes of greengram to study qualitative traits and genetic variability. Higher amount of genotypic variation observed for various qualitative traits such as seed coat colour, terminal leaflet shapes, leaf colour and pod pubescence etc. Analysis of variance revealed that the significant genotypic differences for all the traits with wide range of variability. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the quantitative traits. Environmental influence was low on expression of these characters as it was evident by narrow gap between phenotypic and genotypic coefficient of variation. High heritability along with high genetic advance was observed for days to 50% flowering, plant height, number of pods per plant and 100 seed weight which indicated that the heritability is due to presence of additive gene action and these traits can be improved by direct selection.

**Key words:** Greengram, Genotypes, Characterization, Genetic variability.



## Role of Gramin Bhandaran Yojana in the State of Gujarat – An attempt to Improved Food Security

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**ABSTRACT** The study analyzed the participation of various categories of beneficiaries, extent of coverage, capacity utilization of the storage facilities created, constraints in implementation, and overall performance of the Gramin Bhandaran Yojana (GBY) scheme in the state of Gujarat. The scheme GBY has been successfully implemented across all districts in the Gujarat State, with a various degree of numbers and storage capacity creation as per the cropping pattern, extent of irrigation facilities, and the demand prevailing in the respective districts. Across districts, the top five districts in the order of number of godowns sanctioned under GBY are Rajkot (3099), Amreli (1774), Mehsana (914), Patan (813) and Ahmedabad (740). Whereas, the top five districts in terms of storage capacity created are Banaskantha (31.02 lakh MT), Mehsana (7.78 lakh MT), Rajkot (5.94 lakh MT), Patan (3.60 lakh MT), and Anand (3.09 lakh MT), and rest of the districts, godowns area, falls below three lakh MT. Three districts such as Anand, Gandhi Nagar and Aravalli belonging to the category of high, medium and low performance in terms of number of godowns sanctioned and storage capacity created, were selected for the study. The result indicated that the distribution of godowns was on the basis of demand hence; a majority of godowns were located in intensive agricultural areas such as Rajkot, Amreli, Gandhi Nagar, Anand and Mehsana districts. The average size of godowns constructed under the scheme works out to be below 500 MT, as majority beneficiaries belonged to small and medium category and they had availed for their personal usage. Therefore, there were no adequate documentations on the utilization and returns from the godowns. With regard to the participation of beneficiaries in the scheme, a mainstream belonged to the SC/ ST and women only may be due to a higher proportion of subsidies. The participation of other small and marginal farmers was negligible owing to mandatory margin money and non-awareness about the scheme. However, factors such as lack of awareness among farming community; lack of demand for godowns, delay in subsidy; lack of participation of medium farmers due to a high capital investment were some of the major obstacles to harvest full potential of the scheme. Considering ever increasing population and commitment of the State under National Food Security Act, the study suggested that measures have to be taken to improve the storage availability across the state through preferential subsidy approach to increase the participation of all small and marginal farmers from different categories.

**Key words:** Post harvest loss, Performance and Gramin Bhandaran Yojana





## **Prospectus of genome editing for soybean improvement in India**

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### **ABSTRACT**

Soybean is most important oilseed crop of India contributing 25% to total vegetable oil produced in the country. The productivity of soybean in India remains low and stagnating. To boost soybean productivity, application of modern tools like genomics and genome editing (GE) is imperative. Recently, GE has emerged as powerful tool for targeted gene knockout and gene activation. GE process typically involves directed cleavage of double-stranded DNA in the plant genome by the CRISPR-associated (Cas) endonuclease protein guided by a customizable small RNA molecule. GE is now applied as high precision and efficiency mutagenesis tool for crop improvement. In soybean, several genes have been identified controlling various agronomic, stress tolerance and adaptation traits. These genes can be precisely edited to modify target trait to improve soybean yield and stress tolerance. Globally several examples have been reported for GE in soybean improvement. Multiple genes affecting same trait or different traits can also be targeted simultaneously. Genome edited soybean with high oleic acid content is already reached market in USA. However, in India, GE in soybean is still in the infancy stage. The main hurdles are lack of infrastructure required for GE and subsequent handling of gene edited plants. GE is promising tool for crop improvement but there are many constrains too associated with it like off-target genetic modification, essential nature of some genes and genomic resilience. Nonetheless, an industry scale research environment is required for timely application and harnessing the benefit of GE technology for soybean improvement in India.

**Keywords:** Genome editing, Soybean, CRISPR, Yield, Genes.



## Selection of dual purpose cashew genotype suitable for nuts and apples

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### ABSTRACT

Cashew bears two important products nuts and apples and both have several uses. So, there is a need to develop variety suitable for both. Therefore, an experiment with 14 accessions bearing big cashew apples was started in 2013 and they were planted at 7.5 m x 7.5 m in RBD with check Vengurla-8 to assess them for growth and yield characters. Results of analysis for the data of 2021-22 are presented here. For the stem girth NRC 270 had maximum of 104.13 cm while Vengurla-8 showed minimum with 61.12 m. NRC 176 was the tallest with 5.38 m and Vengurla-8 was the shortest with 3.80 m. Tree spread was maximum in NRC 112 (35.83m) and minimum in NRC 120 (18.33m). Apple weight was maximum in NRC 301 (183.10 g) and minimum in NRC 176 (62.27g). Highest nut weight of 13.41g was recorded in NRC 183 and lowest was in NRC 75 with 6.48g. Nut yield and apple yield were maximum in NRC 175 with 5.01 and 56.47 kg /tree respectively. NRC 175 also presented highest cumulative nut yield of 20.14 kg / tree and apple yield of 233.30 kg / tree for six years. Organoleptic evaluation of fresh cashew apples indicated that NRC 175 is more acceptable with overall acceptability grade of 6.05. Besides, it has the maximum vitamin C content of 343 mg / 100 ml of cashew apple juice. NRC 183 had lowest tannin content (265 mg / 100 ml) and total phenols (263 mg / 100 ml). Thus this study finds out NRC 175 as a dual purpose cashew genotype suitable for both cashew nuts and apples.

**Key words:** Cashew, dual purpose, cumulative yield, organoleptic evaluation, NRC 175



## Genetic diversity assessment for fibre yield in white jute (*Corchorus capsularis* L.)

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### ABSTRACT

Jute stands 1<sup>st</sup> among all natural bast fibre crops. It is cultivated for bast fibres extracted from its stem. It is used in making gunny bags, ropes, twines etc. It can serve as raw material for paper-pulp and biofuel. Two species of jute viz. *Corchorus olitorius* and *Corchorus capsularis* are in cultivation. In recent years, the area under *C. capsularis* has shrunk considerably due to low fibre yield despite having better fibre quality. This necessitates development of varieties having high fibre yield potential. In present study, genetic diversity among 49 accessions of *C. capsularis* were assessed at Central Seed Research Station for Jute & Allied Fibres, Burdwan, West Bengal during 2020-21. The fibre yield ranged from 6.0 to 29.0 g/plant. Among the accessions tested, CIM 32, CIJ 59, CIJ 125, CEX 48, CEX 04 were the maximum fibre yielder. Cluster analysis indicated moderate diversity among the accessions studied. A total of 11 clusters were formed. Seven entries represented the solitary clusters. The accession CIM 32 was found among the best performers for all the traits studied.

**Keywords:** Jute, Germplasm, Diversity, Plant height, Fibre Yield



## Correlation and path analysis in rice (*Oryza sativa*)

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### ABSTRACT

Rice is life and the most consumed cereal grain in the world. Yield enhancement is the major breeding objective in rice breeding programme and knowledge on nature and magnitude of genetic variation governing the inheritance of quantitative characters like yield and its components is a prerequisite for effective genetic improvement. In this study, 19 genotypes along with their checks were evaluated and assessed for agro-morphological variability for four traits viz., days to fifty per cent flowering, Number of panicles per square metre, plant height (cm) and grain yield (kg/ha) at Hybrid Rice Evaluation Centre, Gudalur, Tamil Nadu. Relationships between yield and yield contributing traits were studied through analysis of correlation among them. The correlation studies revealed that, among all the traits days to fifty per cent flowering exhibited positive and significant association with grain yield (kg/ha). As simple correlation does not provide a clear understanding of cause and effect relationship, path analysis was carried out. Path analysis revealed positive direct effect on grain yield (kg/ha) due to days to 50% flowering (0.589) and plant height (0.1914), whereas panicle per metre square showed negative effect (-0.1367) with grain yield. The trait plant height, panicle per metre square showed negative indirect effect with days to 50% flowering (-0.0364), plant height (-0.0002), respectively. The trait panicle per metre square showed positive high indirect (0.0460) effect through days to 50% flowering towards grain yield (kg/ha). The trait grain yield (kg/ha) showed significantly positive high indirect effect (0.6231) with days to 50% flowering. Moreover, high residual effect indicated that variables studied in the present investigation are insufficient and therefore, other attributes besides these traits are contributing to grain yield.

**Keywords:** rice, correlation, path analysis.



## **EFFECT OF DEPTH OF PLANTING ON YIELD OF ARECANUT**

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### **ABSTRACT**

Areanut is an important plantation crop and commercially being cultivated in 7.30 lakh hectare with the production of 9.02 lakh tonnes. The area is increasing due to assured price. But the farmers are planting at different depths which affect the yield. Hence, it is essential to standardise the depth of planting to achieve higher yield. The present investigation was carried out at Arecanut Research Centre, Shivamogga. Planting was done during 2005-06 and yield data was recorded after stabilisation of the yield from 2015-16 to 2020-21. The experiment consists of three treatments viz., 60 cm<sup>3</sup> pit, planted at 45 cm depth; 75 cm<sup>3</sup> pit, planted at 60 cm depth and 90 cm<sup>3</sup> pit, planted at 75 cm depth. The experiment was laid out in randomized complete block design with seven replications. Significantly, higher fresh nut yield (15.54kg/palm/year) was observed in 60 cm<sup>3</sup> pit at 45 cm depth of planting followed by 75 cm<sup>3</sup> pit at 60 cm depth (12.51kg/palm/year) and it was less (10.79 kg/palm/year) in 90 cm<sup>3</sup> pit size at 75 cm depth of planting. Significantly, higher fresh nut yield (213.40 q/ha/year) and processed red nut yield (25.60 q/ha/year) was observed in 60 cm<sup>3</sup> pit planted at 45 cm depth, whereas, it was minimum in 90 cm<sup>3</sup> pit planted at 75 cm depth. The higher B:C of 3.74 was recorded in 45cm depth of planting as compared to 60 cm and 75cm depth of planting. The present study concluded that, planting of arecanut seedlings in 60 cm<sup>3</sup> pit at 45 cm depth is ideal for higher yield and B:C.

**Key words:** Arecanut, pit size, yield



### **Mining nutri-dense accessions from Assam rice collection.**

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### **ABSTRACT**

Rice is a staple crop for more than half of the Indian population where North-East Indian states are primarily dependent on rice for their diets. Traditional rice germplasm (landraces) are highly diverse and good source of nutritional traits but still remain nutritionally uncharacterized. Nutritional profiling of 395 Assam landraces was done for starch, AC, TDF, TPC, oil, phenol and TPA using AOAC and standard methods and the mean content of the landraces was found to be 75.2 g/100g, 22.2 g/100g, 4.67 g/100g, 9.8 g/100g, 5.26%, 0.40 GAE g/100g and 0.34 g/100g, respectively. GI was estimated in 24 selected accessions out of which 17 accessions were found to have low GI (<55). Multivariate analysis including PCA and HCA were applied to decipher the similarities / differences in the multiple nutritional attributes. PCA revealed that PC1, PC2, PC3 and PC4 contributed to 81.6% of variance where maximum loadings were from protein, oil, starch and phytic acid. HCA revealed 16 clusters and the trait specific accessions of these clusters could be identified for the novel cultivar development in breeding programs. Significant correlations were found among different traits which can facilitate in the direct and indirect selection of the evaluated accessions for quality improvement program.

**Abbreviations:** AC, Amylose Content; TDF, Total Dietary Fiber; TPC, Total Protein Content; TPA, Total Phytic Acid; GI, Glycaemic Index; PCA, Principal Component Analysis; HCA, Hierarchical Cluster Analysis; PC, Principal Components

**Keywords:** Landraces, nutritional composition, variability, multivariate analysis, PCA, HCA



## Impact of land use and land cover on soil properties in semi-arid region of Central Gujarat

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### ABSTRACTS

A study examined the dynamics of soil physical and chemical properties under different land use systems in parts of Mahi Ravine region of Gujarat. Soils were sampled at surface (0-15cm) and sub-surface (15-30cm) layer under (i) agricultural land use system irrigated cotton/ pearl millet for over 5 years, (ii) ten-years-old bamboo with conservation measure plantation, (iii) mango orchard lands for >35 years old (iv) over 40-years-old Eucalyptus plantation semi undisturbed (v) 15 year old sapota orchard plantation and (vi) 12 year old fallow land.

Pearson's correlation matrix of 14 major soil attributes representing physical and chemical properties resulted in a significant correlation ( $P < 0.05$ ). Clear positive relationships among soil organic carbon (SOC), mean weight diameter (MWD), and soil textural properties were recorded, indicating role of SOC in aggregate formation under different land use systems. Supplementary, among land use systems, mango orchard showed larger MWD followed by bamboo base land and sapota orchard. The SOC, available nitrogen (Av-N), available phosphorous (Av-P), available potassium (Av-P) and cation exchange capacity (CEC) were higher in agricultural land use system compared to other land use system. Therefore, trees-based orchard land use system may be suggested in ravenous land of Mahi ravine region to maintain soil health status for longer ecosystem sustainability in line with the changing landscape in the area.

**Key words:** Ravine land, Land use system, Soil physical properties Semi-Arid ,



## Physico-chemical characterization of Jamun genotypes in Karnataka

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### ABSTRACT

Jamun (*Syzygium cuminii* Skeels.) is an underutilized fruit crop with array of medicinal properties and distributed throughout India. It is an important indigenous fruit crop belonging to the family Myrtaceae commonly called as Jambul, Black Plum, Java Plum, Indian Blackberry and Jamblang. Fourteen genotypes of Karnataka namely AJG-85, Bahadoli, Chintamani, Hadonahalli, Hogalgere, K-45, Kalahalli, Krishnagiri, Sl. No. 20, Sl. No. 58, Doopdal, GKVK-1, Mysore and GKVK – 2 were characterized for physico-chemical attributes of Jamun during 2017-2020 at Department of Postharvest Technology, College of Horticulture, Bengaluru. Different Jamun genotypes recorded variation in fruit characters. The genotype Doopdal showed maximum fruit length (3.47 cm), fruit breadth (2.47cm), fruit size (8.57 cm<sup>2</sup>), seed length (2.44 cm), the genotype GKVK-1 showed highest seed breadth (1.10 cm), fresh seed weight (2.71 gm), dry seed weight (1.81 gm), the genotype Bahadoli registered maximum fruit weight (15.44 gm), pulp weight (13.23 gm), pulp content (89.18 %) and pulp-seed ratio (8.24 %) was found highest in the genotype AJG-85.

**Keywords:** Jamun, genotypes, physico-chemical, Karnataka, GKVK-1, AJG-85





## Characterization of diverse bread wheat germplasm for earliness using agro-morphological traits

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### ABSTRACT

Wheat (*Triticum aestivum* L.) is a widely grown cereal crop, which caters staple food to ~1/3<sup>rd</sup> of the global population. It is well known that the climate change is adversely affecting the wheat production by intensifying biotic and abiotic stresses; and earliness is a trait by which plant can skip the terminal stresses like heat, drought etc. An investigation was carried out to evaluate 81 bread wheat genotypes comprised of doubled haploids, landraces, exotic accessions and popular Indian cultivars for earliness. The analysis of variance revealed that mean sum of square due to genotypes was significant for all of the agronomic traits. Days to 50% flowering ranged from 127.50 to 149.25 days with a mean value of 134.77 days. Four genotypes viz., CIMMYT entry no.98, CIMMYT entry no.101, CIMMYT line 60 entry no.35 and CIMMYT line 60 entry no. 50 were significantly superior to the best check VL 892. Days to 75% maturity varied from 160 to 181.75 days with a mean value of 170.60 days. Nine genotypes viz., CIMMYT entry no.98, CIMMYT entry no.101, CIMMYT line 60 entry no.15 CIMMYT line 60 entry no.35, CIMMYT line 60 entry no.36, CIMMYT line 60 entry no.44, CIMMYT line 60 entry no.50, CIMMYT entry no.105 and CIMMYT entry no.107 were significantly superior than the best check C 306. In totality four genotypes viz., CIMMYT entry no.98, CIMMYT entry no.101, CIMMYT line 60 entry no.35 and CIMMYT line 60 entry no. 50 were early and can be used in future wheat improvement for earliness.

**Keywords:** Bread wheat, Mean performance, Earliness, Biotic and Abiotic Stress



**Food matrix interactions, micro structure and molecular configuration of starch  
contributes to 'Low glycemic nature of pearl millet'**

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**ABSTRACT**

Trends of obesity and diabetes globally has maligned carbohydrate rich foods, highlighting inherent glycemic potential (IGP) as a major quality indicator. Even though there is a 'healthy halo' as well as diabetic friendly appeal to pearl millet (PM), comprehensive systematic studies were lacking. Furthermore, shift to look nutritional quality of crop/diet from single component mode to matrix approach also accelerated our research towards unravelling the possible governing factors of IGP in PM. The present work thus aimed to investigate such variables (micro-structure, food matrix composition/interaction as well as molecular configuration). *In-vitro* oro-gastro intestinal simulation model of starch dynamics revealed PM to be low IGP (63.71%) compared to rice (65.89%). Micro-structural analysis revealed that high pericarp thickness ( $22.71 \pm 0.20 \mu\text{m}$ ) could be a vital component hindering the easy accessibility of carbolytic enzymes even though granule size ( $2.16 \pm 0.12 \mu\text{m}$ ), as well as endodermal surface area ( $1199.64 \pm 2.86 \mu\text{m}^2$ ), was lower than control rice. It was also found that dense food matrix components and higher starch-lipid (S-L) interaction visualized by CLSM contributes to the resistance towards digestive enzymes. The molecular structures were explored using FTIR, XRD to understand the synergistic effects of short-range and longer-range molecular patterns ( $R_{1047/1022}$ : 0.80 & CD %: 21.73%) of PM starch, which revealed the superior crystalline compactness as vital towards low IGP. The results show the importance of micro structure, dense composition, molecular configuration of starch as well as component interactions (S-L) in attenuating starch digestion in a real food matrix (*i.e.* PM) while the complexities of real digestion should be considered and explored using dynamic models in future.

**Key words:** Pearl millet; Inherent glycemic potential, intrinsic variables, food matrix



## Studies on overall combining ability in intra-hirsutum cotton hybrids

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### ABSTRACT

In the era of marker-assisted breeding and genomics, the role of conventional breeding strategies and their implications in basic plant breeding remain significant. Combining ability studies in upland cotton (*Gossypium hirsutum* L.) using a full diallel mating design with 10 parents were conducted at A.R.S Dharwad Farm where 90 hybrids were generated and analysed for 10 traits. Based on the results of the combining ability, overall *gca* and *sca* were calculated by 2 different methods given by Arunachalam and Bandopadyaya (1979) and modified by Mohan Rao *et al.* (2004) considering the combining ability status of all the traits. Overall combining ability analysis using both methods gave almost similar results. High general combiner parents based on their overall *gca* status were identified. The superior crosses involved either High  $\times$  High, High  $\times$  Low or Low  $\times$  High *gca* combinations. Ranking of parents based on overall *gca* indicates whether it is a high or low general combiner and overall *sca* status of crosses give an idea about the nature and potentiality of a cross. Overall combining ability technique would thus lead to precise selection of parents and hybrid combinations for future breeding activities.

**Keywords:** combining ability, cotton, diallel, *gca*, *sca*.



**Selection of stable moisture stress tolerant recombinant inbred lines in groundnut (*Arachis hypogaea* L.) using combination of drought tolerant indices**

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**ABSTRACT**

The intermittent rainfall pattern and prolonged moisture stress severity may increase with the changing climate scenario and has realized the need for improving crop productivity by developing cultivars with enhanced stress resilience. However, crop like groundnut can sustain the drought but moisture stress during reproductive stages dramatically affects the pod and kernel yield. A field experiment was conducted over the two years during summer 2017 and summer 2018 to identify stable moisture stress tolerant recombinant inbred lines. RIL populations having 147 lines were evaluated for pod yield per plant under drought stress and well watered conditions by following augmented design. Significant yield reduction was observed due to moisture stress in both the years. The pod yield per plant under induced water stress and well watered conditions were used to determine different drought tolerance indices (DTI) viz. geometric mean productivity (GMP), mean productivity (MP), harmonic mean (HM), drought resistance index (DRI), stress tolerance index (STI), yield index (YI), yield stability index (YSI) for each genotype and year. The combination of drought tolerance indices over the two years were used to identify the stable drought tolerant genotypes. The genotypes viz. RIL 126, RIL 133 and RIL 249 were found to be the most drought tolerant across DTI and RIL 529 and RIL 265 were found to be highly susceptible. In the present study using combination of DTI, contrasting genotypes for drought tolerance were identified and were confirmed by yield reduction under stress environment for their further use in breeding programme.

**Keywords:** Moisture stress, DTI, Groundnut.



## RNA interference: Approaches and Applications in crop improvement

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RNA interference (RNAi) is a promising gene regulatory approach that has significant impact on crop improvement which permits down-regulation in gene expression with greater precision without affecting the expression of other genes. It is post transcriptional gene silencing in which small RNAs interfere with the translation of the target mRNA transcript resulting in the suppression or complete inhibition of gene expression. Apart from engineering RNAi mediated resistance in plants through transgenic approaches like electroporation, biolistic & microinjection, there are non-transgenic methods of RNAi technology which opened the doors of environmental friendly pest management (Younis *et al.* 2014). Mechanism of action of dsRNA can be categorised into four types namely, direct control agents, resistance factor repressors, developmental disruptors and growth enhancers. Mitter *et al.* (2017) designed non-toxic, degradable, layered double hydroxide clay nanosheets loaded with dsRNA shows sustained release of dsRNA. This novel approach which is stable with high specificity opens new avenues for crop improvement in developing nutritionally improved, disease & pest resistant, abiotic stress tolerant, and high yielding elite varieties by having its application in engineering gene function.

**Keywords:** RNA interference, crop improvement, biotechnology.



**Assessment of improved chickpea varieties for higher yield under farmer field of Kalyana Karnataka Region.**

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**ABSTRACT**

ICAR-KVK, Raddewadgi, evaluated the high yielding chickpea varieties through on farm testing (OFT) in the farmer field during the year 2020-21 & 2021-22 *rabi* season. The treatment comprises chickpea varieties Viz, Annigeri-1, JG-11 and NBeG-47. The OFT conducted in the three farmer fields of Jewargi and Chittapur blocks, Kalaburgi district under rainfed condition in medium to deep block *Vertisol*. The observation on days to 50 per cent flowering, test weight, number of pods per plant and yield was recorded and economics was worked out. The results of the OFT indicated that, among the varieties tested the highest average chickpea yield (1840 kg ha<sup>-1</sup>) was recorded with NBeG-47 over the Annigeri-1(1450 kg ha<sup>-1</sup>) and JG-11 (1730 kg ha<sup>-1</sup>). The per cent increase in yield of NBeG-47 was to the tune of 26.9 and 6.4 over Annigeri-1 and JG-11. The same variety NBeG-47 recorded the less number (55-60 days) of days to 50 per cent flowering in comparison with Annigeri-1(65-70 days) and JG-11(65-70 days). The number of pods per plant and test weight was higher with NBeG-47. The economics parameters like gross returns (Rs .73,600 ha<sup>-1</sup>), net returns (Rs.46,100 ha<sup>-1</sup>) and BC ratio (2.68) higher with NBeG-47 over the other two varieties.

**Key words:** Chickpea, varieties, yield and economics



**SOCIO-ECONOMIC PROFILING OF OYSTER MUSHROOM  
PRODUCTION STAKEHOLDERS FROM RAIPUR AND DHAMTARI  
DISTRICT OF CHHATTISGARH**

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**ABSTRACT**

The study was conducted in Raipur and Dhamtari districts of Chhattisgarh. Total 60 multi stakeholders were selected from the selected district to study the socio-economic profile of the oyster mushroom stakeholders. Relevant data were collected with the help of personal interview. The data were analyzed using appropriate statistical tools. The result indicates that majority of the stakeholders i.e 41.67% were up to 35 years aged and more than half (55.00%) belongs to graduation and above level educational category followed by higher secondary (21.67%), high school (11.67%) and middle school (5.00%). When it comes to specific experience, majority (40.00%) of the stakeholders have more than 6 year of experience in oyster mushroom production followed by 1-3 years (33.33%) and 4-6 years (26.67%), respectively. It is evident from the data that majority (50.00%) of the stakeholders have 1-10 years of farming experience followed by 26.67 per cent have 11-20 years of farming experience and 16.67 per cent have 21-30 years and only 6.67 per cent have more than 30 years of the farming experience.

**Key Words:** Oyster Mushroom Production, Stakeholders, Farming Experience.



**GENETIC DIVERSITY ANALYSIS IN BITTER GOURD (*Momordica charantia* L.)  
FOR YIELD AND ITS ATTRIBUTING CHARACTERS**

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**ABSTRACT**

Twenty four bitter gourd (*Momordica charantia* L.) genotypes were studied in a field experiment conducted at experimental field of College of Horticulture, Mudigere, during summer 2017-18. The objective of the study was to estimate the genetic diversity among the genotypes for yield and its attributing characters. There was a significant difference among the genotypes for all the characters studied. Twenty four genotypes were grouped into five clusters, cluster I was the largest cluster having twenty genotypes and remaining clusters had only one genotype each. Fruit weight (31.16%) contributed maximum to the total genetic diversity among twenty four bitter gourd genotypes followed by flesh thickness (19.93%), node at which first female flower appear (11.59%). Intra cluster  $D^2$  values ranged from 0.00 to 191.79. Among the five clusters, cluster I with twenty genotypes showed maximum intra cluster distance ( $D^2= 191.79$ ). The clusters II, III, IV and V had no intra-cluster distance ( $D^2= 0.00$ ) as they possessed single genotype in each cluster.

**Key word:** Diversity, cluster,





**Varietal response of barnyard millet genotypes against shoot fly, *Atherigona falcata*  
(Muscidae: Diptera)**

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**ABSTRACT**

This field experiment was carried out during *Kharif* 2019 at Agricultural Research Station, V. C. Farm, Mandya. Results revealed among 18 evaluated genotypes, IIMR BM-2-17 and DHBM 93-3 genotypes expressed high tolerance (HT) with mean dead heart in the range of 1.00 to 5.00 per cent. Further, BMV 583 and VL 270 genotypes were as tolerant (T) with mean per cent of head heart (5.00 to 25.00). Eight genotypes (IIMR BM-29-17, VMBC 333, VL 207, LDR 1, BMV 591, TNEF 317, BMNDL-2 and BMNDL-3) were grouped under moderately tolerant (MT) with mean per cent dead hearts (25.00 to 50.00). Similarly, DHBM 19-7, BMNDL-1, VMBC 332 and TNEF 318 genotypes were grouped under susceptible (S) with mean of dead hearts (50.00 to 85.00 per cent). VL 254 and PRD 903 genotypes were highly susceptible (HS) with beyond 85.00 per cent of dead hearts. Similarly, lowest number of eggs were noticed in IIMR BM-29-17 followed by BMV 591 BMV 583 (0.11), IIMR BM-2-17, VL 270 and highest number of eggs<sup>-1</sup> 10 plants recorded in LDR 1 genotype. PRD 903, IIMR BM-29-17 and DHBM 93-3 genotypes at 14, 21, 28 and 35 days after sowing expressed resistance against shoot fly.

**Keywords:** Genotypes, Barnyard millet, Shoot fly.



**Studies on soil and foliar application of zinc on soil properties, growth, yield and quality of Cauliflower (*Brassica oleracea* var. *botrytis* L.)**

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**ABSTRACT**

A field experiment entitled “Studies on soil and foliar application of zinc on soil properties, growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.)” was conducted in the farmer’s field during *Kharif* 2020. The experiment was laid out in a randomized complete block design with 9 treatments and 3 replications. The results revealed that application of 4 kg of Zn ha<sup>-1</sup> through ZnSO<sub>4</sub> as soil application + 0.5 per cent Zn through zinc sulphate as foliar spray along with RDF + FYM significantly increased the plant height (61.27 cm), number of leaves plant<sup>-1</sup> (22.83), plant spread (65.63 cm in N-S and 72.87 cm in E-W) chlorophyll content (60.09 SPAD reading), total soluble solids (6.13<sup>0</sup> brix), ascorbic acid (60.13 mg 100g<sup>-1</sup>), curd yield (33.16 t ha<sup>-1</sup>) Zn content and uptake. After harvest of cauliflower, significantly higher zinc content in the soil was recorded in T<sub>5</sub> treatment (1.75 mg kg<sup>-1</sup>) compared to other treatments.

**Keywords :** Zinc, Foliar spray, Cauliflower, Growth, Yield and Quality



## **An Analytical Study on Odisha Millet Mission**

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### **ABSTRACT**

Millet is one of the cereal grain belongs to grass family. Its widely consumed in developing countries and in India. Millet are basically used in Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh. Millet is a rich source of nutrition. The food products and beverages made out of them have many health benefits. "Different types of millets have their own specialties. Sorghum grain is completely gluten-free and rich in iron, protein and fibre. Finger millet is a source of natural calcium and iron. It helps cure anaemia, and improves bone health. Pearl millet consists of magnesium which helps in reducing respiratory problems. Foxtail millet helps in the steady release of glucose, which is beneficial for diabetic patients Government of Odisha lunched the Millet Mission since 2017. The objective of the mission is to spread the awareness about the use of millet and the grain should be used as an alternative food for rice. Millets were prominently grown crops in many regions of Odisha. They played an important role in the diet of tribal communities. Odisha Millets Mission aims to increase household consumption. Odisha Millets Mission is being implemented with the noble objective to bring Millet revolution. It is slowly accepted by common people and all new-age health cafes and healthy FMCG products are introducing millets in their menus with products like millet crackers, chaklis and even cookies. There are several varieties of millets. Pearl millet (bajra), sorghum millet (jowar), buckwheat (kuttu), amaranth (rajgira), finger millet (nachni /ragi), foxtail millet (kangni), little millet (samai), kodo millet (kodon), barnyard millet (sanwa) and proso millet (chena) are some of the types. The nutritional value, availability and huge production of the grain has drag the special attention of stakeholders. This article deals with three major aspects that millet as a substitute food against rice, critical analysis of Odisha Millet Mission and awareness of millet consumption in common people.

**Key words:** Millet, Millet consumption and Millet Mission



## Studies on efficiency of constructed wetland system for treatment of domestic sewage effluent

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### ABSTRACT

An experiment with different combinations of filterbed materials and hydrophyte carried-out to study their influence on the efficiency of domestic wastewater treatment through vertical flow constructed wetland during 2017-18 at the Department of Soil Science and Agricultural Chemistry, Dharwad, Karnataka. Twenty treatment combinations involving five of filterbeds ('*gravel*', '*gravel-sand-gravel*', '*gravel-sand-brick-gravel*', '*gravel-sand-charcoal-gravel*' and '*gravel-sand-(charcoal+brick)-gravel*') and four hydrophytes (Typha, Paragrass, and Phragmites) were evaluated for treating domestic wastewater. The pH, electrical conductivity (EC), sodium absorption ratio (SAR), residual sodium carbonate (RSC), biological oxygen demand (BOD), chemical oxygen demand (COD), boron and sodium of treated sewage effluent was compared to untreated sewage effluent. Among different filterbeds, the efficiency of gravel was lower compared to other filterbeds in the reduction of pH. Among the four hydrophytes, typha was more effective in reducing the sodium concentration in treated sewage effluent. The improvement in water quality of treated sewage effluent, especially BOD and COD was mainly due to the redox oxidation status created by rhizosphere of hydrophytes. The reduction in solids, soluble salt and nutrient levels in treated sewage effluent was attributed to phenomena like filtration, adsorption and precipitation. The vertical flow constructed wetland was effective in reducing pH, EC, BOD, boron, sodium, SAR and RSC in the sewage effluent.

**Keywords:** BOD, COD, SAR, RSC and constructed wetland



**Assessment of genetic variability in recombinant inbred lines of rice (*Oryza sativa* L.) using phenotypic traits under submerged condition**

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**Abstract**

Evaluation of genetic variability of recombinant inbred lines (RILs) was done at phenotypic level under submerged conditions to assess the presence of variability for desired traits and amount of variation for different parameters. The RIL population was derived from an inter-specific cross between BPT5204 and HPR14 parents. 1255 RILs and parents were evaluated for their performance for various important agronomical traits. Phenotypic data were subjected for descriptive statistical analysis *viz.*, mean, range, standard deviation, coefficient of variation. Preliminary evaluation of RILs showed presence of genotype by environment (G×E) interactions for nine quantitative traits. For few traits higher values of genotypic coefficient of variation (GCV) (21.62- 35.23%), phenotypic coefficient of variation (PCV) (22.09- 38.92%), heritability (63.85-81.94%) and genetic advance as a percentage of mean (GAM) (23.71- 65.79%) were observed for plant height, total number of tillers, non productive tillers, productive tillers, test weight, five panicle weight and single plant yield. Similarly, higher heritability ( $h^2$ ) coupled with higher GAM for majority of the traits indicated existence of additive gene action. Low PCV, GCV, GAM and high  $h^2$  were observed for days to 50% flowering and panicle length indicating presence of non-additive gene action and can be used for exploitation of heterosis. High GCV and PCV was observed for nonproductive tillers, single plant yield, and test weight indicating that these characters could be used as selection for crop improvement.

**Key words:** Rice breeding, PCV, GCV, Heritability



**Effect of nutrient omission on yield, nutrient uptake and economics of *rabi* sorghum in *vertisols* under rainfed and irrigated conditions**

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**ABSTRACT**

A field experiment was conducted to study the “Effect of nutrient omission on yield, nutrient uptake and economics of *rabi* sorghum in *vertisols* under rainfed and irrigated conditions” at AICRP on sorghum, MARS, University of Agricultural Sciences, Dharwad, during *rabi*2020. The experiment consisted of two main plots (M<sub>1</sub>: Rainfed and M<sub>2</sub>: Irrigated) and nine nutrient omission treatments. The experiment was laid out in a split plot design with three replications. The results indicated that, significantly higher grain yield (44.87 q ha<sup>-1</sup>), stover yield (8.52 t ha<sup>-1</sup>), total nutrient uptake (93.86 kg N ha<sup>-1</sup>, 28.51 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, 94.04 kg K<sub>2</sub>O ha<sup>-1</sup>, and 226.24 g Zn ha<sup>-1</sup>), higher gross returns (Rs. 115786), net returns (Rs. 77085) and BC ratio (2.99) were recorded under irrigated condition (M<sub>2</sub>). Among nutrient omission treatments, application of 50:25 kg NP ha<sup>-1</sup> + FYM @ 3 t ha<sup>-1</sup> + ZnSO<sub>4</sub> @ 15 kg ha<sup>-1</sup> (S<sub>1</sub>) exhibited significantly higher grain yield (49.56 q ha<sup>-1</sup>), stover yield (9.55 t ha<sup>-1</sup>), total nutrient uptake (109.97 kg N ha<sup>-1</sup>, 32.63 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, 109.33 kg K<sub>2</sub>O ha<sup>-1</sup> and 283.63 g Zn ha<sup>-1</sup>) and higher gross returns (Rs. 128146). While, application of 50:25 kg NP ha<sup>-1</sup> + ZnSO<sub>4</sub> @ 15 kg ha<sup>-1</sup> (S<sub>2</sub>) recorded significantly higher net returns (Rs. 88057) and BC ratio (3.41). The per cent reduction in grain and stover yield was to the tune of 31.88 and 34.86, respectively due to omission of both nitrogen and phosphorous.

**Key words:** Nutrient omission, *Rabi* sorghum, ZnSO<sub>4</sub>.



## “Impact of cluster frontline demonstrations on Redagram productivity in Haveri District of Northern Karnataka”

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### ABSTRACT

Red gram (*Cajanus Cajan L.*) is an important pulse crop in India, plays a major role in augmenting the income of small and marginal farmers of Northern Karnataka. The low production of traditional varieties of red gram was a cause of concern for the farmers at large. To overcome this problem of low yield, ICAR-Krishi Vigyan Kendra in Haveri district has conducted cluster frontline demonstration in field of adopted villages. The present study was conducted by KVK, Haveri during 2021-22 *kharif* season with twenty five cluster frontline demonstrations in Hunasikatti and Kamododha villages of Haveri district. The results of demonstrations showed that cultivation of high yielding variety GRG-152 of Red gram has given yield increase of 28.92 % over local check. The technology gap ranges from 3.55 in 2021-22. This high extension gap requires urgent attention from planners, scientists, extension personnel and development departments. The technology index varies from 60.64. The changes will accelerate the adoption of newer technologies to increase the productivity of green gram in this area. There is a need to adopt multi-pronged strategy which involves enhancing green gram production through horizontal and vertical expansion and productivity improvements through better adoption of improved technology. The difference in technology gap in different years was due to better performance of recommended varieties with different interventions and more feasibility of recommended technologies during the course of study. Similarly, the technology index for all demonstrations in the study was in accordance with technology gap. It can be concluded that the red gram production could be enhanced by adoption of improved technologies through Cluster Front Line Demonstrations. Hence, there is a need to disseminate the improved technologies among the farmers with effective extension methods.

**Key words:** Extension gap, Farmers practice, Frontline Demonstration, Red gram, Technology gap, Technology index



## Studies on the effect of growth hormones and graftability of Pala

(*Manilkara hexandra* Roxb.)

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### ABSTRACT

An experiment was conducted to study the vigour and growth of seedling and graftability of pala seedlings with sapota in the orchard unit of the department of horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2021. Six month old pala (*Manilkara hexandra*) seedlings were transplanted in polybags with normal potting mixture. The seedlings were sprayed with GA<sub>3</sub> 200ppm at 30, 60 and 90 days and urea @ 1 per cent at 30, 60 and 90 days after potting. Observations like plant height, stem girth, number of leaves /plants, fresh weight of seedlings, dry weight of seedlings, root length and shoot: root ratio were recorded. From the results, it was revealed that the potted pala seedlings sprayed thrice with GA<sub>3</sub> (200 ppm) attained maximum height of 34.70 cm and graftable girth of 2.28 cm was noticed in urea @ 1 per cent spray. Fresh weight and dry matter production of seedlings were maximum in GA<sub>3</sub> 200ppm sprayed thrice at 30, 60 and 90 days resulting in 22.10 g and 10.38 g respectively, along with higher shoot: root ratio(1.83). It was also found that those pala seedlings can be used as rootstock for sapota var. oval to obtain maximum success of 54 per cent.

**Key words:** Pala, rootstock, GA<sub>3</sub>





## **Local Food Systems: an effective marketing model to overcome disruptions to food systems and lower the environmental foot print**

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### **ABSTRACT**

A local food market provides a direct marketing outlet for local farmers and food processors and maybe in open-air markets put up on a seasonal and weekly or bi-weekly basis (Jacobson, 2006). The definition of local food systems does not always refer to the geographic location of production to consumption but best defined as local, based on sale of produce by farmers directly to consumers at local farmers' markets, schools, hospitals and institutions (Martinez, Steve, et al 2010, Abby Reich 2022) Local food markets are much more than the sale and demand for local food .They are a blend of supporting local economies, social interaction, nutrition and health (Abby Reich (2022). Local or traditional food markets are a primary source of food distribution and purchase in many of the LMICs ([GloPan, 2016](#)). Farmers' markets operate in many states of India (Punjab, Haryana, Rajasthan, Madhya Pradesh, Tamil Nadu, Karnataka and Odisha). The most characteristic feature of these markets is the absence of middlemen and other marketing costs where the sellers themselves do the loading and unloading of vegetables themselves and directly sell the vegetables to the consumers. Farmers markets known as Rythu Bazar (RB) were established in the year 1999 in the erstwhile combined states of Telangana and Andhra Pradesh, India. RBs are a successful model of direct marketing of fresh vegetables and fruits on a daily basis to urban consumers mostly by the small and marginal farmers located close to cities. The seller farmers in the RBs are provided with water, raised platforms and basic sanitation facilities by the marketing department free of any charge (Srinivasa et. al.2014). Lack of involvement of farmers in price fixation, poor sanitation and storage facilities, improper allocation of selling space were some of the constraints faced by farmers using the Rythu Bazar scheme as reported by Chandak and Leua (2014). Supporting local farms has multiple benefits, it helps the local economy, eases the access to food during disruptions like the COVID-19 pandemic, reduces the transport cost thereby the carbon footprint and thus can impact our changing climate for



## Genetic architecture for fruit yield and quality attributes in papaya

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### ABSTRACT

Papaya (*Carica papaya* L.) is a leading fruit crop in India owing to its greater nutritional, industrial, pharmaceutical and medicinal values. However, the major constraint of papaya growers is the high cost of hybrid seeds. With an aim to develop public sector hybrid, an experiment was conducted during 2018-21 involving six parents, their 30 F<sub>1</sub> hybrids (including reciprocal crosses) with a commercial hybrid check 'Red Lady', adopting Griffing's diallel analysis magnitude of heterosis, combining ability and gene action for fruit yield & its yield attributing characters in papaya were measured. In per se performance of crosses, the hybrids of Pusa Delicious or CO-8 as one of the parents, recorded higher fruit yield. Hybrid of Lucknow Local and Gujarat Junagadh papaya-1 was led to dwarf-medium stature, early flowering, fruiting and harvesting with lower inception of first fruit. Hybrids with Pune Selection-1 as a parent exhibited lower cavity index. However, none of the hybrid exhibited positive significant heterosis over commercial check for fruit yield/ plant, nevertheless, possibility of isolating desirable segregates does exist. The hybrid of Pusa Delicious x Lucknow Local exhibited higher positive standard heterosis for fruit yield and hybrid CO-8 x Pusa Delicious demonstrated significantly-positive heterosis for fruit quality attributes.

**Keywords:** Papaya breeding, Hybrid, Heterosis, Red Lady, Combining ability



## Genetic enhancement of resistance to aflatoxin contamination in groundnut (*Arachis hypogaea*)

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### ABSTRACT

Peanut (*Arachis hypogaea* L.) is an important grain legume and nutritious food ingredient, being the third most important source of vegetable protein and oil that plays a significant economic role in small-scale farming system. Aflatoxin contamination caused by *Aspergillus flavus* is a serious constraint that causes significant economic and financial losses to producers of groundnut. Deploying genetic resistance in new crop varieties provide a permanent solution to this problem. Present study aimed to develop breeding lines with resistance for colonization to *Aspergillus flavus* and superior agronomic traits. Present work was initiated at Department of Biotechnology, University of Agricultural Sciences, Dharwad by using GPBD 4, a high yielding Spanish variety with high oil content, resistant to late leaf spot and rust as female parent and ICGV 2207 and ICGV 2266 identified as promising genotypes for aflatoxin resistance as male parents. Crossing programme was initiated with an objective of developing promising lines with combination of LLS, rust and aflatoxin contamination resistance. 198 F<sub>5</sub> lines from cross GPBD 4 X ICGV 2207 and 70 F<sub>5</sub> lines from cross GPBD 4 X ICGV 2266 were subjected for field evaluation in replicated trial at two locations (Dharwad and Belgaum). Observations were recorded on pod weight, shelling percentage and test weight. All these lines were screened for resistance to colonization for *Aspergillus flavus* (IVSCAF) with aqueous conidial suspension of an aflatoxinogenic strain of *A. flavus* (Af 11-4). Seed surface colonization by *A. flavus* was recorded following pinprick method of detection of cotyledon resistance. IVSCAF score was recorded following 0-4 scale after eight days of incubation. Analysis of the results revealed significant variation among the lines for both yield parameters and per cent seed colonization by *A. flavus* ranging from 20-100% (1-4). 22 lines in cross GPBD 4 X ICGV 2207 and nine lines from the cross GPBD 4 X ICGV 2266 recorded superior agronomic traits in both the locations. For IVSCAF, twelve lines from GPBD 4 X ICGV 2207 and four lines from GPBD 4 X ICGV 2266 recorded significantly high resistance (1-2) over the susceptible parent GPBD 4 (4). None



## Effect of jeevamrutha application on quality parameters in guava (*Psidium guajava* L.)

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### ABSTRACT

In modern agriculture, excess use of synthetic inputs leads to environmental degradation and agro ecological imbalance. With ill effects of higher usage of chemicals and fertilizers farmers are looking for alternate farming practices which are eco-friendly, affordable and enhance or maintain the productivity sustainably. Though, natural farming practices are being practiced by farmers in India especially in Karnataka, Andra Pradesh and Maharashtra by the use of traditional knowledge but the production practices have not been standardized. The present experiment was conducted at regional horticulture research and extension center, Dharwad during 2019-20 and 2020-2021 with an objective to study the effect of different dosage and frequency of application of liquid jeevamrutha on quality parameters of guava (*Psidium guajava* L). The experiment consists of totally twelve treatments of different combination of dosage and frequency of jeevamrutha and were compared with control treatment (recommended package of practice). On comparison of jeevamrutha treatments with RPP, the results revealed that, in pooled data, TSS of the fruit was not influenced significantly by jeevamrutha application, however RPP recorded the higher TSS (12.77 °Brix). With respect to reducing and total sugar content in fruits, RPP (recommended package of practice) recorded the higher values (2.83 % and 7.69 %, respectively).

**Keywords:** Guava, Quality, Jeevamrutha.



## **SPEED BREEDING: A CUTTING-EDGE APPROACH TOWARDS CROP IMPROVE**

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### **ABSTRACT**

The most pressing challenges to food availability now and in the future are population growth and climate change which is expected to grow by 25% over the next 30 years and would reach around 9 billion by 2050 and meeting future food demand will be a challenge. Over the last five to six decades conventional breeding had led to the release of many varieties but the progress is very slow as it demands considerable time, space, inputs for selection, crossing of desirable plants followed by 4–6 generations of selfing in order to fix the yield traits. The duration of the breeding cycle is a major checkpoint in the progression of plant research and breeding. In order to accelerate this breeding cycle in crop plants researchers in the University of Queensland developed a new concept called ‘Speed breeding’ (SB) relying mainly on temperature control, photoperiod extension, and early seed harvest which accelerates various physiological processes thus saves breeding time and resources through rapid generation advancement. Speed breeding can be used to advance up to 4–6 generations per year instead of 2–3 generations under normal glasshouse conditions. Speed breeding protocols are well demonstrated and standardized for long-day plants like wheat, barley, oats and mustard are being extended to short-day plants to reduce the generation interval time. Various selection methods can be integrated into speed breeding, such as the single seed descent (SSD), single pod descent (SPD), single plant selection (SPS), genomic selection, clonal selection and marker-assisted selection (MAS) to shorten the breeding cycle and for efficient resource use. A combination of SB technology and MAS has accelerated development of herbicide-tolerant chickpea and the introgression of valuable allelic variation from wild relatives in lentil. Certain challenges and limitations hamper the adoption of speed breeding in many developing countries by the lack of trained plant breeders and lack of the requisite infrastructure however, existing constraints can be overcome by further optimising SB protocols for critical food crops and integrating them into plant breeding pipelines.

**Keywords:** breeding cycle, genomic selection, marker-assisted selection, photoperiod, single seed descent



## Growth performance of area, production and productivity of turmeric in Telangana

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### ABSTRACT

India is home for wide variety of spices and known as “spice bowl of the world”. Turmeric (*Curcuma longa*), known as “Indian saffron”. In India turmeric was cultivated in an area of 2.51 lakh ha with production of 9.26 lakh tonnes during 2019-20. Telangana ranks first in the country with an area of 55,000 ha, production of 3.07 lakh tonnes and with productivity of 5582 Kg/ha. This study is mainly based on the secondary data on area, production and productivity of turmeric in Telangana, were collected for the years 1980-2019 from various sources. The performance of turmeric was examined by estimating the compound growth rates of area, production and productivity. The results revealed that, compound growth rates for area, production and productivity of Telangana were 2.54 per cent, 4.47 per cent, and 1.87 per cent were found and showing the positive and significant growth rate in area, production and productivity for period of 40 years at both 1 per cent and 5 per cent level of probability.

**Keywords:** CGR (compound growth rate), area, production and productivity.



**Inheritance of Mungbean Yellow Mosaic Virus (MYMV) resistance in interspecific crosses of mungbean (*Vigna radiata* (L.) Wilczek) and rice bean (*Vigna umbellata* Thunb.)**

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**ABSTRACT**

Understanding the genetics of mungbean yellow mosaic virus resistance plays a pivotal role in development of resistant varieties to combat worldwide threat of the MYMV epidemics. Since there is no stable source of resistance in mungbean for MYMV, it's essential to take up interspecific hybridization with rice bean in order to introgress resistant genes from rice bean which is highly resistant to MYMV. Green gram variety KKM- 3 which is susceptible to MYMV was used as a female parent and two rice bean lines KBR-1 and RBL-6 which are highly resistant to MYMV were used as male parents in generating interspecific hybrids. The inheritance of resistance to mungbean yellow mosaic virus (MYMV) in interspecific crosses of mungbean and ricebean was studied. F<sub>1</sub> interspecific hybrids of the cross KKM-3 × KBR-1 were resistant and the cross KKM-3 × RBL-6 were found to be highly resistant. The F<sub>2</sub> generations of the two crosses were screened for MYMV and Chi-square test confirmed the segregation ratio of 3:1 resistant : susceptible plants in both the interspecific crosses, indicating that the MYMV resistance in interspecific crosses of mungbean and ricebean is controlled by monogenic dominant gene.

**Key words:** Inheritance, Interspecific, Mungbean, Ricebean, MYMV and Resistance.



## Antioxidant activity of rice in interaction with silicon and nitrogen fertilization in Alfisol

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### ABSTRACT

Silicon plays an important role in growth of plant by the increase of antioxidants. The reactive oxygen species (ROS) are highly reactive and toxic and can cause protein, lipid, carbohydrate and DNA damage that ultimately leads to oxidative stress. Rice plants yielded significantly more grain by maintaining a large number of green leaves and tillers as well as higher dry mass above and below level, sugar content and antioxidant enzyme activity. Enzymatic antioxidants include SOD, CAT, Ascorbate Peroxidase (APX), Mono Dehydro Ascorbate Reductase (MDHAR), Dehydro Ascorbate Reductase (DHAR), and GR plays a important role by addition silicon and nitrogen. Rice cultivated on *Typic Rhodustalf in Alfisol* which is widely spread in Cauvery delta zone in Tiruchirapalli. The field experiments was laid out in split plot design with three replications conducted in the farmers field , Koppu village in Trichy district during *rabi* and *Kharif* seasons as direct and residual crop. . The treatment 125 % N (N<sub>4</sub>) gave significantly higher POD, CAT and SOD over the control. The results are related with positive correlation for POD, CAT and SOD with available N and N uptake in *Alfisol* in *rabi* and *Kharif* seasons, respectively. The highest antioxidant enzymes with the different levels of silicon was recorded in the treatment with the application of FA @ 30 t ha<sup>-1</sup>.The correlation was received positively between POD with available Si and Si uptake in *Alfisol* in *rabi* and *Kharif* seasons, respectively. The hypothesis was Si may affect to increase by elevating the antioxidant system by the key enzymes such as CAT, SOD and POD involved in the oxidative stress defence of the plant cell

**Keyword:** Rice, silicon, nitrogen and antioxidant enzymes





## **CROPPING PATTERN CHANGES AND CROP DIVERSIFICATION IN BULDANA DISTRICT OF MAHARASHTRA**

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### **ABSTRACT**

The present study was based on secondary data collected from various government publications of Buldana district and pertains to a period of 43 years i.e. from 1970-71 to 2013-14. The compound growth rates of area, production and productivity of major crops were estimated for four sub-periods i.e. Period-I (1970-71 to 1979-80), Period-II (1980-81 to 1989-90), Period –III (1990-91 to 2000-01), Period-IV (2000-01 to 2013-14) and overall period (1970-71 to 2013-14). Coefficient of variation was used for analytical tools and simple tabular analysis to examine the changes in cropping pattern. Crop diversification was studied with Herfindahl index, the advantageous crops were worked out with land concentration ratio and comparative advantage was computed for last 10 years i.e. from 2004-05 to 2013-14. In Buldana district crop diversification has significantly increased from subsistence to more commercial crops. There existed wide temporal changes in the cropping pattern. Over a period of study the proportions of area under rice, jowar, cotton, groundnut and other pulses had reduced, whereas it was increased in respect of gram, tur and soybean. Soybean attained prestigious position in the cropping pattern and showed increasing land concentration ratio from year 2009-10 to 2013-14, it is more advantageous crop in Buldana district.

**Keywords:** - Cropping Pattern changes, Crop Diversification, Advantageous crops



## **Meta-QTL analysis: An approach to detect robust and precise QTL for breeding programs**

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### **ABSTRACT**

In crop plants, most of the economically important traits like minerals, nutrients, quality and biotic and abiotic stresses are predominantly quantitative in nature. Though a large number of QTLs controlling various traits have been mapped. Their direct deployment in the marker-assisted selection (MAS) is still limited. The possible reason is the lack of availability of stable QTLs over diverse genetic backgrounds, environments and the minor effects of multiple QTLs in controlling the trait(s). To resolve this issue, meta-QTL analysis is a practicable approach to get a better insight and understanding of these complex traits via identifying robust QTL hot-spot regions and stable meta-QTLs which can be introgressed in the plant genome. It provides a way to compile QTL results from different studies leading to the generation of a consensus map and validation of the consistency of QTLs from one experiment to another under diverse genetic backgrounds and environments using software like MetaQTL and BioMercator. The utility of this approach will help to detect the stable meta-QTL that will further help to identify candidate genes providing a deeper understanding of the genetic basis of different quantitative traits that will eventually contribute to sustainable agricultural crop production through molecular breeding.

**Key words:** Meta-analysis, QTL, BioMercator, marker assisted selection, Meta-QTL



## **Probabilistic break-even analysis of field crops in Madhya Pradesh**

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### **ABSTRACT**

A study was conducted to assess farmer's profitability for field crops in Madhya Pradesh. For estimating the break-even yield cross-sectional data for the year 2019-20 on plot and state level of cost of cultivation for various crops was obtained from Directorate of Economics and Statistics, Government of India official website. Break-even yield was calculated and probability of not achieving break-even yield by farmer in the state was obtained. The results revealed that for cotton crop probability of not breaking even was 1 while for pigeon pea it was 0.66. The study suggested annual policy review after assessment of probabilities to address the needs of farming community.

**Key words:** break-even yield, probability, profitability

## **Probabilistic Break-even analysis of field crops in Madhya Pradesh**

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**Key words:** break-even yield, probability, profitability



**Influence of nano particle seed treatment on germination and seedling vigour in soybean (*Glycine max* (L.) Merrill)**

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**ABSTRACT**

Soybean is the world's most important seed legume, which contributes to 25 % of the global edible oil, about two-thirds of the world's protein concentrate for livestock feeding. India ranks fifth in the area and production in the world after USA, Brazil, Argentina, and China. An experiment was conducted at Seed Centre, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during the year 2021 to enhance the seed germination and seedling vigour in soybean. The seeds of soybean variety Pusa 9712 were dry dressed with nano particles of zinc oxide, titanium dioxide and silicon dioxide each with 100 mg/kg, 250 mg/kg, 500 mg/kg, 750 mg/kg and 1000 mg/kg in screw capped glass bottles at room temperature. The glass bottles containing seed and nanoparticles were shaken gently for 3 mins at an interval of 3hrs. Seeds shaken without nanoparticles served as control. After treatment, seed quality parameters were assessed along with control. The results revealed that among the nano chemicals, zinc oxide recorded better results for all the seed quality parameters than the other chemicals. Soybean seeds treated with 500 mg/kg zinc oxide nano particle recorded significantly higher values for days to first count (62 %), speed of germination (3.6 days), germination (94 %), field emergence (91 %), vigour index I & II (3469 & 3113, respectively), dehydrogenase enzyme activity (1.23 OD) than control (52 %, 4.6 days, 84 %, 79 %, 2723 & 2372, 0.89 OD, respectively). Higher concentration of 1000 mg/kg in all the nano formulations reduced the seed germination and other seed quality parameters. The moisture content and electrical conductivity value have not been unaltered by nano seed treatments. The experiment results revealed that seed treatment with ZnO nano particle@500 ppm can enhanced the seed germination and seedling vigour in soybean.

**Key words:** Soybean, nano treatment, seed germination, seedling vigour, enzyme activity.



## **Influence of organic seed priming on seed quality parameters in maize (*Zea mays* L.)**

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### **ABSTRACT**

Maize (*Zea mays* L.) is one of the most important cereals of the world and it has worldwide significance as human food, animal feed and raw material for number of industrial products. Despite the high yielding potential and various advantages of maize, the yield per unit area of the crop is low due to the use of poor quality seeds for sowing. Seed priming is one of the most important treatments to enhance rapid and uniform germination and increase seed tolerance to adverse environmental conditions. To study the effect of organic seed priming, an experiment was carried out at Agricultural Research Station, Vaigaidam, Tamil Nadu Agricultural University, Tamil Nadu. Maize seeds were soaked in fresh leaf extracts of Chicory (*Cichorium indybus* L.) at 5%, 10% and 15% concentration in double the volume of leaf extract for 12 h along with water soaking and untreated seeds formed the control. After priming treatments, the seeds were dried back to original moisture content and seed quality parameters were evaluated. The results revealed that maize seeds primed with 10 % leaf extract of *Cichorium indybus* L., significantly increased the germination (96 %), rate of germination (15.26) and dry matter production (2.62 g 10 seedlings<sup>-1</sup>) compared to control (84 %, 12.23 & 1.96 g 10 seedlings<sup>-1</sup>). In the same treatment, the electrical conductivity (0.183 dSm<sup>-1</sup>), leachate amino acids (25.13 µg) and lipid peroxidation (0.102 µg) were minimum than the control (0.213 dSm<sup>-1</sup>, 34.12 µg and 0.176 µg) but the dehydrogenase (0.370 OD), catalase (2415 units) and peroxidase enzymes (0.421 mg) activity were higher than the control (0.285 OD, 2248 units and 0.327 mg, respectively). The experiment results revealed that maize seeds primed with 10 % leaf extract of *Cichorium indybus* L., increased the seed germination and seedling vigour in maize.

**Keywords:** Maize, Organic priming, *Cichorium indybus*, seed germination, Seedling vigour



## **Title- Analysis of QTLs related with popping traits in maize (*Zea mays* L.)**

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### **ABSTRACT**

The rising demand for popcorn necessitates improving the popping quality with higher yield of popcorn cultivars. Towards this direction several Quantitative Traits Loci (QTLs) for popping traits have been identified. However, identification of accurate and consistent QTLs across different genetic backgrounds and environments is necessary to effectively utilize the identified QTLs in marker-assisted breeding. In the current study, 99 QTLs related to popping traits reported in 8 different studies were assembled and projected on the reference map "Genetic 2005" using Bio Mercator v4.2 to identify meta QTLs with consistent QTLs. Most of the popping traits are quantitative in nature and highly influenced by environment (E) and genotype (G)  $\times$  environment (E) interaction effect. QTL mapping is one of the potential approaches to locate the genomic regions of quantitative traits like PEV and other popping traits. A number of major QTLs explaining over 10% phenotypic variance (PVE), associated with various popping traits have been reported in earlier studies. In this method, all the possible QTL combinations were tested and the one which maximizes the likelihood was selected. Two steps in meta-analysis were followed. In step 1, QTLs on each linkage group were clustered, assuming their normal distribution around the true location. Subsequently, the QTL model on each linkage group was selected using the Akaike Information Criterion (AIC). The model with the lowest AIC represents the number of meta-QTLs. In step 2, meta-QTLs were generated in accordance with the best model. Further, the position and CI (95%) of the meta-QTLs were calculated and the flanking markers for meta-QTLs were selected. The locus lookup browser was used to determine the physical position of the flanking markers. The polygenic traits are affected by both environmental and genetic factors. As the popping traits are complex in nature, QTL mapping is the best approach to understand the genetic architecture of the concerned traits [18]. Genetic background, population size and genotype  $\times$  environment interaction are crucial factors affecting the functionality of mapped QTLs. In case of large CI, several genes can be present and hence reliability of QTLs for use in MAS cannot be guaranteed based on few studies. Although, few studies led to the identification of major QTLs for popping traits, progress in deployment of these QTLs in maize breeding programme is limited because of lack of consistency and validation in variable environments and in new genetic backgrounds. In this direction identification of major effect QTLs related to popping traits across different environments and background is prerequisite to make advancement through marker assisted



## NIRS as an emerging powerful technology for nutritional inclusive crop improvement

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### ABSTRACT

In spite of recent positive trends in commitments and investments in increasing the nutritional sensitivity of agriculture, to date, there is still limited evidence that agricultural interventions are benefiting nutrition. Technological tools are available to greatly enhance the nutritional value in breeding programs however, enhanced nutrition in any crop improvement or breeding program might only be achieved if the screening of nutritional traits is handy, economical and fast. NIRS is one of the most proven tools to measure organic composition like protein, fat, starch, amino acid, polyphenols, phytic acid, amino acid, fibre content etc. in large sample size where laboratory analysis is time consuming and expensive. It can further elevate the efficiency of nutrition inclusive selection if available in mobile form however question is whether it is equally precise as benchtop, therefore, we explored benchtop and portable NIR technologies and advanced calibration methods. For this purpose, we generated the NIR spectra of 328 grain samples from multiple cereals (finger millet, foxtail millet, maize, pearl millet, sorghum) with a standard benchtop NIR Spectrometer (DS2500, FOSS) and a novel portable NIR-based sensor (HL-EVT5, Hone). We explored classical deterministic methods (via winISI, FOSS), novel machine learning (ML)-driven methods (via Hone Create, Hone), and one convolutional neural network (CNN)-based method for building the calibrations to predict grain protein out of the NIR spectra. All tested methods enabled us to build relevant calibrations out of both types of spectra (i.e.,  $R^2 = 0.90$ , RMSE = 0.91, RPD = 3.08). Generally, the calibration methods integrating the ML tended to enhance the prediction capacity of the mobile sensors. We documented that the prediction of grain protein content based on NIR spectra generated by the novel portable sensor (HL-EVT5, Hone) was highly relevant for quantitative protein predictions ( $R^2 = 0.91$ , RMSE = 0.97, RPD = 3.48). Thus, the presented findings lay the foundations for expanded use of NIR spectroscopy in agricultural research and development.





## **Impact of agricultural land use practices on aquatic avifaunal biodiversity in lake Tana, Northwest Ethiopia**

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### **ABSTRACT**

Agriculture is the backbone of Ethiopia's economy, accounting for the majority of GDP and exports; however, the sector is being undermined by land degradation and a lack of adequate plant-nutrient supply. These issues are worsening in many parts of the country and are having a negative impact on bird biodiversity and habitats, resulting in a decline in avian population and habitats. Here, we used a digital land use detection technique in conjunction with multi-temporal satellite imagery interpretation to investigate this impact in lake Tana, Ethiopia over a period of 30 years and to assess changes in agricultural and grassland conditions over time. Supervised classifications were performed in ERDAS imagine 2017 software, followed by post-classification in ArcGIS software. The images were categorized into agricultural land, and grasslands. While grasslands (3.26%) decreased between 1987 and 2017, representing loss of habitats for grassland avifaunal species, agricultural land (5.3%) increased, resulting in lowered species richness and abundance. Moreover, avifaunal species richness, and abundance varied significantly between agricultural land and grassland. It is concluded that the lake Tana experienced significant changes in land use land cover, having an impact on avifauna and the impact on sustainable agricultural land use land cover will be discussed.

**Keywords:** Lake Tana; Arc GIS; grassland; sustainable agriculture, avifauna



## EFFECT OF CULTIVATION PRACTICES ON TRADITIONAL RICE CULTIVARS IN THE WESTERN ZONE OF TAMIL NADU

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### ABSTRACT

Rice (*Oryza sativa* L.) is an important agricultural crop, primary source of calories and protein on a daily basis for more than half of the world's population. Locally farmed traditional rice cultivars have been proved the availability of high grain protein, carbohydrate and ash content. So the people are becoming more interested in organic and traditional products these days. Due to the lack of information about traditional cultivars, study conducted to examine how traditional rice cultivars performed under various growing techniques, field research was conducted at wet land farms at Tamil Nadu Agricultural University, Coimbatore. The study's design consisted of a split plot with two replications. The main plot had three cultivation techniques (organic, inorganic, and control), whereas the subplots included eleven rice cultivars. Data on growth characteristics, yield, and yield characteristics were obtained and statistically evaluated. Traditional cultivars' growth, yield characteristics, and yield were all higher under organic farming than check (CO 51). The findings showed that all ten traditional rice cultivars responded well to organic farming methods as opposed to inorganic and control methods. Among cultivars Annamazhagi (C<sub>1</sub>) has given the best performance. The requirement for traditional rice cultivars in a regular diet and for consumption is still relatively low, but this study aids in the production of organic, high-quality traditional rice cultivars using appropriate farming techniques.

**Key words:** Traditional rice cultivars, organic production package, Annamazhagi, productive tillers, yield.



## Effect of different position of leaves on quality and biochemical parameters of mulberry genotypes.

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### ABSTRACT

Mulberry, *Morus indica* is considered as sole food plant for silkworm, *Bombyx mori* L. Quality of mulberry leaf is considered as one of the major factor for the feeding preference by silkworm which in turn leads to improved cocoon crop productivity. Position of the leaf plays an important role in quality of mulberry leaf. Leaves were harvested separately at different leaf positions viz. top (2<sup>nd</sup> to 5<sup>th</sup> leaf) and bottom (8<sup>th</sup> to 12<sup>th</sup> leaf) from different mulberry genotypes including V<sub>1</sub>, M5, S36, S54, Mysore local, *M. laevigata*, *M. nigra* and S-13 at 45 days after pruning in 3 different replications. Leaf quality and biochemical analysis such as moisture content, nitrogen and protein content was estimated for different genotypes. Leaf quality analysis from leaf samples showed significant differences among the genotypes. The results revealed that among the top harvested leaves, maximum moisture content in M5 (73.81 %), nitrogen and protein content in V<sub>1</sub> were 4.60 % and 28.78 % respectively and minimum moisture content (67.6%), nitrogen (3.45%) and protein (21.56 %) was noticed in the genotype *M. nigra*. Leaves from the lower portion of the mulberry plants revealed no significant difference for moisture content, but maximum nitrogen (4.20%) and protein content (26.25%) was noticed in V<sub>1</sub> variety and minimum was recorded in S-13 variety.

**Keywords:** Mulberry, Genotype, Biochemical, Quality, Position of leaf



## Morphological Characterization of Roselle (*Hibiscus sabdariffa* L.) Germplasm for Qualitative traits

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### ABSTRACT

An experiment has been conducted with an objective to study qualitative characters in roselle for two years at three different agro-climatic zones of India (two of West Bengal and third in Andhra Pradesh) during *Kharif*, 2013 & 2014 from a set of sixty roselle germplasm consisting of forty five indigenous, eleven exotic and four released varieties. Data on eighteen qualitative traits viz., plant height, stem pigmentation, nature of stem, leaf shape, leaf vein colour, leaf margin pigmentation, lobe number, petiole pigmentation, nature of petiole, calyx pigmentation, calyx type, nature of calyx, petal colour, petal eye spot, pollen colour, staminal column colour, stigma colour and pod shape have been recorded. Five traits viz., stem pigmentation, nature of stem, petiole pigmentation, nature of petiole and calyx pigmentation have three types of variants (polymorphism), whereas, the rest of the traits showed two types of variants (dimorphism). Based on these observations, roselle germplasm can be divided into two groups i.e. fibre and leafy vegetable types based on the trait, plant height. Generally, fibre purpose genotypes are taller in nature, whereas, the leafy vegetable types are shorter. The two groups can be further sub-divided based on stem pigmentation and leaf shape. Stem pigmentation, leaf shape and petiole colour are the most variable traits for fibre crop whereas calyx pigmentation, petal eye spot and pod shape are most variable traits for seed crop. Characterization of germplasm on the basis of their qualitative traits will be useful in identification of genotypes for different purposes including framing of DUS characteristics in roselle.

**Keywords:** Characterization, qualitative traits, roselle



**CHARACTERIZATION AND CLASSIFICATION OF SOIL FOR SUSTAINABLE  
AGRICULTURE IN CHOTANAHALLI MICRO-WATERSHED, TUMKUR DISTRICT,  
KARNATAKA**

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**ABSTRACT**

An intensive study of micro-watershed was carried out for evaluation of land resources of Chotanahalli micro-watershed of Karnataka, using geospatial techniques for characterization and classification, to assess soil fertility, generation of thematic maps and to prepare potential land use plan for micro-watershed. Nine master profiles were characterised and classified, seven soil profiles in which 1,2,4,5,6,7 and 8 were classified as *Alfisols* and two profiles that is 3 and 9 were classified as *Inceptisol*. Soil depth was shallow to very deep. Soil reaction and EC showed irregular trend with depth. Soil erosion is divided into two classes namely slight erosion (e1) and moderate erosion (e2) and slope was nearly level to gently sloping. The OC decreases with the increase in depth of profiles. The CEC, BD and MWHC increased with increase in depth of profiles. The exchangeable bases found in the order of  $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$  on the exchange complex in profiles. The pH of surface soil is strongly acid to slightly alkaline in reaction. SOC, S and B were low to medium in range. The available N, P, K were medium in range and Ca and Mg were sufficient in soil. Fe, Mn and Cu were sufficient and Zn was present in deficient to sufficient range.

**Key words:** Watershed, Nutrient, Soil and Profile



## **Study on Youth Perception of Youth on Agricultural Mechanization Enhancement through Digital Marketing**

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### **ABSTRACT**

In the post COVID era, the digital marketing strategies were well played a role in the Indian agriculture. Considering the future agricultural community, a study was undertaken among youth through a questionnaire to study the digital marketing tool for Agricultural mechanization enhancement. Among 50 respondents from youth sector, majority lies between 21 to 25 years of age and 80% of them were professionals from Agriculture and allied sectors. Almost, 96% of respondents prefer digital marketing in their day to day life. Study shows that youth strongly (92% respondents) believes that digital marketing will enhance agricultural production. Earlier outcomes were compared with the results. Respondents strongly opined (with average ratings of 4.06) that digital marketing can enhance agricultural mechanization at most of the cases but not covers the complete sector. Among various aspects in agricultural mechanization such as machinery sales, machinery hiring, maintenance through digital marketing platform observed to be positive perceptions towards digital marketing, discussed detail in this chapter. Major hurdles for enhancement of Agricultural mechanization were found to be lack of awareness, farmer's educational level, fraudulents and other few factors which were discussed. The study reveals a positive approach to digital marketing with its own pros and cons, adoption with mechanization, forms a strong base for food security.

**Keywords:** Digital marketing, Mechanization enhancement, Youth in farming.



**Molecular approach to study population structure of diverse oat (*Avena sativa* L.) genotypes**

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**ABSTRACT**

Oat is a multipurpose crop used for fodder and grain purpose. Presence of variability affect the nutritional and food security of country. In the present study, a comprehensive molecular approach, based on multiple marker system was used for characterization of 62 diverse oat genotypes. Number of different alleles, number of effective alleles, Shannon's Information Index, Expected Heterozygosity, Unbiased Expected Heterozygosity was calculated for each population using GenAlEx software. STRUCTURE version 2.3.1 was used to cluster the data based on 29 polymorphic markers using a Bayesian technique. Using population structure analysis, at K=2 maximum likelihood value of  $\Delta K$  was observed. This led to grouping of the population into two sub-populations. The results from Structure analysis were found in concordance with the grouping of the genotypes concluded by PCA and UPGMA clustering analyses. The admixture observed in the two populations is evident from the sub-grouping of genotypes from UPGMA clustering analysis. Through AMOVA, clarity on the presence of enough genetic variation was seen within clusters (96%). Genotypic characterization can be substantiated by evaluating variation among oat genotypes through various molecular techniques. The determination of dissimilarities will be a valuable tool in selection of parents for oat improvement programmes.

**Keywords:** oat, population, characterization, molecular study



**CRISPR/Cas9 Mediated Genetic Transformation of Tomato (*Solanum lycopersicum* L.)  
Cultivar Arka vikas for Resistance to Potyvirus**

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**ABSTRACT**

Tomato (*Solanum lycopersicum* L.) is an excellent candidate for checking out CRISPR/Cas9 gene editing in a dicot crop. Because of the availability of effective transformation methodology, genome diploidy, a high-quality genome sequence and its economic importance. Effective genome editing requires proficient production of regenerated plants and an efficient method of delivering Cas9 and sgRNAs to the plant. Here, we demonstrate tomato cv. Arka vikas transformation mediated by *Agrobacterium*. Similarly we developed a system based totally on CRISPR-Cas9 in this plant. Hypocotyls and cotyledonary explants used as source of direct shoot regeneration. More than 40% multiplication rate was achieved from hypocotyledon explants subjected to a two-step sterilization procedure and grown on complete MS medium supplemented with BAP (2.0 mg/L), IAA (0.5 mg/L), photoperiod of 16/8 h and 45% relative humidity at 20±2 °C. *In vitro* direct shoot regeneration was accomplished in 8 weeks by using hypocotyledon on MS medium supplemented with TDZ (0.5 mg/L)+IAA (1 mg/L)+ Zeatin (2mg/L) at 15±2 °C. The attempt of using *Agrobacterium*-mediated transformation resulted in successful integration of the binary modified pBI121/Cas9 vector into the shoot regenerated explants of tomato cv. Arka vikas. PCR analysis confirmed the integration of Cas9 into tomato cv. Arka vikas. The protocol for direct shoot regeneration was standardized. Successful demonstration of integrated Cas9 in this study constitutes first step in developing strategies for genetic manipulation of tomato cv. Arka vikas. Furthering the development of this technology holds significant potential for advancing genetic research in tomato by integrating multigene targeting and/or use of recyclable cassettes.

**Keywords:** *Agrobacterium*; CRISPR/Cas9; sgRNAs; hypocotyledon; direct shoot regeneration; PCR analysis





**Studies on Character Association and Path Coefficient Analysis in Rice Genotypes  
(*Oryza sativa*)**

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**ABSTRACT**

A field experiment was conducted during *Kharif*, season of 2020 at Research Farm, Main Rice Research Centre, Navsari Agricultural University, Navsari, Gujarat. The objectives of this study were to detect interrelationships among cultivars by estimating correlation coefficients and path coefficient analysis among the rice genotypes. Forty genotypes were evaluated in the randomized complete block design with three replications. Various quantitative traits were measured to investigate the correlation coefficients and path coefficients. The association studies indicated that grain yield per plant was significantly and positively correlated with number of productive tillers per plant, grains per panicle, 1000 grain weight and straw yield per plant at genotypic level. While plant height, panicle length and kernel breadth showed positive and highly significant association, which suggested that these characters can be improved simultaneously with grain yield per plant by direct selection. However, it was observed to be non-significantly and positively correlated with amylose content and protein content, suggesting less significance of these traits for improvement. Genotypic path coefficient analysis revealed that the highest positive direct effects on grain yield per plant were exhibited by straw yield per plant followed by L/B ratio, kernel breadth, grains per panicle, amylose content, 1000 grain weight, panicle length and productive tillers per plant. Therefore, selection for such traits is easy and would be useful to bring about improvement in rice.

**Keywords:** Rice, Correlation Coefficients, Path Coefficient Analysis.



## **Upscaling the minor millet cultivation for livelihood improvement and sustainable income for the underprivileged farming community**

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### **ABSTRACT**

Barnyard millet and little millet are important minor millets which considered to be eco-friendly crops, often grown without fertilization; they are suitable for fragile and vulnerable ecosystems. In spite of these advantages, underutilized and neglected in the cultivation part in several areas. It is also a known fact that the Theni, Madurai and Dindigul districts of southern Tamil Nadu have a major population of Scheduled caste (SC) and Scheduled tribes (ST), Among the tribes, “Paliyans” are living near the foothills of the Western Ghats, which is largely rural. These populations are really vulnerable communities that need a better agricultural system for livelihood improvement and nutritional security. Here, our aim was to improve incomes, nutritional status, and empowerment on the promotion of minor millets for the attainment of food security through agricultural interventions on seed production technology and value addition in minor millets such as barnyard millet and little millet that resolve agricultural production and ensures availability of quality seeds and helps in creating jobs of a vulnerable community. As part of the Natural Resources Data Management System (NRDMS) programme on SCST development, we initiated various agricultural activities to upscale the minor millet cultivation and consumption in eight blocks in three districts namely Theni, Madurai and Dindigul districts of Tamil Nadu, India. In summary, our holistic approach brings into the independent seed security system at the village level by insisting on the seed selection, seed production, value addition and exchange of seeds among the farming community for sustainable income.

**Keywords:** SCST farming community, Minor millets, Interventions, Income generation



## **Ensuring household food security in the era of Covid 19 pandemic: A conceptual review**

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India had imposed one of the strictest lockdowns of the covid 19 pandemic and this has invariably affected the livelihoods of millions of people, especially rural households. Even before the covid 19 pandemic more than 820 million people did not have enough to eat and the pandemic has further worsened the situation. In agriculture, most of the problems faced by the farmers are production losses, labour shortages, difficulty in market access, job loss, distress migration, which has affected economy as a whole. Food inflation is on the rise and this has affected the purchasing power which in turn has disrupted food consumption pattern in the rural households. Hence is time to strengthen our markets, activities related to production, marketing and storage of food production through innovations. The role of Farmer Producer Companies, agri-tech startups have played a prominent role in ensuring food accessibility and availability during the pandemic. The pandemic also has brought to focus the importance of ICT during crisis in filling the gap. Hence it is imperative to analyse the multi-dimensional implications of food insecurity while formulating policies. The aim of the review is to highlight the impact of covid 19 pandemic on the existing food system and propose strategies for post pandemic recovery.

**Keywords:** Pandemic, food security, impact, rural households



## SUSTAINABILITY OF COMMODITY BASED ASSOCIATIONS IN SOUTHERN KARNATAKA OF INDIA

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### Abstract:

Recently, the Govt., of India has initiated community based farmers' groups based on the major crop grown in that specific agro-climatic zones. Such groups were known as Commodity Based Associations (CBA). These were grass root level autonomous registered bodies established in rural and urban areas around a single enterprise applying the good agricultural practices and using the best marketing channels to maximize the profits. The Research study was conducted in Southern Karnataka during 2017-18. The ICAR-University of Agricultural Sciences Bangalore (UASB) has initiated and formulated 10 CBA through Krishi Vigyan Kendras (KVKs) in its jurisdictional districts, in Southern districts of Karnataka State, these have been operational since 2015. There was necessity to find out how far these CBA were sustainable in getting the profits to the farmers?. In view of this, this research was conducted to understand the functioning patterns of CBA and their level of sustainability. The total random sample of respondents drawn was 50 from the selected CBA. The research design adopted was *ex-post-facto*. The data were collected with a pre-tested interview schedule and also using secondary sources with PRA tools where ever necessary to supplement the research information. The indicators for sustainability were identified based on the judges rating method and selected the relevant statements based on the face validity under each identified indicator. The range of sustainability was worked out and categorized least to most suitability level. The study found that the profits earned had been the one of the key indicators sustainability, by taking this in to cognizance, all the CBA of UASB, KVKs of Mandya, Chamarajnar, Tumkur, Ramanagaram and Hassan districts, the extent of working functional level was moderate. Regarding CBA, the respondents perceived to have been, to some extent economical at the average level and with moderate level of sustainability. The overall percentage of the sustainability of ICAR-UASB-KVKs was 72.22% indicating that all the CBAs were sustainable, except the CBA of minor millets Tumkur District, the main reasons being non-availability immediate accessible to mills to process the produce and finding appropriate marketing channels to sell the minor millets produce in cities and towns. The implication of the study being, for future sustainability of all the CBA, there is a need of external agencies resource support, especially in marketing of the commodities.

**Key words:** Commodity Based Associations, Sustainability, Krishi Vigyan Kendras, Indicators and Commodities



## RESOURCE USE EFFICIENCY OF FARMING SYSTEM IN KORAMANGALA- CHALLAGHATTA VALLEY PROJECT AREA

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### Abstract

The research empirically estimates the resource use efficiency and resource saving target ratio of farmers in KCVP and NKCVP area using Data Envelopment Analysis (DEA). Data for the study was obtained from Kolar district of Karnataka, 120 vegetable growers were randomly selected through random sampling technique, and data collected with the aid of pre-tested questionnaire coupled with interview schedule. Resource efficiency of vegetable farmers was studied and degrees of overall technical efficiency (CRS) and pure technical efficiency (VRS) were determined using a neoclassical non-parametric model called DEA. Additionally, overuse of resources was examined, and resource saving of different resources were estimated. The results on technical efficiency revealed a mean efficiency scores of 0.74 and 0.90 for technical and pure technical efficiency in FS- I, whereas in FS- II (0.70 and 0.80), FS- III, (0.65 and 0.80) and in FS- IV (0.68 and 0.83) KCVP area indicating resources were comparatively more efficiently used in FS-I followed by FS-II, FS-IV and FS-III. While comparing KCVP and NKCVP areas, resources were more efficiently used in NKCVP area than KCVP area. To reduce excessive usage, farmers should be encouraged to follow the recommended package of practices by consulting experts from farm universities or agricultural department.

Key words: Technical efficiency, Non-parametric, Constant returns to scale(CRS), Variable returns to scale(VRS), Farming systems(FS)

**Theme - 2**  
**Technological Innovation in High-Tech Horticulture  
and Precision Farming**

## Study of average heterosis and heterobeltiosis for yield and its attributing characters in okra [*Abelmoschus esculentus* (L.) Moench]

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### ABSTRACT

The present experiment was conducted at the Vegetable Research Farm, CCS Haryana Agricultural University, Hisar in the year 2020 to find potential parents and superior cross combinations for the improvement of yield in okra. Twelve lines and two testers were crossed in a Line x Tester mating design to produce 24 F<sub>1</sub> hybrids. These F<sub>1</sub> hybrids, along with 14 parents and a commercial check, were evaluated to determine the magnitude and direction of heterosis for growth, earliness and yield contributing characters in okra. At the 5% and 1% levels of significance, an analysis of variance for various quantitative characteristics investigated during the experiment revealed highly significant differences between the parents, crosses, and the commercial check. Significant heterosis was found over better and mid parent for most of the traits studied in the desirable direction. The results revealed that the highest significant average heterosis was observed in the cross HB-76-2-4 x H.N (25.54%) followed by cross HM-3 x H.U (25.42%) and HB-96-2 x H.U (23.88%) while the cross HBMS-1 x H.U observed the significant positive heterosis (18.54%) over the better parent. High estimates of heterosis derived from hybrid combinations revealed considerable genetic variability among the parental lines and also reveals good scope for commercial exploitation of heterosis in okra.

**Keywords:** Average heterosis, Heterobeltiosis, Line, Okra, Tester

### Application of artificial intelligence in plant disease diagnosis

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### ABSTRACT

Artificial intelligence (AI) holds the promise of driving an agricultural revolution at a time when we must produce more food using fewer resources. The main idea behind AI is to create technology that works similarly to the human brain. Artificial intelligence has a huge impact in all Industrial Sectors. AI accomplished solving numerous problems and saving a profitable resource by minimizing environmental deterioration. Artificial Intelligence is making a revolution in agriculture by replacing traditional methods by using methods that are more efficient and helping the world to become a better place. The agriculture sector can be considered as the backbone for any developing economy. To obtain the maximum yield from the crops, it is required that farmers should be provided with the best technologies and methodologies. Due to its ability to perceive the problems, developing the appropriate reasons for that and to establish optimal solutions for it, artificial intelligence can act as a great aid in addressing the diseases of crops. The population is expanding enormously with this expansion the interest of food and business is likewise expanding. Intervening of AI in Agriculture is serving farmers to recover their farming efficiency and diminish environmental hostile influences. Disease infection is the main drawback of Agriculture. To identify and detect the disease on agriculture product, the AI technique is introduced.

### **Influence of crop geometry and harvesting heights for increasing the productivity of leaves in annual moringa (*Moringa oleifera* Lam.)**

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#### **ABSTRACT**

Moringa belongs to family Moringaceae and their leaves are rich in protein, vitamins, potassium, calcium, iron, phosphorous, beta carotene and natural antioxidants. Moringa leaves control malnutrition and getting popular over India and other developing nations. An experiment was conducted during 2021 at Western block farm, Horticultural College and Research Institute, Periyakulam. The experimental study consists of four crop geometries viz., 1.50m x 0.25m (S<sub>1</sub>), 1.50m x 0.50m (S<sub>2</sub>), 1.50m x 0.25m x 0.25m (S<sub>3</sub>), 1.50m x 0.50m x 0.50m (S<sub>4</sub>) and three harvesting heights of 30cm (T<sub>1</sub>), 45cm (T<sub>2</sub>) and 60cm (T<sub>3</sub>). Study was laid out in split plot design with three replications. Plant height, fresh leaf yield and dry leaf yield were significantly higher in the closer spacing of 1.50m x 0.25m x 0.25m whereas number of primary branches and secondary branches, stem girth, light interception, leaf area were significantly higher in the wider spacing of 1.50m x 0.50 m. Harvesting heights had no influence on the growth parameters in first harvest but exhibited significant impact in the second harvest. Harvesting height of 60cm was observed as the highest plant height in second harvest. Leaf yield recorded maximum in harvesting height of 30cm during first harvest and 45cm in second harvest. The spacing S<sub>3</sub> (1.50m x 0.25m x 0.25m) coupled with the harvesting height of 45cm (T<sub>2</sub>) in second harvest provided the highest fresh (6.71tha<sup>-1</sup>) and dry (1.22tha<sup>-1</sup>) leaf yield.

**Keywords:** Moringa, crop geometry, harvesting heights, light interception, leaf yield

### **Seed designing on seed quality parameters and fusarium wilt of brinjal (*Solanum melongena* L.)**

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#### **ABSTRACT**

Fusarium wilt of brinjal caused by *Fusarium oxysporum* f. sp. *melongena* is one of the major diseases of brinjal. An experiment was conducted under net house on seed designing of brinjal seeds to know its effect on seed quality parameters and in controlling the fusarium wilt disease of brinjal. Seven different seed designing treatments were set with combination of fungicides as seed priming agents, *Prosofis juliflora* leaf powder as filler material and bio-control agents as seed pelleting material using untreated seeds as control. As a result seed designing with carbendazim (0.2 %) + GA<sub>3</sub> (15mg/100ml) + *Trichoderma viridae* recorded highest germination percentage (96.00 %), root length (7.92 cm) and seedling vigour index (1313) as compared to other treatments and untreated control (88.67 %, 5.98 cm and 962, respectively) in laboratory. Under net house, designed seeds were planted in plastic trays filled with media inoculated with fusarium wilt pathogen. The treatment seed designing with carbendazim (0.2 %) + GA<sub>3</sub> (15mg/100ml) + *Trichoderma viridae* shown highest germination percentage (68.33 %), reduction in disease incidence over control (50.38 %) and lowest total mortality (37.02 %) as compared to other treatments and control.



**Germination and vigour conception in passion fruit (*Passiflora edulis* var. *flavicarpa*)**  
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**ABSTRACT**

The investigation on viability, vigour and storage studies in passion fruit (*Passiflora edulis* var. *flavicarpa*) seeds was carried out at Department of Fruit Science, K. R. C. College of Horticulture, Arabhavi. The germination of passion fruit seeds is less and uneven which may be due to physical (integument impermeability to water and gas), chemical (presence of inhibitory substances), physiological immaturity (mechanisms of germination inhibition), embryo immaturity (Favaris *et al.*, 2020). Pre-germination treatments may enhance the germination potential of passion fruit seeds. Hence, more emphasis has to be given to underutilized fruits due to their nutritional importance and medicinal properties. Among the seven pre-germination treatments studies, seeds treated with thiourea 1 per cent for 10 minutes recorded highest germination percentage (59.48 %) followed by GA<sub>3</sub> 250 ppm (49.33 %). Minimum number of days taken for initiation (18.33 days), 50 per cent (28.33 days) and maximum germination (38.00 days) were recorded in seeds treated with GA<sub>3</sub> at 250 ppm for 10 minutes. Vegetative parameters such as shoot length (26.54 cm), root length (15.91 cm), fresh weight of seedling (6.50 g), dry weight of seedling (1.38 g), seedling vigour index-I (1571) and seedling vigour index-II (82.38) were recorded highest in seeds treated with thiourea 1 per cent for 10 minutes and lowest for control.

**Key words:** Seed vigour, Recalcitrant seeds, Seed Endosymbionts, Seed viability, SVI

**Nutritional survey of kiwifruit orchards in Sirmaur district of Himachal Pradesh**

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**ABSTRACT**

The present study entitled “Nutritional survey of kiwifruit orchards in Sirmaur district of Himachal Pradesh” was undertaken during 2018-2020 in Sirmaur district of Himachal Pradesh. Soil and leaf samples from 16 representative kiwifruit blocks were collected. Majority of the soils were found to be sandy loam to sandy clay loam in texture. Bulk density values indicated that soils are devoid of compaction problem. Soil pH was near neutral in reaction. EC values were in safe limits (< 0.8 dS m<sup>-1</sup>). The organic carbon contents were medium to high. Soils were high in available P, K, Ca, Mg, SO<sub>4</sub><sup>2-</sup>, Cu, Fe and Mn, however, available N was recorded medium in range for both the surface and sub-surface layers. Whereas, 56.2 and 100 per cent of the samples were medium in range for surface and sub-surface soils in DTPA-Zn availability, respectively. Leaves were sufficient for N and P contents, whereas, K deficiency was recorded in majority of leaves. Leaf Ca, S, and Mn were under sufficient ranges, whereas, Mg, Cu, Zn and Fe were excess/high. High coefficients of variations (>5%) for both soil and plant nutrient analysis indicate that there is need for judicious application of fertilizers and organic manures for sustainable crop production in the study area.

**Keywords:** Nutrient management, Kiwifruit, Leaf content, Nutrient uptake.

## Effect of drip irrigation and fertigation studies in Marigold cv. Maxima Yellow at Periyakulam condition

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### ABSTRACT

Drip irrigation is an irrigation method that saves water and provides the most economical method of applying fertilizer by utilizing fertilizer injectors that operate without any external power supply. Fertigation use soluble fertilizer that flow directly towards the plant root zone through the drip system, drip emitters or micro sprinkler system. An experiment was conducted to find the optimum dosage of fertigation for marigold cv. Maxima Yellow. A field experiment was carried out at Horticultural College and Research Institute, Periyakulam, Theni district during the year 2015 -16. The bio chemical status of soil before and after harvesting of crop was found non-significant due to fertigation treatments in marigold. At first flower bud appearance stage leaf NPK status differed significantly with levels of fertigation. The experiment field with 810 m<sup>2</sup> (18 x 45 m) installed with drip irrigation system was selected for experimentation. The field was divided into 6 sub plots and laid out in randomized block design with different doses of water soluble fertilizers given through drip with following treatments viz., T<sub>1</sub> -75 % of RD of fertilizers using WSF, T<sub>2</sub> -100 % of RD of fertilizers using WSF, T<sub>3</sub> -125 % of RD of fertilizers using WSF, T<sub>4</sub> -75 % WSF + 25% Straight Fertilizer, T<sub>5</sub> -50% WSF + 50% Straight Fertilizer, T<sub>6</sub>-25% WSF + 75% Straight Fertilizer, T<sub>7</sub>-100 % Straight Fertilizer (Control). The growth and yield attributes like plant height (cm) (1<sup>st</sup> flower bud appearance stage), stem girth (cm)(1<sup>st</sup> from ground level), number of primary branches, plant spread (N x S) & (E x W) (cm), days taken to 1<sup>st</sup> flower bud appearance, days taken for full bloom, flower duration (days), flower diameter (cm), pedicel length (cm), individual flower weight (g), yield of flowers per plant (g), number of flowers per plant, estimated yield / hectare (tonnes) were studied. Plant height (cm), stem girth (cm), number of primary branches, plant spread (cm), flower duration (days), flower diameter (cm), pedicel length (cm), individual flower weight (g), yield of flowers per plant (g), number of flowers per plant, estimated yield/hectare (tonnes) was highest in T<sub>2</sub> -100 % of RD of fertilizers using WSF and lowest was observed in T<sub>1</sub>- Control (no fertilizers)

**Keywords:** Drip irrigation, fertigations, African marigold, growth, yield attributes



**Prediction of soil moisture based on environmental parameters in real-time using machine learning techniques in a naturally ventilated polyhouse**

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**ABSTRACT**

For effective and optimum utilization of fresh water in irrigation, it is essential to develop smart irrigation (internet of things) systems based on the dynamic prediction of soil moisture pattern of the field in the near future. Irrigation can be scheduled by incorporating feedback from moisture and weather sensors. A developed IoT system was used to monitor and collect the micro-environmental parameters from the sensors deployed inside the greenhouse. The soil moisture was predicted based on the information collected at the field using different machine learning techniques like decision tree, random forest, multiple linear regression, xstream gradient boosting and K- nearest neighbour. This prediction of soil moisture based on environmental parameters would aid in maintaining the required amount of water per plant in real-time, preventing the plant from experiencing stress. Random forest shows better accuracy ( $R^2=0.95$ , RMSE=0.10, MAE=0.01) followed by extreme gradient boosting (0.94, 0.11, 0.01) whereas multiple linear regression (0.87, 0.15, 0.11) showed less accuracy. The proposed method could aid in making effective irrigation decisions that use the least amount of water. The region or area-wise prediction can be done for giving more accurate farming suggestions of which crop can be grown by analyzing the data based on the soil and weather conditions.

**Keywords:** Machine learning, Real-time, Soil moisture, Prediction, Micro-environment.

**Effect of humic acid and zinc sulphate on quality and post-harvest life of acid lime (*Citrus aurantifolia* Swingle)**

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**ABSTRACT**

The purpose of this research was to see what effect humic acid and zinc sulphate had on the quality and post-harvest life of acid lime (*Citrus aurantifolia* Swingle). The study used a completely randomized design with three repetitions and seven treatments: foliar spray of humic acid alone or with a combination of zinc sulphate at the pea stage. T<sub>6</sub> (Humic acid 40 ml/l + ZnSO<sub>4</sub> 0.5%) was the most successful treatment, with the longest shelf life (16.14 days), lowest physiological weight (8.36%), spoiling percent (3.55%), and average seed content (8.97). TSS (°Brix), ascorbic acid (mg/100 ml of juice), and juice content were considerably altered by foliar application of humic acid and zinc sulphate (percent). The T<sub>6</sub> treatment was the most successful of all the treatments, with the highest TSS (8.27 °Brix), ascorbic acid (37.70 mg/100 ml), and juice content (46.73 percent), while the T<sub>1</sub> (Control) treatment had the most acidity (8.21 percent). Similarly, T<sub>6</sub> had the highest TSS (8.50 °Brix), ascorbic acid (34.37 mg/100 ml), and juice content (46.73 percent) 10 days after harvest, while T<sub>1</sub> (control) had the highest acidity retention (8.14 percent).

**Key words:** *Citrus aurantifolia* Swingle, Humic acid ZnSO<sub>4</sub>, shelf-life, quality attributes



**Technological advancement in digital farming and india's  
present scenario: a review**

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**ABSTRACT**

Technological advancements in agriculture practices for improving the crop yield is essential phenomena for countries like India. In order to compete day to day increasing food demand for growing population and also to strengthen the economy, advancement in agriculture practices has become immensely necessary. In India, same practice use differently because of its highly variable climatic and geographical conditions. India faces many problems like, small land holding, climate change, agroclimatic variation in different states, uneven rainfall, conventional (old)practices and political and economic tantrums, unavailability of storage and transport facilities, in spite of these economic losses also occur due to the lack of indispensable information to the farmer. To overcome these obligatory problems, we have to acknowledge technological advancements and digitalization in agricultural practices. Some of the furtherance like precision farming, drone technology, mobile applications and data analytics which will provide us the useful information about moisture percentage, soil health, fertilizer doses requirements, disease and pest management and exact prediction of the crop nutrient demand and also helpful in making appropriate schedule and storage arrangements to decrease the post-harvest losses. We can also make marketing strategies according to the data we get and can convert old farming practice into high profitable enterprise. To make this review paper possible we went through vast literature, data, websites, journals ,magazines and research papers directly or indirectly related to the agriculture advancement and digital progression .With the help of available information we tried give our reader an brief and Hi-tech understanding of Digital Technologies like Artificial Intelligence, Internet of Things, Big Data Analytics, Satellite Imagery and Remote Sensing, Machine Learning, Unmanned Aerial Vehicles (Drones) Robotics , sensors ,companies and their mobile applications.

**Keywords:** Digitalization, IOT, sensors, drones, AI

**Horticulture based farming systems: A sustainable model for food security and diversity**  
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**ABSTRACT**

Horticulture based farming systems have emerged as important strategy to address the increasing need for food and nutrition under the changing climate and resource degradation scenario. On-station horticulture based farming system model (1.5 ha) has been developed using 4 different modules viz., Module 1- Fruit Orchards (with intercropping of vegetables), Module 2- Vegetables, Module 3- Field crops and Module 4- Pond-Dyke system with integration of poultry birds for improving profitability, enhancing productivity and nutritional security of farmers. The total gross returns obtained from the model were Rs 4,07,776, Net returns were Rs 181815 with cost of cultivation of Rs 2,25,961. The economic efficiency was reported to be highest in Module 1 (685.0 Rs/ha/day) followed by Module 3 (361.03 Rs/ha/day). Sixteen crop families are have been integrated in this model which provide a perennial cover of around 39 %. Apart from meeting the annual requirement the surplus obtained upon selling in the market provides additional income of Rs 318186.2. The model was able to address the goal of gender equity where men have contributed to 40 % and women have contributed to 60% of the total work force required. The model provided more opportunities for women labour hence balancing the gender equity.

**Development and Performance evaluation of Real- Time Wireless Smart Drip Irrigation System for scheduling of irrigation using Internet of Things**

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**ABSTRACT**

The purpose of this study was to compare various irrigation methods: An IoT-based soil moisture monitoring (IoT-SM) method using moisture sensors and an ET-based strategy. The best irrigation scheduling strategy should be determined by commercial production: keeping the soil water content near field capacity will result in a better fresh yield but not a more dry matter. Sweet corn was chosen as the crop under study. Growth characteristics (plant height, yield, and water productivity) were compared for each of the two approaches. For IoT based soil moisture monitoring method, two irrigation regimes were used: 43.5 per cent and 34.8 per cent (as field capacity (FC) of soil and 80% of FC, respectively) and crop evapotranspiration (ETc 100 per cent) for the ET-based method. The results showed that the IoT-SM 43.5 per cent could produce higher yields of about 12.05% and water savings by 11% compared to the ETc 100 per cent-based irrigation method. The developed IoT system was durable and water-resistant, allowing it to be deployed in outdoor agriculture. At the same time, a solar power supply eliminates the need for cabling and reduces sensor node maintenance.

**Keywords:** Zea mays, Smart irrigation; Evapotranspiration (ET), Soil moisture sensors, Water productivity



**Effect of fertilizer sources and rate through drip fertigation on growth and yield of custard apple (*Annonas squamosa* L.) Cv. Balanagar**

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**ABSTRACT**

A study was conducted during 2019 to 2020 and 2020 to 2021 to find out the effect of fertilizer sources and rate through drip fertigation on growth and yield of custard apple (*Annonas squamosa* L.) Cv. Balanagar. The experiment was laid out in factorial randomized block design with eight treatment combinations which included four levels of fertigation (100, 75, 50% and surface application) and two sources of fertilizers (water soluble fertilizers and solid fertilizers) with four replication. Nitrogen, phosphorus and potassium (NPK) content of solid and water soluble fertilizers were applied through fertigation as well as soil application to test various attributes of 5-years-old custard apple cv. Balanagar. The investigation indicated that 100% RDF (recommend dose of fertilizers) with water soluble fertilizers (F<sub>1</sub>S<sub>2</sub>) resulted in maximum plant height (3.25 m), plant spread (N-S) (3.17 m) and (E-W) (3.05 m), canopy volume (19.90 m<sup>3</sup>), stem girth (8.05cm), leaf area index (2.87), relative chlorophyll content ( 56.31 SPAD readings), total chlorophyll content (2.49 mg g<sup>-1</sup> flw), minimum days from flowering to fruit set (8.21 days), percent of fruit set (44.71 %), fruit length (7.38 cm), fruit diameter (7.85 cm), average fruit weight (184.93 g), fruit volume (196.73 g), fruits per branch (20.27), fruits per plant (84.55) and fruit yield (6.45 t ha<sup>-1</sup>). However, surface application of 100% RDF with solid fertilizers (F<sub>4</sub>S<sub>1</sub>) resulted in minimum growth and yield attributes in custard apple.

**Key words:** Custard apple, fertigation, source of fertilizers, growth, yield

**Effect of nitrogen, phosphorus and potassium fertilization on growth and yield of custard apple (*Annonas squamosa* L.) Cv. Balanagar**  
Priya, B\* Kurubar, A. R. Ashok, H. Ramesh, G. Udaykumar, N. Umesh, M. R and Rajkumar, R. H.

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### ABSTRACT

Custard apple (*Annona squamosa* L.) can tap a considerable volume of soil with its extensive root system under natural habitat. However, the natural fertility of soils is rarely sufficient to give economic yields. A study was undertaken during 2019-2020 and 2020-21 at the Horticulture Garden, Department of Horticulture, College of Agriculture, Raichur, Karnataka to find out the effect of N, P and K application on growth and yield of custard apple Cv. Balanagar. The experiment consisted of 5 treatments comprising T<sub>1</sub> (control), T<sub>2</sub> 75% RDF (188:94:94 g/plant), T<sub>3</sub>-100% RDF (250: 125:125 g/ plant), T<sub>4</sub>-125% RDF (313:157:157 g/plant) and T<sub>5</sub>-150% RDF (388:187:187 g/plant). The results revealed that increasing levels of N, P and K (388:187:187 g/plant) (T<sub>5</sub>) significantly increased growth and yield of custard apple. However, maximum plant height (3.25 m), plant spread (N-S) (2.55 m) and (E-W) (2.52 m), canopy volume (19.90 m<sup>3</sup>), stem girth (8.05cm), leaf area index (2.87), relative chlorophyll content (56.31 SPAD readings), minimum days from flowering to fruit set (12.61 days), percent of fruit set (44.71 %), fruit length (7.38 cm), fruit diameter (7.85 cm), average fruit weight (184.93 g), fruit volume (196.73 g), fruits per branch (12.22), fruits per plant (84.55) and fruit yield (6.45 t ha<sup>-1</sup>) were observed in 150% RDF (388:187:187 g/plant) (T<sub>5</sub>) as compare to control (T<sub>1</sub>).

**Keywords:** Custard apple, fertilizers, plant growth, yield

### Fruit drop: Causes and Control Measures

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### ABSTRACT

Fruit drop is the detachment or separation of a fruit from a branch of a tree, caused by the formation of a separation of layer of cells on the fruit stalk due to a series of physiological and biochemical events. Fruit drop is caused by several internal and external factors like condition of pollination and fertilization, seed content of fruits, competition between the organ of plant, hormonal balance and climatic conditions, phytotechnical intervention, harvest and diseases, respectively. Shortly after bloom, a number of flowers and fruitlets of fruits abscise due to poor pollination or due to nutrient shortages or because of environmental stress. As the fruits of some species and varieties approach the picking maturity, they tend to loosen from the stalk and considerable quantities may drop prior to and during the picking operation. Such type of problems can be mitigate by adopting following ways. Pollination, Plant growth regulators, Balance nutrition, Integrated pest management and Integrated diseased management. Control of fruit drop in some fruit crop. Royal delicious is used as a pollinizer for Golden Delicious apple. Mango: 20 ppm of NAA, Citrus: 2, 4-D 10 ppm and 20 ppm Zinc sulphate (0.05%) have been found to be effective.

**Key Words:** Fruit drop, Pollination, Abscission, PGR, Nutrients



**Alternate bearing: a major challenge to growers of fruit crops.**

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**ABSTRACT**

Alternate bearing is a major challenge to growers of fruit crops. It is typically initiated by an abnormally heavy crop in trees, followed by a light or no subsequent crop. Broadly two causes have been assigned for alternation namely, Environmental triggers and Endogenous factors. Several environmental triggers have been found to influence alternation like climatic stress (frost, cool weather, low air humidity). Edaphic factors (salinity, drought, water table), pests and diseases etc. Frost has more influences on terminal bearing fruits. It is more damaging during spring season. Excessive fruit drops were observed in olives, oranges, avocado and mango due to low air humidity during early fruit development phases. Edaphic factors such as high salinity favours leaf drop and reduction in photosynthetic area. Moisture stress during flower formation increases sterile flowers in olives, while summer drought has resulted in excessive fruit drop in fruits. Severe attack of pest and diseases devastate the whole crop and bring the trees towards alternation. There are several endogenous causes responsible for alternation in fruit trees such as inhibition of flower initiation by growing fruits, lack of suitable pollinizers and pollinators resulting in poor fruit set, effect of seed on prevention on fruit drop and encouragement of very heavy crop load etc. Contribution of leaves to reproductive growth, competition between vegetative and reproductive sink, fruit load, C:N ratio and imbalances of hormones are other important contributors to the alternation. Phenomenon of alternation is more prominent in the perennial fruit crops particularly in Anacardiaceae (mango and pistachio), Carylaceae (Hazelnut), Oleaceae (olives), Rosaceae (apple, pear, plums, apricot etc), Rutaceae (orange, Tangor, Satsuma etc) and also tamarind, jamun etc. fruit crops. Within a tree species some cultivars are regular while others are alternate bearer e.g. in mango Amrapali is regular while Langra is strongly alternate bearer. This type of alteration is overcome by following approaches. Planting of regular bearing varieties, proper orchard management, pruning, deblossoming and fruit thinning and use of growth retardants.

**Key words:** Alteration, Mango, Fruit thinning, Deblossoming, Nutrients



## Roof water harvesting and its efficient use under protected cultivation with automated sensor-based irrigation and fertigation for Capsicum

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### ABSTRACT

The greenhouse experiment was conducted in two seasons during 2020-21 at UAS, GKVK, Bengaluru to optimize the automated sensor-based irrigation and fertigation along with Roof water harvesting to grow capsicum. The study consists of three levels of automated sensor-based irrigations through Mahindra smart flow technology (I<sub>1</sub>: 75 % ASM, I<sub>2</sub>: 50 % ASM and I<sub>3</sub>: 25 % ASM) and 4 levels of fertigation (F<sub>1</sub>: 75 % RDF, F<sub>2</sub>: 100 % RDF, F<sub>3</sub>: 125 % RDF and F<sub>4</sub>: 150 % RDF) with 100 % RDF and surface irrigation as control. The experiment was laid out in RCBD design with factorial concept and replicated thrice. The greenhouses were designed to harvest rain water from six poly houses having roof area of 200 m<sup>2</sup> each and facilitated to store in tank having 3,00,000 liters capacity. The VH400 moisture sensors (TDR) were used during the study, which irrigate based on fixed threshold limit of each irrigation regimes. Initiating from third week after transplanting, 16 fertigation were scheduled once in a week based on growth stages of capsicum. The results revealed that sensor-based irrigation schedule at 75 % ASM with 125 % RDF was better combination for enhancing growth, yield attributing parameters viz., capsicum fruit length (87.51 mm), diameter (76.17 mm) and volume (207.67 cm<sup>3</sup>) & fruit yield per plant (1751 g plant<sup>-1</sup>) and realizing higher fruit yield (60,089 kg ha<sup>-1</sup>). The same combination also enhanced economics viz., net return (Rs. 13,98,731 ha<sup>-1</sup>) & B:C ratio (2.07) and resources use efficiency viz., nutrient use efficiency (79.5 kg kg<sup>-1</sup> nutrients applied), water use efficiency (16.75 kg m<sup>-3</sup>) and energy productivity (0.80 kg MJ<sup>-1</sup>). During 2020, we were able to harvest 7,74,000 liters of water from roof top of 1200 m<sup>2</sup> green houses and that met 100 % water requirement of capsicum during both the seasons.

**Key words:** Capsicum, Economics, Energy, Growth, Productivity, Yield



## Need for precision farming: Indian context

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### ABSTRACT

The food requirement is supposed to be doubled by the year 2050 (Bisoyi, 2006). The major problem in developing agricultural economies like India is a poor grasp of cutting-edge technologies and unawareness, and the unwillingness to use modern techniques (Ramamoorthy *et al.*, 2016). The future of vegetable production will be severely competitive, knowledge-intensive and market-driven. The arduous challenge will be increasing the productivity level of a pollution-free product. Precision Farming is conceptualized by a system approach to re-organize the total system of agriculture towards a low-input and high-efficiency system. (Shibusawa, 1998). We desire modification based on domestic conditions which aim to replace big machinery with high energy consumption, over-application action of chemicals with Intelligent machines and Intelligent processes in precision farming. Precision farming research is an important part of the National Agricultural Innovation Project (NAIP). Studies have already shown that systematic soil testing followed by proper application of NPK fertilisers alone can increase the productivity level by 2–3 times in most of the states of India (Siddiq, 2000). The high cost and oblivious procedure of traditional soil sampling is one reason for this improper fertiliser application. Cheap dynamic soil sampling technology as well as nutrient status analysis on a large scale by RS and GIS can do much improvement. Misconceptions about precision farming are that it is often confused with yield mapping. Yield mapping is a tool that is one of the first steps toward implementing an SSCM strategy. Precision farming is sometimes misinterpreted as sustainable agriculture. Precision farming is a tool to help make agriculture more sustainable however, it is not the total answer. Precision farming aims at maximum production efficiency with minimum environmental impact. Initially, it is a way forward towards exploring the potential for improved productivity (and profitability). Major PF challenges in the context of Indian Horticulture which needs to address critically are farmer having small farm size, heterogeneity of cropping systems, lack of local technical expertise, the complexity of tools and techniques requiring new skills, about Resources it requires high initial investment-specific data, Infrastructure and Institutional constraints include market imperfections and limited ability to integrate information from diverse sources. Mindset, Culture, attitude and perception change brought through participatory awareness drives will reduce resistance to the adoption of new technologies (PF) and slows down the negative environmental impacts on our fast depleting polluted natural resources, Precision Farming is an effective tool of the decade.

**Keyword:** Precision Farming (PF), Modern Technology, Remote Sensing (RS), Geographical indication system (GIS), Site Specific Crop Management (SSCM)



### **Future of India through Hi-Tech Horticulture**

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#### **ABSTRACT**

Hi-tech horticulture refers to the use of advanced technologies like integrated pest management, integrated nutrient management, hybrids seeds, genetically modified planting materials, protected cultivation, Plasticulture, micropropagation, micro-irrigation, fertigation, hydroponics, precision farming, high-density planting, advanced mechanization, etc for the management & qualitative production of horticulture produce for high economic return. India is the second most popular country in the world with an increasing population, the cultivable land resource is shrinking day by day. By using hi-tech horticultural techniques, we can enhance work efficiency concerning higher yield and qualitative production of Horticultural crops. The future of horticulture depends on the propagating materials like seedlings and rootstocks which can be only produced in a nursery with proper care and management. Hi-tech nursery always provides good quality planting materials which always give better production. In fruit crops, better rootstocks possess disease resistance, insect resistance, drought resistance, and salt resistant qualities. Horticulture uses the Hi-tech resources in the cultivation of most of the fruit crops which give higher income to the farmers. Hydroponics is a way of developing plants without soil and instead of the use of mineral nutrient solutions in a water solvent. Aeroponics is the method of developing plants in air or mist surroundings without the usage of soil. Vertical farming is the preparation of growing crops in vertical layers. Hi-tech horticulture is a technology that is trendy, less environment-dependent, and capital intensive however with a capability to boost productivity and farmer's financial gain. Hi-tech horticulture is beneficial not just for raising fruits, vegetables, and flower crops but conjointly for conservation, plant protection, and post-harvest management together with value-addition.

**Keywords:** Hi-tech nursery, Hydroponics, Fertigation, Aeroponics, Plasticulture, Advance Mechanization.

## Variation in fruiting characters among different peach accessions based on DUS test guidelines

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### ABSTRACT

15 peach accessions namely July Elberta, Early Redhaven, Suncrest, TropicSweet, Paradelux, Saharanpur Prabhat, Earligrande, Flordaprince, TropicSnow, Flordaglo, Vallegrande, TropicBeauty, Pratap, Shan-i-Punjab and Glohaven were evaluated for their fruiting characters at Department of Fruit Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan. Maximum fruit length (53.69 mm) was recorded in Early Redhaven and minimum (37.37 mm) in Saharanpur Prabhat whereas fruit breadth was recorded maximum (54.38 mm) in Flordaprince and minimum (42.62 mm) in July Elberta. Mucron tip was present in seven accessions whereas absent in eight accessions. Flesh colour was observed as white in Saharanpur Prabhat, Flordaglo and TropicSnow whereas yellow in remaining peaches under study. Adherence of stone to flesh was absent in July Elberta, Early Redhaven, Suncrest, Pratap, Shan-i-Punjab, Glohaven, TropicSweet, Saharanpur Prabhat and TropicSnow whereas present in rest of the accessions. From the present study, it can be concluded that all the accessions studied recorded variation for most characters and the descriptive database so developed will help in DUS testing. It would also facilitate in multiplication of true to type planting material and help in checking bio-piracy.

**Keywords:** Accessions, Peach, fruiting, DUS testing

### Power requirement for cutting cumin stem

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### ABSTRACT

Cumin is an important seed spice crop of India. India is the largest producer, exporter and consumer of cumin seed in the world. Harvesting of cumin crop is one of the important operations which has to be performed within a very short window with available resources by the farmers. The operation is done manually using sickle. Manual method is time-consuming and labour intensive. Therefore, a mechanical way of harvesting is needed to confront the timely harvesting with minimum losses. In order to design a harvesting machine with appropriate operational parameters, information regarding plant properties and energy required to cut the cumin stem is necessary. Accordingly, it is also very much needed to measure the cutting force and power required for cutting cumin plants. The cutting force of cumin stem was measured using texture analyser. Cutting force was measured to cut one stem, two stems and three stems at a time. Based on the cutting force the power required to cut cumin plant was also determined. The average specific cutting force required to cut one, two and three cumin plant stems at a time were observed as 13.33, 28.25 and 49.13 N.mm<sup>-2</sup> respectively.

**Keywords:** Cumin, cutting force, cutting power, harvesting

## **Impact of nutritional garden on nutritional security of lodha tribal women of Mayurbhanj district of Odisha**

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### **ABSTRACTS**

The population of Lodha in Odisha is estimated to be around 9088 people (2011 census), with the majority of them living in the Mayurbhanj district of Odisha. Undernourishment, inadequate consumption of protein and energy as well as deficiencies in key micronutrients such as iodine, vitamin A and iron are the key factors in the morbidity and mortality of Lodha tribal women in Mayurbhanj district. Though vegetables are well known as the most important source of these micronutrients, yet the per capita vegetable consumption in selected villages of Lodha inhabiting areas was very low. The present study was conducted in 2019-20 and 2020-21 to study the impact of Nutritional garden on the nutritional intake of the Lodha tribal women, so that it will be helpful for planning and monitoring programmes for the betterment of Lodha Tribal women. Study revealed that before establishment of nutritional garden, 62% of the respondents included green leafy vegetables in their daily diet, whereas after intervention of Nutritional garden 67% of the Lodha tribal women added leafy vegetables in their daily diet. In case of other vegetables, its intake increased from 59.7% to 68% on daily basis in their diet after establishment of nutritional garden. The fruit consumption by the Lodha tribal women was increased significantly (71.5 %) after establishment of nutritional garden. The carbohydrate intake of the respondents was 173.03 gm and 190.13 gm before and after establishment of nutritional garden (t-13.44) respectively and both was more than ICMR recommendation (130 gm). As the vegetable consumption increases, the intakes of different nutrients, vitamins and minerals like protein, vitamin A, vitamin C, Calcium, iron etc. among the respondents also increased significantly after intervention of nutritional garden ( $p < 0.001$ ). The study concluded that the intake of vegetables and nutrient increased significantly after introduction of nutritional garden at the backyard of the tribal women. The nutritional garden develops a positive attitude among the Lodha tribal women towards nutritional changes of their family members.

**Keywords:** Lodha, Nutritional garden, Vegetables, Tribal women

## Protected cultivation technology to enhance the farmers income in Tamil Nadu

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### ABSTRACT

India is predominant in greenhouse cultivation of flowers and vegetables in the recent years. Floriculture crops such as rose, gerbera, carnation, anthurium, liliun, orchids, chrysanthemum, and vegetable crops like tomato, yellow and red bell peppers (from the capsicum family), cucumber, greens and exotic vegetables, and so on are cultivated in protected structures. The farm income is the key factor to measure the economic status of the farmers. Cultivation of crops under controlled conditions extends the advantages of quality of products, productivity and fetches high prices to the farmers. It increases the farmer's income by cultivating the crops in the off-season as well as in normal season. Despite of increase in income from PCT and increased financial assistance to establish the protected cultivation technology discontinuance rate is also in considerable number. In this juncture, a study for addressing the above issue was carried out to compare the income level, of adopter and non-adopter of protected cultivation technology in Tamil Nadu. In conclusion of the study, the income of the vegetable and flower growers in protected cultivation were comparatively higher than the open field growers. But the major reasons for the discontinuance of the technology were high investment cost of protected cultivation structures, lack of guidance and paucity of credit. The policy recommenders may introduce crop specific low-cost greenhouses, so that the discontinuance rate of the technology can be reduced. In addition, credit may be guaranteed by implementing agency (State dept/NABARD) and ease of norms to avail credit by the PCT farmers.

**Keywords:** Protected cultivation technology, farm income, discontinuance, flowers, vegetables.

## Histo-molecular studies for identification of non-zygotic embryogenesis in polyembryonic mango (*Mangifera indica* L.) genotypes

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### ABSTRACT

Identification of nucellar from zygotic seedlings in mango through morpho-biochemical methods is impractical to maintain clonal rootstocks during propagation. The current study aimed to identify the origin of poly-embryos in the embryo sac of polyembryonic Vellaikulamban and Olour with monoembryonic Totapuri reference through histochemical techniques and followed by differentiation of polyembryonic seedlings using SSR markers. The samples (flower-ovary and fruitlets-ovule) were collected from the day of anthesis to 30 days after anthesis at 3 days interval and thereafter micro-techniques were employed using hematoxylin stain and counterstain Orange-G in order to detect the embryonal changes in the embryo sac as well as in sporophytic tissues (Nucellus and integument). During the initial growth stages, the putative entry of nucellar embryos from micropylar nucellus into the embryo sac of Vellaikulamban and Olour was observed through Olympus optical microscope at different magnifications but the same changes were not observed in Totapuri. The suppression of a zygotic embryo was observed due to the dominant growth of nucellar embryos. The typical zygotic embryo developmental stages were noticed in Totapuri whereas comparable nucellar embryo growth was perceived in both polyembryonic genotypes at later stages. Out of twelve, 11 SSR markers differentiated the vigorous seedlings as nucellar and a last weaker seedling as zygotic in the Vellaikulamban and Olour. Based on genetic dissimilarity, seedlings formed from nucellus were grouped with the maternal parent in a dendrogram using the neighbor-joining approach, whereas zygotic embryos were grouped in a completely distinct cluster. Prior to the selection of clonal rootstock as planting material, our study helps in a basic understanding of the diverse origin of polyembryonic mango seedlings.

**Keywords:** Embryo, Seedlings, Zygotic, Nucellar, SSR, Mango, Polyembryony

## **A new approach to sustainability: Integration of organic farming, natural farming and protected cultivation**

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### **ABSTRACT**

Climate change and sustainability are the issues of primary concern globally in all sectors including agriculture. In order to deal with the issue of climate change and to achieve sustainability, various advancements in the techniques are introduced in the field of farming. Most important of those are organic farming, natural farming and precision farming. In the study entitle “**A New Approach to Sustainability: Integration of Organic Farming, Natural Farming and Protected Cultivation**”, data from various authenticated sources were collected and analyzed. The fertigation technique for efficient nutrient management was highlighted. The influence of fertilizers used in organic farming or natural farming is also studied. Among BLO, FM, alpha alpha, sludge etc., BLO (200 mg N / pot) gave maximum shoot based on fresh weight (95 grams / plant). The effect of various types of mulches showed that grass mulch gave maximum yield per hectare (66.76) followed by BPM (57.50). The data on sheep manure vermi compost on quantitative as well as qualitative properties of cucumber in greenhouse showed that yield increase as we increase the rate of treatment from 0 to 10 to 20 to 30 tonnes per hectare. The study reflected the need of organic certification in order to promote the organic farming. Thereafter, the status of natural farming is also studies along with organic farming. Organic and natural farming under protected conditions offers a lot of opportunity to encash its productive potential to a wider extent with greater assurance of high quality and toxin free vegetables. The low yield of vegetables in initial phase of organic and natural farming can be compensated with higher market price for quality produce provided properly labelled products are marketed. Visualizing the greater demand of quality vegetables in UPCs and very negligible research on organic and natural farming under protected conditions, initiatives may be undertaken to channelize research activities under such conditions.

**Keywords:** Precision Farming, Organic Farming, Natural Framing, Sustainability, Climate, Environment.





**Influence of planting densities, canopy architecture and fertigation on growth, yield and fruit quality of apple under high density plantation**

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**ABSTRACT**

The study of planting densities, training systems and fertigation doses was carried out on 4-years old apple cultivar Jeromine grafted on M.9 rootstock to improve yield and fruit quality, and the experiment was laid out in a randomized block design (factorial) with treatment combinations of three planting densities viz. 4000 trees/ha, 3200 trees/ha and 2666 trees/ha, trained to two training systems i.e. Tall Spindle and Vertical Axis and fertigation doses (100 and 75 % of AD NPK) and each replicated three times having two trees per replication during the year 2019 and 2020 at Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni. The results revealed that the trees planted at a density of 2666 trees/ha observed significantly highest vegetative growth parameters, yield, fruit length, diameter, weight, TSS and firmness, followed by 3200 trees/ha and lowest in 4000 trees/ha. The trees trained to Tall Spindle training system recorded significantly higher values for yield, fruit length, diameter, weight, TSS and firmness in comparison to the trees trained to Vertical Axis, however vegetative growth parameters were higher in Vertical Axis trained trees than Tall Spindle. In case of fertigation, the trees subjected under 100 per cent of AD (NPK) recorded higher vegetative growth parameters, yield, fruit length, diameter, weight, TSS and firmness than 75 per cent of AD (NPK).

**Keywords:** Planting density, Tall Spindle, Vertical Axis, Fertigation, Yield



## Reduction in green house gases

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### ABSTRACT

Climate change is a global phenomena of climate transformation characterised by changes in the planet's normal climate (temperature, precipitation, and wind) driven primarily by different human activities. Agriculture, forestry, and other land use account for over a quarter of all anthropogenic green house gas (GHG) emissions. Both afforestation and Bio energy with carbon capture and storage (BECCS) are high-intensity negative-emission technologies that have an impact on agriculture via land markets There is a negative impact on agriculture since cropland availability is decreasing due to averted deforestation or afforestation, as well as demand for bio energy. As a result, it highlights vulnerabilities in the global agricultural industry with changes in area, production, productivity and price implications as well as biotic and abiotic stress that may respond to climate change, ozone damage, or direct heat stress. The effects of climate change are expected to worsen in the second half of the twenty-first century. As a result of the increase in extreme weather occurrences, the negative effects of climate change have been deemed detrimental. A change in the climate is likely to have a negative effect on overall agricultural production. The two important strategies are mitigation and adaptation can help to minimize the negative effects of climate change. Mitigation options are helpful, but it is desirable to combine adaptation and mitigation strategies in order to best manage the impact of climate change. Policy support, research and socio-psychological empowerment of farmers are needed to implement the potential technologies.

**Keywords:** Climate change, Mitigation, Agriculture, Adaptation, Stress, Emission.

### Optimisation of agro techniques for protected cultivation of coriander

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#### ABSTRACT

Leafy greens have often been bruted as pesticide-contaminated and unsafe, necessitating a safe approach in their cultivation. Among the greens, coriander (*Coriandrum sativum* L.) is a fragrant, antioxidant-rich herb with multiple health benefits and many culinary uses. The increasing concern for safe food production has urged the consumers to include coriander as an integral component of the home gardens, especially in rain shelters. Research works on the crop in Kerala are meagre and an experiment was conducted on the standardization of agro techniques in leafy coriander under protected condition at College of Agriculture, Vellayani, Thiruvananthapuram during 2020-21. Among the seed treatment methods evaluated, 16 h soaking of the split seeds in  $\text{KH}_2\text{PO}_4$  ( $10\text{gL}^{-1}$ ) solution was found superior in terms of germination percentage and seedling vigour. However, for bulk sowing, 24 h soaking in ordinary water and incubation for five days was found to be the best. Among the agronomic practices, for higher leafy yields under protected condition, a spacing of 30 cm x 10 cm and three harvests could be recommended (10.14 and 12.04 kg per  $10\text{ m}^2$ ), and although could be cultivated year-round, July planting proved to yield comparatively better.

**Keywords:** Coriander, harvests, leafy, rain shelter, spacing, yields

### Effect of vermicompost and humic acid combinations on vigour, yield and quality parameters of African marigold cv. Seracole

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#### ABSTRACT

An investigation was carried out in search of the best dose of vermicompost and humic acid combination for better growth and quality of African marigold. The research work was done in 2017-2018 at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal. The experimental design was Randomized Block Design (RBD) with three replications and nine treatments. All the vegetative and reproductive parameters have shown significant differences among the treatments. According to the results recorded, basal application of  $2\text{ kg/m}^2$  vermicompost along with the foliar spray with 1.5 g/l of humic acid ( $T_8$ ) gave the highest plant height (54.54 cm) and the number of primary branches (7.21) regarding vegetative parameters. In case of reproductive parameters, maximum flower diameter (7.44 cm), the number of flowers per plant (84.16) and yield per hectare (47.01 tonnes) were observed in treatment  $T_8$ . The quality parameters like total chlorophyll content (2.19 mg/g) and total carotene content (44.77 mg/100g) were also recorded highest in  $T_8$ , whereas  $T_1$  (Control) gave the lowest performances regarding most of the vegetative and reproductive parameters.

**Keywords:** Humic acid, Vermicompost, African marigold, Organic, Bio-stimulant



## **Development of sensor-based safety alarm system for injury prevention in fodder cutter machine**

### **ABSTRACT**

Agricultural activities are considered one of the most hazardous occupations. It is having a high risk of fatal and non-fatal injuries contributing factors. Increased farm mechanization is one of the contributing factors to occupational health hazards among farm workers. This adversely impacts the productivity of farm workers, health, safety, and economic status. Chaff cutter is used to chop the fodder by farmers to make the fodder more palatable, to help in curing fodder, for storage, and to reduce spoiling in fodder storage. Hand injuries are associated with this machine. To provide a forewarning signal to the worker in the dangerous working (injury-prone area) zone of the chaff cutter feeding chute, a microcontroller-based alarming system was developed. Passive infrared (PIR) sensor was used as a motion detection element sensing infrared radiation emitted by the human body. The system was designed to give the sound of an alarm as the hand motion is detected in the danger zone. The performance characteristics of the PIR sensor were studied under varying conditions of distance, hand orientation, and ambient conditions for different subjects. The effects of distance between the sensor and human hand (5, 8, 12.5, 17, and 20cm), hand orientation (pronation, supination, and fodder holding position), room temperature, and/or fodder temperature (18, 20, 24, 27.5 and 30°C) for five subjects of different age groups were studied. The regression equations for sensor response to different hand orientations as functions of distance, age, and room or fodder temperature were obtained using Response Surface Methodology. The optimum distance for mounting the system on the feed chute was obtained as 12.5 cm ahead of identified dangerous area. hand orientations pronation and supination, the sensor gave high response under different temperature conditions followed by holding position. The optimum working temperature for best usage of the sensor system was in the range of 24 to 27°C. The worker's response to audible frequencies was also studied with the speed of hand movement.

**Prediction of available water content from modelled soil particle size fractions using pedo-transfer function: a novel conceptual modeling approach**

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**ABSTRACT**

The lack of detailed soil texture information largely restricts many applications in agriculture, hydrology, climate, ecology and environment. This study predicted 30 m resolution spatial variations of sand, silt and clay contents at a district level and at multiple depths 0–5, 5–15, 15–30, 30–60, 60–100 and 100–200 cm. Quantile random forest modeling was used to predict the sand, silt, and clay percentage in each standard depth utilizing environmental covariates (twenty primary and secondary terrain derivatives with nineteen bioclimatic variables) and the datasets (95 soil profiles) collected under LRI project. The study was carried out in part of part of Meghalaya plateau, which is located in 25° 48' to 26° 04' N latitude and 91° 20' to 92° 16' E longitude with an area of 2448 km<sup>2</sup>. The performance of models for different depths was evaluated by calculating uncertainty indicators *viz.* coefficient of determination ( $R^2$ ), root mean square error (RMSE), mean error (ME), bias and Lin's concordance correlation coefficient (LCCC). The values of RMSE in validation data for sand, silt and clay were respectively 5.21, 3.99 and 3.91 in 0-5 cm soil depth. The values of RMSE were higher for sand and silt because these fractions have wider ranges. The mean ME values were very close to zero, suggesting overall unbiased predictions. The mean  $R^2$  values of the predictions of soil texture fractions at different depth intervals were between 0.81 and 0.90. This indicates the models explained around 81–90% of soil texture variation present. Overall, the mean CCC values ranged from 0.74 to 0.85, indicating good agreement between the predicted and observed values. After getting the depth wise sand, silt, and clay percent for each pixel, the soil textural class for Ri-Bhoi district was developed using R. These soil particle size fractions were used in pedo-transfer function to generated depth wise field capacity and permanent wilting point maps *i.e.* 0-15 and 15-30 cm from which volumetric available water content for the surface and sub-surface layer of the district were calculated and mapped. This unique information generated by using remote sensing and GIS along with mathematical modelling will help farmers, researchers and policy makers to take suitable crop and other planning in the district at large scale.

**Keywords:** Environmental covariates, quantile random forest, pedo-transfer function, field capacity, permanent wilting point, particle size fractions.

## Automated yield estimation of orchard crops using UAV imagery and deep learning based computer vision

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### ABSTRACT

Yield estimation in orchards is a challenging and cumbersome operation requiring utilisation of a large number of resources. Traditionally, the yield estimation in orchards is carried out by visual inspection wherein manual counting is performed to identify the yield from orchard crops. Early estimation of yield from orchards helps the growers and other stakeholders in identifying and planning strategies regarding storage, transport, marketing, etc. The above-mentioned challenges motivate the development of an efficient artificial intelligence-based system for real-time yield estimation. In this study, we explored the feasibility of a deep learning-based computer vision approach to real-time detection and counting of mandarin oranges from the commercial orchard to estimate the yield. The data collection was carried out with the help of an unmanned aerial vehicle for quick and flexible data acquisition. Further, the data collected have been pre-processed and the object detection model YOLOv4 was developed for accurate detection and counting of the unripe and harvest-ready fruits. The results indicate that the YOLOv4-based detection is highly accurate with an overall mean average precision of 80.4% and has shown a detection precision of 84.5% on harvest-ready fruits.

**Keywords:** Artificial intelligence, Computer vision, Deep learning, Horticulture automation, Yield estimation

## Suitability of jack fruit, *Artocarpus heterophyllus* as host of eri silkworm, *Samia ricini* Donovan

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### ABSTRACT

Present study aimed to analyse the acceptance of Jack Fruit leaves as host of eri silkworm. Totally there are six treatments *i.e.*, Rearing of Eri Silkworm from I<sup>st</sup> Instar onwards, II Instar, III Instar, IV Instar and V Instar on Jack Fruit Leaves and on Primary host, Castor (Control). Each treatment replicated six times with 20 larvae per replication. The results of the study revealed the prolonged larval duration in all the treatments (1<sup>st</sup> Instar to 5<sup>th</sup> Instar) when reared on jack fruit leaves. In treatment I, 70 per cent mortality was observed within two days after treatment and 100 per cent mortality recorded in ninth day. With respect to treatment II, 100 per cent mortality was noticed within six days after treatment. Regarding treatment III, 80 per cent mortality was noticed in 4<sup>th</sup> day and 100 per cent mortality in 7<sup>th</sup> day after treatment. In treatment IV, no mortality was observed till two days after treatment. During 7<sup>th</sup> day of treatment, 100 per cent mortality was observed. 100 per cent mortality was recorded in 9<sup>th</sup> day after treatment in treatment V. Hence from the present investigation it was concluded that Jack Fruit leaves can't be utilized as host of eri silkworm during scarcity of its primary host, Castor leaves.

**Keywords:** Impact – Jack Fruit leaves, Host - Eri Silkworm

**Vertical nutri-farming system (VNFS) for nutritional security of rural women**  
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### ABSTRACT

Vegetables are the essential part of balanced diet, rich source of micronutrients and nutraceutical compounds. Considering the ever growing population in the country the RDA of vegetables (300 g/day/person) cannot be met by growing horizontal cultivation alone. Hence, adoption of alternate technology of vegetable cultivation is crucial to achieve self sufficiency in vegetables production. Vertical farming is practiced for growing of plants in vertically stacked layers. The ultimate production from vertical farms is more as the growing area is increased many fold. Generally, vertical farming is practiced under indoor condition within a particular space and remains relatively expensive to build as it requires controlled environment which restricts its adoption in most of the developing countries as well as in India. Keeping this in view, a study was conducted to design and develop a gender friendly vertical nutri-farming system (VNFS) for growing of year round nutritious vegetables with integration of mushroom cultivation. Mushroom is a rich source of protein, vitamins, minerals, folic acid, iron and is the only vegetarian source of vitamin D. Mushroom cultivation is a women friendly low cost enterprise which requires little infrastructure, space and money. The VNFS model is a low-cost triangular shape structure made up of iron which is carried out under outdoor condition. A total of six number of troughs on both sides of the structure will be utilized for year round vegetable cultivation in the vertical space and the in between space will be utilized for paddy straw and oyster mushroom cultivation. The VNFS model is an innovative approach to the landless farmwomen for ensuring dietary diversity and nutritional security.

**Keywords:** Vegetables, Mushroom, Women, VNFS, Nutrition

### Current advances in molecular breeding of melon

Komala Majjiga

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### ABSTRACT

Melon (*Cucumis melo* L.,  $2n = 2x = 24$ ) is one of the most important horticultural crops, and is widely cultivated throughout the world for its edible fruit. It displays an extreme polymorphism in shape, size, colour, texture and flavor of the fruit. Due to this huge variability, there is a lot of scope for the development of melon hybrids producing high fruit quality and yield by the various breeding strategies. Molecular breeding is considered to be an efficient strategy, however requires prior knowledge on quantitative trait loci (QTL) that responsible a particular trait. Recently, the construction of high-resolution genetic maps based on whole genome resequencing identified the QTLs on chromosome 11 and 5, that associated with fruit size which is the most important domestication and differentiation trait. Whereas, fruit pedicel length variability was found to be regulated by the cytokinin oxidase, as a candidate gene of major-effect QTL CmFp13.1. Nevertheless, the breeding programs are also focused on introducing disease resistance. Therefore, the QTLs for Powdery Mildew resistance were identified on *Pm-R5* gene that facilitate the marker-assisted selection. Moreover, the identification of new sources for disease resistance among the melon germplasm accessions would be beneficial in either directly using them as cultivars or as resistance donors in breeding programs. Recently, 27 Tunisian melon accessions collected from local farmers have been tested for resistance to Fusarium Wilt by molecular analysis and revealed that 13 out of 27 accessions carried the resistance *Fom-1* gene, confirming their resistance to *Fusarium oxysporum*.

**Keywords:** Melon, QTLs, Molecular breeding, Disease resistance



## Monitoring and regulating climatic condition of polyhouse for successful offseason grafting of citrus fruits using internet of things platform

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### ABSTRACT

Citrus fruit (mandarin, sweet orange and acid lime) is one of the most cultivated and consumed fruits in Nepal. The demand for citrus plants is increasing every year. However due to the prevailing climatic conditions the citrus plants are mostly grafted once a year during December to January in Nepal. The average temperature during this period is around 21-29°C. The grafting success rate is around 85 to 90%. This grafting period has been a bottleneck to meet the demand of the citrus plants. The other problem is, these young plants are sent for transplantation in June-July which are merely 5-6 months young. This could increase the chances of mortality rate during transplantation. To address the problem of demand and supply as well as to extend the grafting window period, A robust climate monitoring and climate regulating system is proposed for internal climate management inside a poly house of National Citrus Research Program, Dhankuta, Nepal. An internet of things (IoT) based design and automation is implemented in a polyhouse for off season grafting, which has not been practiced so far in Nepal. The sensors and actuators are equipped and placed appropriately. The IoT platform is designed and deployed to acquire the sensor data in real-time that helps to visualize, monitor and regulate the internal climate inside the polyhouse. This system not only limits the potential to graft citrus plants but also can be extended to other fruits like avocado, walnut, apple, pear, and peach, whose grafting success rate is low at present when carried out in open field conditions.

**Keywords:** Citrus Grafting, Climate monitoring and regulation, Sensor automation, Real time data acquisition, Internet of Things

## Robotic transplanter: The future of transplanting plug-type seedlings

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### ABSTRACT

Manual transplanting of vegetable seedling in field is time consuming as well as labour intensive operation. Due to lack of manpower during transplanting operation and to ensure timeliness in operation, a robotic transplanter using seedling pick-up mechanism and robot movement system was developed. The seedling pick-up mechanism consists of main frame for XY-axis, stepper motor, manipulator, end-effector and control unit, whereas the robot movement system consists of IR sensor, control unit, 12 V battery and dc motor. The seedling pick-up mechanism uses stepper motor to move the manipulator in XY-axis and the manipulator in the Z-axis. The end-effector grasp the seedling, pick-up and moves to the delivery point i.e. XY (0,0). As soon as the seedling was dropped in the delivery pipe, the IR sensor detects the seedling and moves the robot to the next dropping point. The plant to plant spacing can be adjusted based on the crop. Finally, the robot manipulator was tested and evaluated for picking and placing 96 seedlings with soil base from pro-tray and can extract as well as transplant 3 seedlings/min. The potential use is to enhance input use efficiency for sustainable productivity and reduce drudgery by avoiding manual practice.

**Keywords:** Robotic Transplanter, Seedling Pick-Up Mechanism, Robot, Sensor, Manipulator, End-Effector, Computer Programming



**Management zone mapping for site specific soil management of cocoa in Tamil Nadu state**

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**ABSTRACT**

Soil constraints for cocoa cultivation related to soil depth, texture, soil reaction and drainage were mapped for Tamil Nadu state using the available soil map at 1:50000 scale. Each soil property was classified in to four constraint classes viz., no constraint, moderate level of constraint, severe and very severe constraint and thematic maps of soil constraints were developed using ArcGIS software. Depending on these inherent soil constraints for cocoa cultivation, all the soil series were characterized in to different constraints groups viz., very severe, severe, moderate and with no constraints and assigned codes as a ready reckoner to define the soil constraints. The overall constraint map was developed. Among the soil properties studied, major soil constraint is related to soil reaction and it is observed in 68 per cent of the total geographical area of the state. Soil drainage related constraints is observed in 60 per cent, soil texture related constraints in 46 per cent and soil depth related constraints observed in 40 per cent of the total geographical area of the state. Soil management zones were delineated based on the management requirement to improve cocoa productivity through site specific management of these soil constraints.

**Keywords:** Cocoa, Soil constraint mapping, GIS, Tamil Nadu

**Performance evaluation of IoT based automatic drip irrigation system**

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**ABSTRACT**

India is having limited land and water resources. Highest amount of water is used in irrigation sector. There is tremendous pressure from other sectors to reduce the amount of water required in agricultural sector. The study was conducted to evaluate the performance of internet of things (IoT) based drip irrigation system. The system components include microcontroller, moisture sensors, temperature and humidity sensor, drip system, water tank, water timer, rain sensor detector and digital water meter. All the sensors are connected to the microcontroller unit. Instruction for visual the dashboard were done in java-script in the Arduino IDE software and installed in the microcontroller. The maximum variation in observed maximum and minimum temperatures with the data of temperatures obtained from meteorological observatory was 2.8°C and 2.4°C respectively. There was 60% saving of water in IoT based drip irrigation system in comparison with flood irrigation system. The value of application efficiency and uniformity coefficient of IoT based drip irrigation system were 95.33% and 0.96 respectively.

**Keywords:** Drip, IoT, Irrigation, Sensor, IDE software

**Development of seedling pick-up mechanism for automatic vegetable transplanters**  
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### ABSTRACT

A mechanical automatic seedling pick-up mechanism for plug type vegetable seedlings was developed. The studies were conducted on 30 day old brinjal seedlings raised in 9×14 (126) configuration tray for picking and release them to a common place for transplanting into the soil. The mechanism consists of a needle type pick-up pins, a multi-bar push chain, needle path generator and a driving crank. The base plate of path generator is constrained in such a way that it realizes a partial swinging and partial rotary effect to give a sickle trajectory of needle. When the base plate moves forward along the rotary path, at the end of stroke, the pick-up needles picks a seedling from tray-cell horizontally. When it moves back along the rotary path, at the extreme of stroke seedling gets release vertically with forward thrust due to sliding of pusher forward the needles tips. Operational parameters such as moisture content of root bulb, needle penetration into root bulb and pick-up frequency were optimized on the basis of pick-up success rate and leakage rate. The mechanism has optimized seedling pick-up frequency of 38 seedlings per minute with the success rate of 95.6% and average root bulb moisture content of 75%.

**Keywords:** Seedling pick-up mechanism, Vegetable transplanter, Plug seedlings, Success rate

## Use of artificial intelligence in fruit crops

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### ABSTRACT

Artificial intelligence (AI) is a branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. AI makes it possible for machines to learn from past experience, adjust to new inputs and have the ability to execute tasks naturally associated with human intelligence. AI is not a “Man versus Machine saga” but it is a “Man with Machine synergy. Farm enterprises require new and innovative technologies like AI to face and overcome challenges. AI used in fruit crops in various ways *i.e.*, automated irrigation system, crop health monitoring, disease detection, harvesting fruits and sorting classification of fruits. Smart sensing in agriculture gives the capability of farmer to analyze what is good for healthy crop, things are required where, in what amount and at which duration of a time. AI can also be used in drones which obtain high quality images and high resolution spectral data which while correlate with plant growth, health, water and nutrient status that can be used to estimate biomass production.

**Keywords:** Machines, artificial intelligence, drones, crop health

## Synergistic effect of isolated endophytic bacteria on growth performance of bell pepper (*Capsicum annuum* L.)

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### ABSTRACT

Endophytes are the bacteria that resides within plant hosts without causing any symptoms of diseases. These endophytic bacteria are plant growth promoting such as nitrogen fixation, phosphorous solubilization, siderophore and IAA production. In this study, totally 30 endophytes isolated from the different parts of bell pepper (*Capsicum annuum* L.) like stem, root, leaf and screened for their phosphate solubilization and IAA production ability under *in vitro* condition. Among 30 isolates, 8 isolates namely CPR-4, CPL-3, CPS-6, CPS-8, CPS-10, CPR-9 and CPL-5 were able to fix the atmospheric nitrogen. Among endophytes were obtained, CPR-4 isolate was able to solubilize phosphate with highest solubilization index (2.84 mm) compared to other series of CPR, isolates. The results of *in vitro* IAA production revealed that the isolate CPS-2 produced highest IAA (15.32 $\mu$ g ml<sup>-1</sup>) than other isolates. Hence, the present study states that endophytic bacteria isolated in this study could play vital role in enhancing plant growth and development.

**Key words:** CPR: capsicum plant root, CPL: capsicum plant leaf, CPR: capsicum plant root.



## Artificial intelligence based grading system for mango

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### ABSTRACT

Mango is major fruit crop in India which accounts 40% share in total fruit export. In mango-processing industries and during export of mango accurate grading and classification is an essential post-harvest unit operation. However, these processes are carried out manually which are tedious and leads to some errors and low accuracy that directly effects its quality. Thus, substituting the traditional labor-intensive technique by automated technologies based on artificial intelligence will not only increase operation efficiency but also optimize accuracy, labor saving, and appropriate handling of fruits. Also, premium quality fruits can be sorted separately for export. The main content of this article is to study methodology which utilizes digital fuzzy image processing for grading mangoes and development of effective algorithm for segregating mangoes with greater accuracy as compared to manually grading. Also, this study focusses on computer vision-based grading technique which uses image processing and extraction of feature based on grading parameter by combining artificial intelligence with help of CCD cameras. This study will help farmers to evaluate mango quality before export and help to procure profitable income.

**Key words:** Artificial intelligence, grading, mango, image analysis

## Application of time series models for tomato prices forecasting in Karnataka: A comparative analysis

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### ABSTRACT

Time series forecasting is one of the critical approaches as there lies an uncertainty about the future predictions be it agriculture, finances or business. With relentless approaches in agricultural research, has been a boom for new varieties setting benchmarks in marketing. There is huge potential of application of artificial intelligence in this field. In this study, our aim was to compare statistical and deep learning models ARIMA, LSTM, Prophet, NNAR and MLP, and conclude which model was fitting and predicting tomato prices well based on MSE, MAPE, RMSE and MAE metrics. The results showed that LSTM was capturing the trend well and gave best results compared to other models, followed by NNAR and ARIMA with lowest MAPE of 11.65 per cent. The selected LSTM was then used to forecast the tomato prices for next 3 months. The Prophet model was not able to fit properly due to the anomalies present which were later captured using anomaly detection. Automation in artificial intelligence can be very useful in agriculture not only reducing the work but also maintaining the accuracy.

**Key words:** Time series, LSTM, price, ARIMA

**Parthenocarpic (seedless) cucumber for farmers' prosperity**<sup>1</sup>Pooshpendra Singh Dixit\*, <sup>2</sup>C M Tripathi and <sup>3</sup>Jitendra Kumar<sup>1</sup>SMS (Horticulture), DRI, Krishi Vigyan Kendra, Chitrakoot-210206 (U.P.)<sup>2</sup>Senior Scientist & Head, DRI, Krishi Vigyan Kendra, Chitrakoot-210206 (U.P.)<sup>3</sup>Ph.D. Scholar (Vegetable Science), CSKHPKV, Palampur (HP)

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**ABSTRACT**

Protected cultivation is getting momentum in India as the area has already reached approximately 25,000 ha mainly due to efforts under different horticultural schemes. Cucumber is one of the major vegetable crops growing under protected conditions. Protected cultivation of cucumber ensures year-round production due to controlled environment. Apart from this, there are subsidies and loans available for building greenhouse and playhouses. cucumber grown in protected condition has higher productivity and superior quality than open cultivation. In addition to gynoeious and monoecious varieties, there is also a third type of cucumber, parthenocarpic cucumber. Unlike the gynoeious and monoecious varieties, which require pollination to produce fruit, parthenocarpic varieties produce fruit without the need for pollination thus saving the labour and time. Parthenocarpy varieties are seedless, or nearly so and the fruit develops in the absence of pollination and fertilization. Consumers also prefer eating seedless cucumber. Parthenocarpy cucumber sets fruit early and are more synchronous in maturity than other cucumber types. Pusa Seedless Cucumber-6 variety of cucumber gives first fruit harvest at 40-45 days with a yield of 1260 kg/100 m<sup>2</sup>. The main reason for growing parthenocarpic cucumbers in polyhouse is that they will guarantee good harvests because most of the flowers will be female and most of those will produce cucumbers without pollination. The other parthenocarpic cucumber varieties can successfully be grown throughout the year in poly house conditions in India are: Punjab Kheera-1, Pant parthenocarpy Cucumber -2, Hilton, Kian and Hilton.

**Keyword:** Protected cultivation, Micro climate, Seedless, Year-round cultivation

## Role of temperate fruits in livelihood options and employment generation in hilly areas of India

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### ABSTRACT

The potential of horticulture in raising agricultural production, value added farm income and employment in the country has been recognized long ago. The Fourth Five Year Plan (1969-74) recognized that importance of horticultural sector can make significant contribution towards accelerating agricultural growth. Horticultural crops have a strong potential to raise returns to land, labour and capital and are labour intensive and thus are conjectured to be more pro-small farmers who have higher endowment of family labour in relation to land. In a holistic way of horticulture can be promoted as a means of agro-diversification for the second green revolution in India, providing the much needed impetus to the growth of agricultural sector, through increase in trade, income and employment. The Indian agriculture is diversifying towards the production of high value commodities along with the increasing role of smallholding farmers. Diversification towards horticulture got real boost in the early 1990's which coincided with liberalization of economy. Augmenting facilities for processing, marketing and storage, development of rain fed and irrigated horticulture was one of the objectives of new agricultural policy resolution in 1992. Horticulture assumed importance as an indispensable part of agriculture with the varied agro-climate regions that India has a variety of horticultural crops can be grown offering a wide range of choice to farmers for crops diversification. Agricultural diversification reduces rural poverty and enhances the sustainability of the agricultural system. The rationale for focusing on diversification towards horticultural crops for triggering agricultural development is an account of its contribution to poverty reduction through higher employment generation, higher potential for value addition and for generating foreign exchange and provision of food and nutrition security through supply of micro nutrients and roughages. Horticultural crops are significant part of total agricultural produce in the country comprising of fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices and plantation crops. New introduction such as mushrooms, bamboo and bee keeping (for improving the crop productivity) has further expanded the scope of horticulture and have become key drivers of economic development in many of the states in the country. The horticulture sector is contributing around 29.5 per cent of the GDP in agriculture from about 13.08 per cent. It also provides 37 per cent of the total exports of agricultural commodities.

**Keywords:** Horticulture, temperate fruits, employment generation, livelihood options

**Per-se assessment of indigenous coconut (*Cocos nucifera* L.) genotypes for yield and quality**

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**ABSTRACT**

The coconut palm botanically recognized as (*Cocos nucifera* L.) is an significant tree in the humid tropics of the world. Coconut is cultivated both as a cash and nourishment crop. It is grown in more than 95 countries and supports the livelihoods of millions of individuals in the world's population. Indonesia and Philippines are the leading and largest producers of coconut in the world. India occupies third position in coconut cultivation. The Southern States of India viz., Kerala, Tamil Nadu, Karnataka and Andra Pradesh put together account for 91 per cent of the total coconut production in the country. Conservation of coconut germplasm has been undertaken globally in view of its economic substance. Coconut genetic wealth have been conventionally collected and conserved with the objective of using this germplasm to improve the genetic constitute of the existing varieties. Selected germplasm is generally used as planting material to improve the coconut productivity, test material to determine the phenotypic and genotypic characters of value and population base for breeding superior hybrids/varieties. Description of preserved coconut germplasm has been undertaken globally for identification of important features of different accessions for them to be effectively used in coconut breeding. With this view, a total of six coconut genotypes (IC No. 610371, 610372, 610373, 610374, 610375 and 610379) were collected, conserved and assessed in Field Gene Bank of ICAR-AICRP on Palms, Coconut Research Station, Tamil Nadu Agricultural University, Aliyarnagar centre from 2008 to 2021. The palms were planted in a replicated trial consisting of six palms per replication. The data recorded during 2017 to 2021 revealed that, genotype having IC number 610379 registered lowest palm height of 436.4 cm among the all genotypes. Maximum stem girth (105.6 cm), leaf scars in 1m length (16.3), annual leaf production (11.2/palm/year), number of functional leaves (34.8/palm), total leaf length (559.3 cm), petiole length (156.3 cm), number of inflorescence produced per year (10.8) and annual nut yield (94.7 nuts/palm/year) were observed in the genotype with IC number 610371. The maximum fruit length (26.5 cm) fruit breadth (19.3 cm), fruit weight (2348.5 g), de-husked nut weight (712.4 g), kernel weight (356.4 g) and kernel thickness (1.4 cm) were recorded by the genotype with IC number 610373. The highest copra weight (149.2 g/nut), copra yield per palm (14.1 kg/palm) and copra outturn per hectare (2.5 t/ha) were observed in the genotype with IC number 610371. To conclude, the genotype with IC Number 610371 performed superior over other genotypes under the agro-ecological conditions of Western Zone of Tami Nadu and it may be utilized for future crop improvement programme to develop superior varieties or hybrids in coconut.

**Keywords:** Coconut, Local Germplasm, Field Gene Bank, Collection, Conservation and Assessment



**Evaluation of cassava hybrids for postharvest physiological deterioration tolerance and other important traits for varied industrial uses**

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**ABSTRACT**

Postharvest Physiological Deterioration (PPD) is one of the major constraints of cassava as the tubers are rendered unfit for consumption, processing and marketing within 24-48 hours after harvest. The main objective of this study was to evaluate the parents and F<sub>1</sub> clonal progenies of cassava for major agronomic traits and PPD tolerance. The experiment was laid out as single row plot of 8 mounds per genotype with 3 replications. Significant variation was observed for all the traits recorded. The plant height ranged between 148.5 to 310 cm. The yield traits such as number of tubers/plant, tuber yield per plant and individual tuber weight of the clonal population was recorded along with PPD evaluation. The tuber yield/plant ranged from 0.87 to 7.03 kg with an average of 3.08 kg. The total number of tubers and number of marketable/commercial sized tubers per plant was between 2 to 18 and 2 to 12 tubers respectively. The tuber yield per plant ranged between 0.99 to 5.81kg and the individual tuber weight ranged between 0.25 to 1.10kg. The average cassava mosaic disease (CMD) score of the hybrids was 2.01. The PPD evaluation of the clonal progenies was done over five time points such as 1,3,5,7 and 15 days after harvest. The F<sub>1</sub> clonal progenies showed wide range of tolerance from low to high tolerance and cassava genotypes with extended shelf life of more than a week were identified among the clonal progenies. The top performing genotypes of desired traits can be further sent to advanced yield trails and multi-location trials aimed at developing cassava variety with extended shelf life along with desirable traits.

**Keywords:** Cassava, Postharvest physiological deterioration, clonal evaluation, shelf life



**Automatic drip irrigation scheduling effects on yield and water productivity of Maize****Thiyagarajan, G<sup>1\*</sup>, V. Ravikumar<sup>2</sup> and S. Panneerselvam<sup>3</sup>**<sup>1</sup>Forest College and Research Institute, TNAU, Mettupalayam – 641 301<sup>2</sup>Water Technology Centre, TNAU, Coimbatore – 641 003<sup>3</sup>Department of Agronomy, TNAU, Coimbatore – 641 003\* Corresponding author Email: [thiyagu@tnau.ac.in](mailto:thiyagu@tnau.ac.in)**ABSTRACT**

Water allocation is one of the major factors affecting the productivity of Maize. Drip irrigation has been found as a suitable water saving method in Maize cultivation. Automated drip irrigation which has been considered as a smart and effective water application technique which can increase the water savings and yield. With this background, a field experiment was conducted to study the performance of automated drip irrigation in Maize at Coimbatore during 2021. Six irrigation treatments two on timer-based drip irrigation, three tensiometer based drip irrigation (30, 50 and 70 cb) and one manually operated drip irrigation treatments with 100% ET<sub>c</sub> were laid in randomized block design with four replications. The irrigation interval was fixed as once in two days and once in three days based on crop evapotranspiration (ET<sub>c</sub>) in timer-based drip irrigation and once in three days based on ET<sub>c</sub> in manual drip irrigation. Recommended dose of fertilizers and standard crop management practices were followed for all treatments. Time of operation of drip system was calculated based on the area represented by a dripper. The results of the experiment showed that the irrigation based on tensiometer reading of 50 centibar (cb) produced better yield (7543 kg ha<sup>-1</sup>) and maximum water productivity of 12.49 kg/ha-mm was achieved.

**Keywords:** Crop evapotranspiration, Drip Irrigation, Irrigation scheduling, Tensiometer, Timer based irrigation

**Micropropagation of disease-free seedlings of ginger (*Zingiber officinale* Rosc.)**

Pratap Chouti

**ABSTRACT**

The experiment was conducted to standardize an alternative media for micro propagation of ginger. The study consisted of two experiments viz., shoot and root growth under *invitro* condition and hardening of seedlings under greenhouse. Significant differences were noticed among the media with standardized and alternative sources of components. Among the alternative gelling agents used, MS media with China grass at 25 g/l produced 86.67 per cent uncontaminated explants with prominent sprouting of 91.67 per cent in Maran and 86.67 per cent in Rio de Janerio and Himachal varieties within 11 days of inoculation. Table sugar used at 20 g/l media as a substitute to sucrose produced greater number of average shoots (1.73) per explant with average shoot length of 6.85, 6.68 and 6.79 cm in Rio de Janerio, Himachal and Maran varieties, respectively. All the varieties have produced maximum number of roots along with maximum root length in tender coconut water at 100 ml/l media. Rio de Janerio, Maran and Himachal have produced average number of 2.5 roots with root length of 2.35, 3.20 and 2.49 cm, respectively. In general, in all the three varieties, cocopeat along with sand and soil in the ratio of 1:2:1 showed maximum of 92.59 per cent micropropagated seedling establishment after 21 days of hardening.



## Geomorphometric Analysis of Nileswar Sub-watershed, Kerala Using GIS and Remote Sensing

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### ABSTRACT

The Noyyal basin, a part of the Cauvery river basin, has been analyzed to plan watershed management activities. A Geo-morphometric analysis has been chosen to identify the geohydrological behaviour of the area. The SRTM DEM data have been used for morphometric analysis and evaluation of various morphometric aspects such as Linear, Areal, and Relief. Prioritization of watersheds was done based on erosion susceptibility evaluated by the compound ranking method. Sub-watersheds are delineated from DEM using ArcGIS, based on the sub-watershed details given by the Soil and Land-use Survey of India. Assessment of watershed parameters such as stream order, stream length, stream frequency, drainage density, slope, bifurcation ratio, form factor, circulatory ratio, elongation ratio, and infiltration number was calculated separately for each sub-watersheds using the geospatial techniques. The study found that the stream order varies from one to six. The slope of the study area ranges from 0° to 69.1°. The micro-watershed with the lowest compound rank was assigned as the highest priority. The sub-watersheds were further categorized into three classes, high (<4.7), medium (4.7–5.3), and low (>5.3) priority based on their prioritized score.

**Keywords:** Elongation ratio, Morphology, Noyyal basin, Relief aspect

### Performance evaluation of wood apple cutting machine

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### ABSTRACT

Wood apple (*Feronia limonia*) belongs to the family Rutaceae and it is commonly found in dry plains. A wood apple cutting machine was developed and evaluated for its performance. The major components of the machine include a feeding unit, a cutting mechanism, a frame, a housing, three pair of variable pulleys, an electric motor and an outlet. The performance of the machine was evaluated for cutting wood apple fruits at three feed rate viz. 100 kg/h, 200 kg/h and 300 kg/h and three pulley speeds of 885, 1050 and 1187 rpm. The parameters investigated were cutting efficiency, damage percentage and machines capacity. The optimization of nine speed level was done for three efficient speeds by adopting one way ANOVA in completely randomized design. A pulley speed of 885 rpm, 1050 rpm and 1187 rpm found to favour the cutting of wood apple with minimum damage. Thereafter, the optimization of three feed rate and three speed were carried out. It was performed for cutting efficiency and damage percentage by cutting machine. A feed rate 200 kg/h at 885 rpm speed was found to favour the cutting of wood apple with maximum cutting efficiency of 96.8 % and minimum damage of 3.2 %. The capacity of wood apple cutting machine was obtained as 202.62 kg/ h at 885 rpm. The machine was therefore observed to perform best at the optimum operating speed of 885 rpm.

**Keywords:** wood apple, physical properties, wood apple cutting machine.

## Investigating the morphological variability in *Gymnema sylvestre* (Retz.) R. Br. ex Schult collected from Peninsular India using minimal descriptors

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### ABSTRACT

*Gymnema sylvestre* (Retz.) R. Br. ex Schult is a lactiferous, more or less pubescent woody perennial climber in the Apocynaceae family. *Gymnema* is a well-established natural remedy for diabetes and an important constituent of more than 100 herbal formulations recommended for diabetes and obesity. Gymnemagenin is the active ingredient present in the leaves and is now one of the most widely used botanicals for diabetes management. This plant species has become endangered and is included in the IUCN Red Data Book because of its overexploitation. In view of the current demand for plant-based medications and over-exploitation of the wild supply of *Gymnema*, an investigation was carried out at the ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru, to assess the degree of morphological variability in 35 accessions of *Gymnema sylvestre* collected from Peninsular India. The plants were observed for the morphological traits after 18 months of planting. Quantitative parameters such as leaf length, leaf width, leaf thickness, petiole length, internode length, fresh and dry leaf weight, and qualitative parameters such as leaf color, leaf size, leaf texture (for pubescent), leaf base, leaf tip, and stem color (both young and mature), all of which contribute directly to the plant's biological yield (leaf) were included as the descriptors. Significant variability was observed for all the observed traits showing variability between the collected germplasm. The morphological characterization will aid in assessing the variability and developing an effective set of descriptors. Moreover, the collection and maintenance of several ecotypes will assist in the conservation of this endangered medicinal plant.

Keywords: *Gymnema sylvestre*, gymnemagenin, diabetes, morphological variability

## Effect of deficit drip irrigation scheduling on soil-plant water dynamics of Indian mustard (*Brassica juncea* L.) under horticultural systems in semi-arid ecology of India

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### ABSTRACT

In arid and semi-arid region of developed and developing countries, deficit irrigation has been most widely studied and practiced for enhancing crop productivity and water use efficiency (Wang *et al.*, 2001). A field experiment in mustard was conducted at ICAR-Indian Agriculture Research Institute, New Delhi, Division of Agronomy during *rabi* season 2020-2021. The experiment was carried out in split plot design (SPD) with five main-plot treatments consists of moringa (*Moringa oleifera* Lam.), phalsa (*Grewia asiatica* L.), karonda or Carandas plum (*Carissa carandas* L.), aonla or Indian gooseberry (*Phyllanthus emblica* L.) and guava (*Psidium guajava* L.) and subplot consist of three deficit-irrigation scheduling level (DIS), *viz.* rainfed, 0.4 IW:CPE ratio (irrigation water: cumulative pan evaporation) and 0.6 IW: CPE ratio. Soil moisture content at different growth stages, relative water content (RWC) and soil penetration resistance showed significant differences due to deficit irrigation scheduling and Agri-Horti system in Indian mustard. Among different AHS, Moringa based treatment recorded in highest soil moisture content before sowing (13.9%), at early stage (12.6%) and at pod development stage (16.1%). The highest RLWC was recorded under moringa based AHS. Water use efficiency (WUE), irrigation water use efficiency (IWUE), monetary irrigation water use efficiency (MIWUE) was recorded highest under moringa-based AHS and lowest under guava-based AHS.

**Key words:** Agri-horti system, Water use efficiency, Irrigation water use efficiency, Deficit irrigation, Drip system

### Identification of machine and operational parameters for mechanical harvesting of cabbage

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### ABSTRACT

In India, cabbage harvesting is done manually, it is labour-intensive operation and involves drudgery. Currently no efficient technology for mechanical harvesting of cabbage is available in India. The need of the hour is harvesting of cabbage mechanically. In view of this, a study was conducted to identify machine and operational parameters for mechanical harvesting of cabbage. The experiments were carried out in a laboratory with an instrumented setup. The machine parameters such as type of cutting blade edge (smooth, serrated and teathed) and type of conveying belt (flat, cleated and circular groove) and operational parameters such as cutting speed, machine forward speed, inclination and speed ratio of conveying system were selected. Cutting torque was recorded and conveying efficiency, power requirement for cutting and conveying were determined. The results showed that type of cutting edge, conveying belt, cutting speed and speed ratio affects the performance of the systems significantly. The serrated type cutting edge blade was found to be optimal for cutting cabbage stems. The maximum force required to cut a cabbage stem was found to be 288 N. The circular groove type conveying belt showed better output with an efficiency of 96.4%. The maximum power required to cut cabbage stems and conveying heads were 0.9 kW and 0.06 kW respectively.

**Keywords:** Cabbage, mechanical harvesting, cutting torque, conveying efficiency

## Genetic transformations in flower crops

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### ABSTRACT

Plant transformation technology has been used to develop many varieties of crop plants, but only a few varieties of ornamental plants. This disparity in the rate and extent of commercialisation, which has been noted for more than a decade, is not because there are no useful traits that can be engineered into ornamentals, is not due to market potential and is not due to a lack of research and development activity. The GM ornamental varieties which have been released commercially have been accepted in the marketplace. The most famous genetically modified crops in floriculture are rose and carnation. In these two crops blue colour has been produced, which is not naturally present in these crops. Apart from colour modification transformation studies have been carried out in various aspects like improvement in vase life, inducing fragrance in non-fragrant flowers, resistance towards pest and diseases and alteration in the plant architecture. Blue colour is induced by suppressing the rose DRF gene and over expression of F3'5'H gene of viola and DFR gene of iris. Fragrance is induced by altering the metabolic pathway for primary metabolites leading to the production of volatile aromatic secondary metabolites. The transformation for increasing the post-harvest is done by suppressing the ethylene production by suppressing the ACC synthase and ACC oxidase gene. Apart from there are many fields in which genetic transformation have been carried out. But commercially only blue carnation and blue rose are available in market.

**Keywords:** ACC synthase gene, ACC oxidase gene, Floriculture, GM ornamental varieties

## Performance characteristics of self-propelled power operated cutter bar mower

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### ABSTRACT

The power operated cutter bar mower unit was developed in the laboratory of Farm Machinery and Power Engineering, JNKVV, Jabalpur for small farmers. The prime mower is powered by 5hp diesel engine. V-belt drive is provided for transmission of power from the engine to the traction wheels. An adjustable accelerator wire is connected to the governor for adjusting the engine speed according to the requirement. The worm gear reduction unit is located at the axle having speed reduction ratio of 20:1. The cutter bar mower consisted of six main components including the cutting, transmission, power, handling, frame, and transporting units. Two skids were attached to the cutter bar unit, one on each side, to control cutting height. Performance tests of the mower resulted in an average 0.08 ha/h effective field capacity, 1.40 L/h fuel consumption, 0.761 field efficiency, 2 km/hr of average speed and 30 mm cutting height.

**Keywords:** Power unit, forage harvesting, mower, cutter bar



### Effect of different potting media for foliage plants – An overview

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#### ABSTRACT

In India with changing life style and increased urban affluence, floriculture has assumed a commercial status in recent times, particularly during the past 2-3 decades. The awareness of using these foliage plants is increasing day by day. These are mainly grown in inside and outside showrooms, hotels, houses, institutional buildings, bungalows *etc.* One such important foliage is *Nephrolepis undulate* J. Sm. The potting media play important role in the growth and development of foliage plants. The *Nephrolepis* which are grown in the media consisting of Soil + Cocopeat + FYM + Vermicompost (2:1:1:1) recorded the maximum plant height (95.30 cm), plant spread in both EW and NS direction (72.00 and 73.67 cm), number of shoots (6.17), croziers (3.10), fronds (12.00), crozier length (4.93 cm), frond length (87.00 cm) and width (15.67 cm), leaflet length (8.30 cm) and breadth (2.10 cm), shoot diameter (0.95 mm), chlorophyll “a”, chlorophyll “b” and total chlorophyll content (1.99, 0.97 and 2.96 mg/g of fresh weight), visual plant grade (4.85), shelf life (8.00 days) and vase life (20.33 days).

**Key words:** *Nephrolepis undulate* J. Sm, cocopeat, FYM, vermicompost.



## Microgreens – A concept innovation for nutritional security

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### ABSTRACT

A miniature form of the green leafy vegetables, referred to as microgreens has gained popularity as a novel culinary ingredient during the last decade. Microgreens, frequently known as “vegetable confetti” are tender, young greens that enhances the texture, color and flavor of salads to garnish a variety of main dishes. Microgreens garner immense potential for adapting leafy vegetable production to a micro-scale and for improving nutritional value in human diet (Kyriacou *et al.*, 2016). According to UN, there will be tremendous increase in population to about 10 billion which puts enormous pressure on modern agriculture (McClung, 2014). Also, currently 1 billion people are chronically malnourished with 2 billion more on the go. Consumption patterns, lifestyle adaption and family systems are witnessing a drastic change in the modern era. Eating on the go habits and time constraints have left people, mostly the younger generation, to switch over to nibbling food which caters only to appeal, aroma and taste but not to their personal nutritional enrichment. Apart from rendering rich taste, colour, aroma and texture to food, these harvested green vegetables or tiny seedlings of edible plants have been reported to improve one’s nutrition, having appreciable levels of essential vitamins and minerals, fibre and protein. In terms of minerals, lettuce microgreens contained more of some elements (Ca, Mg, Fe, Mn, Zn, Se, and Mo) than mature vegetables, and these levels were unaffected by changes in soil properties and composition. Recent studies found significant amounts of  $\alpha$ -tocopherol (vitamin E), carotene (pro-vitamin A), ascorbic acid (vitamin C) and phyloquinone (vitamin K1). Phytochemicals such as phenolic antioxidants, anthocyanins, glucosinolates, and carotenoids have also been found in microgreens. In order to inculcate a healthy transformation with the aim of bringing up a healthy genre for future India, a nutritive as well as novel alternative must be introduced.

**Keywords:** Microgreens, Population, Nutritional Security



## Internet of things (IOT) for smart agriculture

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### ABSTRACT

People may use the Internet of Things (IoT) to live and work smarter and achieve total control over their life. The Internet of Things is a network of devices that uses wired and wireless Internet to communicate machine to machine (M2M). People may use the Internet of Things to live and work smarter to achieve total control over their lives. IoT is a revolutionary technology in agriculture that can be applied to agricultural production year-round. IoT is widely used in agriculture such as management systems, monitoring systems, control systems and unmanned machinery. IoT solutions are a type of system that uses various sensors (light, humidity, temperature, soil moisture, crop health *etc.*) to monitor and automate different operations in an agricultural field. There are different Internet of Things (IoT) technologies used in farming, including data collection on temperature, rainfall, humidity, wind speed, pest infestation and soil composition. The functions of IoT include data gathering and processing, planning and decision-making and prescriptions and services. Smart farming based on IoT not only modernizes traditional farming methods, but also targets other agriculture methods such as organic farming and enhances highly transparent farming.

**Keywords:** Internet of Things, agriculture, machine, sensors, smart farming



## **Aquascaping – An underwater art**

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### **ABSTRACT**

Aquascaping is an art and a science which creates sustainable and amazing underwater environments. It is an art of arranging aquatic plants, rocks, driftwood and stones in an aesthetically pleasing manner within an aquarium. In simple words we can say it is landscaping under water or gardening in fish tank. It is a new concept which involves plants, fishes, woods and gravel in aquatic ecosystems. Involvement in care and maintenance of aquascape is known to have a significant impact on mental health and well-being that improve aesthetic view of surroundings and relieve stress. Aquascapes come in a variety of styles, which includes Dutch, Japanese, natural, rock formation, jungle, biotope, and pardalium. The most common and important styles of aquascaping are the Dutch and Japanese. Dutch style is based on creating a similar design with a picturesque garden using texture, color, and size. Japanese style is using rocks, wood and moss to create natural aquatic ecosystems. The main goal of aquascaping is to create an artistic aquatic landscape, but the technical aspects have to be taken into consideration which include fish, substrates, plants, water quality, aquascape ornaments and proper maintenance. In India there is a vast scope for entrepreneurship development in aquascaping. Hence, incorporation of aquascape along with land scape components enhance beauty as well as the life of an environment.

**Key words:** Aquascape, aquarium, gravel, pardalium, rocks

## **Differential responses of top working methods for quality scion wood production in apple (*Malus x domestica* Borkh.)**

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### **ABSTRACT**

The research experiment entitled “Differential responses of top working methods for quality scion wood production in apple (*Malus x domestica* Borkh.)” was carried out in Department of Fruit Science, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh, India in 2018-2019. The experiment was laid out in Randomized Block Design consisting of eleven treatments which were replicated three times. Three grafting methods viz., tongue, cleft and bark performed at 1 m, 1.25 m and 1.5 m in conjunction with two budding methods viz., T-budding and chip budding performed at 1 m each were utilized for top working. The results indicated that the highest graft take success (93.27%), total number of shoots (49.67), annual shoot extension growth (147.00 cm), internodal length (2.55 cm), number of leaves (59.59), leaf chlorophyll content (2.89 mg/100 g), number of graftable shoots (248.00), per cent graftable scion wood (52.73 %) and pruning weight (2.89 kg/tree) was recorded in plants top worked with tongue grafting at 1.25 m height. Whereas, diameter of scion above graft/bud union was found to be in plants top worked with cleft grafting done at a height of 1 m. Therefore, tongue grafting performed at a height of 1.25 m resulted in best top working method for obtaining maximum scion wood in apple.

**Keywords:** Top working, scion wood, apple

## Evaluation and quantification of biochemicals in chekkurmanis (*Sauropus androgynus* L.) using High-performance liquid chromatography (HPLC)

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### ABSTRACT

*Sauropus androgynus*, plant belongs to the Phyllanthaceae family and has several nutritional and therapeutic benefits. It has anti-inflammatory, anticancer and antihypertensive qualities, among other nutraceutical or pharmacological characteristics. Local residents rely on it for their health, food, and agriculture. Proteins, vitamins, polyphenol, carbs, fat, calcium and iron are present in the leaves among other plant parts. This study was carried out at Horticultural College and Research Institute, Periyakulam to observe the biochemical composition of chekkurmanis in two distinct leaf positions (terminal & basal) using leaf extracts prepared in different solvents (Hexane & Ethanol) and quantifying the major components like Phytol, Squalene, Kaempferol and Papaverine using High-performance liquid chromatography (HPLC) analysis. Successful detection of the presence of biochemical compounds such as Phytol was done at 280 nm, Squalene at 195 nm, Kaempferol at 265 nm and Papaverine was detected at wavelength of 254 nm. The quantification of these high value biochemicals was done using External standard (ESTD) quantification method resulted in following: Phytol 0.393 µg/ml, Squalene 0.334 µg/ml, Kaempferol 0.176 µg/ml and Kaempferol 0.558 µg/ml. It was concluded that Hexane leaf extracts of *Sauropus androgynus* obtained from the terminal young leaves contained maximum biochemical compounds, hence they are nutritionally opulent and beneficial for consumption.

**Keywords:** Chekkurmanis, multi- vitamin greens, High-performance liquid chromatography, biochemical compounds, therapeutic, nutritional evaluation

### Small tractor trolley mounted hydraulic platform for multipurpose work in orchard crops

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#### ABSTRACT

The Indian agriculture sector has witnessed a considerable decline in land size and the use of human and animal power for agricultural activities in recent years. In India about 85% farms come under small and marginal land. Due to Small fragmented land holdings, hill agriculture and shifting cultivation, it is a difficult task in managing the small farms with large size tractor. So small tractor mechanization is the need of the hour. As horticulture is leading agricultural sector in India, machines needs to be developed for complete horticulture mechanization. The small tractor operated trolley mounted hydraulic was developed for multipurpose work in orchard such as fruit picking, pruning and spraying. Hydraulic platforms mainly consisted of trolley, frame with four bar linkage mechanism, FRP bucket, gear housing, double acting hydraulic cylinder, hydraulic motor and hydraulic valve. Developed system was coupled with a hydraulic motor to give rotational movement of FRP bucket arm in left and right side to perform task both rows of plant and height up to 10 feet. The fruit picking platform was evaluated in orchard of guava and mango with spaying system. The field capacity of the machine was found to be 0.3 ha/h. Theoretical filed capacity was found to be 0.35 ha/h and field efficiency was found to be 85%. The operating cost of the tractor was found to be 626/hr and machine was found to be Rs. 1330/h. Cost of operation with both tractor and machine was found to be Rs.6520/ha.

**Keywords:** Land holding, small tractor mechanization, hydraulic platform, spraying

### Alternative media composition for production of micro-propagated disease-free seedlings of sugarcane (*Saccharum officinarum* L.)

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#### ABSTRACT

The experiment was conducted to standardize the alternative media composition for production of micro-propagated disease-free seedlings of sugarcane. The study consists of two experiments which includes, shoot and root growth under *in-vitro* condition and hardening of seedlings under greenhouse. Significant differences were noticed between the media with standardized and alternatives sources of components. Among the alternative gelling agents used, MS media with China grass at 25g/l produced mean of 88.04 per cent uncontaminated explants with days taken for sprouting (10.47) and per cent survival of explants (87.67) in varieties VCF0517, Co86032, CoVC18061, CoVC16061 and CoVC16062. China grass as gelling matrix has evolved good results with per cent contamination free explants providing a good support to tissues growing in static conditions (Ozel *et al.*, 2008). All the varieties have obtained maximum number of shoots (11.45) along with maximum shoot length (8.47 cm) in MS media with table sugar 20 g/l. All the varieties have obtained maximum number of roots (8.35) along with maximum root length (6.43 cm) in tender coconut water at 100 ml/l media. The addition of coconut milk significantly increased root growth along with shoot parameters (Boase *et al.*, 1993). The micropropagated sugarcane seedlings were hardened for 21 days with four different potting mixtures in different proportion by keeping sand and soil as constant. The maximum per cent survival of seedlings with decomposed pressmud along with sand and soil in ratio 1:1:2 showed best of 93.33 per cent micropropogated seedling establishment.



## Technological advances in high tech horticulture and precision training

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### ABSTRACT

As the technology is advanced now better information flows with faster communication and lower transaction cost and have made work easier and efficient and have proven a drive for economic growth. Technology has played a major role in growth of horticulture. Horticulture is the science and art of the development, sustainable production, marketing and use of high-value, intensively cultivated food and ornamental plants. Technology has provide more efficient way to produce, sell and harvest crops with sustainability and has solved the scarcity of resources and labour to large extent and some practices like precision training has been adapted to some extent for specific differences within fields and to avoid over or under supplying of plants for efficiency, productivity and profitability. Technology advancement like robotics, automation, use of sensor is designed. With the advancement in technology horticulture has scaled up and start up in horticulture has increased.

### CONTENT

Horticulture is the art, science and practice of growing and maintaining plants in different types of environment. Horticulture involves intensive cultural practices where plants or species are usually given individual attention. Horticulture adapted mechanization for various operations viz. seeding, transplanting, weeding, spraying and harvesting will reduce the time taken for actual operation. Mechanization creates the need for new approaches to cultural practices, for development of new varieties and demands a product with different handling and processing qualities. The machines used in horticulture for various operations are manure spreader, centrifugal fertilizer spreader, plastic mulch and drip line laying machine, pit hole digger or auger, trencher, seed drill or planter, seedling transplanter, power weeder, air blast sprayer or mist bower, pruner and harvesters. Artificial intelligence is the process of making intelligent machine by the human. AI provides more efficient ways to produce, harvest and sell essential crops. AI like robotics (used in monitoring, packaging), automation (help fertilize and move plants), drones and sensor (for growth stage information, crop health, soil variation) and cloud software system (for detecting diseases and weather information) are used. As the generation is going more towards organic farming we can scale up in horticulture by using the ai in innovative manner by giving quality and disease free plants and by making nice link between R and D section, industry and farmers. People can also do agri start up in horticulture as it is profit for the economy by removing the constraints and by the use of nice equipment, proper infrastructure and by use of technology and innovation.

**Keywords:** Efficiency, intensive, mechanization, automation, constraint, innovation



## Physical and engineering properties of selected fertilizers relevant to development of target-oriented fertilizer drill for orchards

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### ABSTRACT

Cultivation of high-density orchards are becoming popular with aim to increase the productivity. Fertilizers play a vital role in crop production. Precision application of fertilizers saves the input cost. Hence, a small tractor operated target-oriented fertilizer drill was designed and developed. The engineering properties such as physical and mechanical properties of fertilizers viz., Diammonium Phosphate (DAP), NPK complex, Single Super Phosphate (SSP), urea, Muriate of Potash (MOP) were measured, which were used in the production of orchard crops. The physical properties namely, length, width, thickness, geometric mean diameter, bulk density, true density, angle of repose and coefficient of friction were measured. The length of fertilizer viz., DAP, NPK complex and SSP ranged from 3.88±0.60 mm to 4.20±0.52 mm. The breadth and thickness ranged from 3.47±0.57 mm to 3.56±0.43 mm and 2.89±0.54 mm to 3.26±0.51 mm, respectively. The geometric mean diameter of granular fertilizer ranged from 3.44±0.53 mm to 3.59±0.39 mm. Bulk density of selected fertilizer viz., DAP, NPK Complex, SSP, Urea and MOP ranged from 753.769±11.40 kg m<sup>-3</sup> to 1123.91±4.19 kg m<sup>-3</sup>. Similarly, true density ranged from 1203.57±180.02 kg m<sup>-3</sup> to 1989.28±836.39 kg m<sup>-3</sup>. Angle of repose of selected fertilizes namely DAP, NPK Complex, SSP, Urea and MOP ranged from 32.46±1.42° to 39.82±0.98°. The coefficient of static friction (CSF) was carried out for rubber, aluminium, glass, wood, mild steel and galvanized iron. The CSF was found highest for rubber as compare to other surfaces. i.e., 38.60±1.42, 38.30±1.25, 30.10±0.73, 39.20±1.13 and 37.10±0.99 for DAP, NPK Complex, SSP, Urea and MOP, respectively. Whereas, lowest was observed in case of glass surface as compare to other surfaces i.e., 25.30±1.05, 25.20±0.91, 22.10±1.10, 24.50±0.52 and 31.20±1.61 for DAP, NPK Complex, SSP, Urea and MOP, respectively.

**Keywords:** Fertilizers, Engineering properties, Physical properties

## **Integrated approach for enhancing growth and yield of pomegranate (*Punica granatum* L.) cv. Bhagwa.**

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### **ABSTRACT**

An experiment entitled “Integrated approach for enhancing growth and yield of pomegranate (*Punica granatum* L.) cv. Bhagwa” was conducted during two consecutive years from 2019 to 2021 at farmer’s field, Bagepalli taluk, Chikkaballapur district. The experiment was laid out in a randomized complete block design (RCBD) involving 12 treatments with three replications. The main objective of the experiment was to enhance the growth and yield of pomegranate by reducing the cost of cultivation. In the present study, among the different INM treatments, the application of 100 % RDF + vermicompost (5 kg/plant) + neem cake (1 kg/plant) + trichokawach (100 g/ plant) + darakshak (4 ml/litre) foliar application + VAM (50 g/plant) + *Penicillium pinophilum* (20 g/ plant)+ seaweed extract (20 g/plant) + chitosan (2 g/litre) + salicylic acid (300 ppm) + phosphoric acid (3 ml/litre) + micronutrients (soil and foliar application) + growth regulators (foliar application) (T<sub>12</sub>) recorded the maximum plant height (2.37 m), stem girth (51.49 mm), fruit weight (290.67 g), fruit length (8.93 cm), fruit diameter (8.98 cm), aril weight (205.02 g), number of arils per fruit (486.79), rind weight (85.66 g), number of fruits per plant (79.60), yield (23.55 kg/plant and 21.92 t/ha) and highest benefit cost ratio (1:3.34) as compared to control. Therefore treatment T<sub>12</sub> could be one of the best integrated approach to enhance the growth and productivity of pomegranate and also economically viable to achieve maximum profit to the growers.

**Keywords:** Bio-stimulants, bio-fertilizers, growth regulators, organic manures, pomegranate

### **Artificial intelligence with Advanced horticulture**

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### **ABSTRACT**

Artificial intelligence is the chain of making smart machine by the human. It comes under wide area of computer science that focus on the creation of probable and inflatable systems which not only behave smartly but also display behaviour to the same level as human beings think and act, achieving human like performance in all perception tasks using purely logical reasoning. An AI based automatic system has been developed and designed for identifying the over matured pineapple. Python language has been used to identify the features of a matured pineapple. The developed system field tested and found to succeed the identification of 92% the correct fruits. AI technology is rapidly compact the problems while recommending specific action that is required to overcome the problem. Introduction of digital agriculture, mechanization and industrialisation of production processes, connectivity and data management are set to release the next revolution in the history of agriculture and farming.

**Keywords:** Human, smartly, pineapple, agriculture, computer, farmin

**Influence of various natural farming modules on available NPK, viable microbial count and economics of seed production on African marigold (*Tagetes erecta*L.) cv. 'Pusa Narangi Gainda'**

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**ABSTRACT**

A field study during 2018 and 2019 was conducted at the experimental farm of Department of Seed Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan. Different doses of Jeevamrit applied through drenching (25ml/m<sup>2</sup>, 50ml/m<sup>2</sup>, 75ml/m<sup>2</sup> and 100 ml/m<sup>2</sup>) and as foliar sprays (5%, 10%, 15% & 20%) at 15 days interval, alternatively + Brahmastra @ 2.5 % and Neemastra @ 2.5 % at 7 days interval, alternatively along with RDF and untreated control as well as organic module based on *Trichoderma viride* comprised in the treatment modules. The trial used a Randomized Block Design (RBD) layout, with 19 treatments replicated three times. M<sub>18</sub> had the highest available N, P, and K values (454.30 kg/ha, 87.54 kg/ha, and 434.74 kg/ha, respectively), which were statistically comparable to M<sub>16</sub> natural farming modules. M<sub>16</sub>, on the other hand, had the highest number of viable microbiological count of beneficial bacteria (119.17 10<sup>5</sup> cfu/g soil), fungus (17.33 10<sup>3</sup> cfu/g soil), and actinomycetes (14.00 10<sup>2</sup> cfu/g soil). Similarly, M<sub>16</sub> had the highest benefit-to-cost ratio (3.69:1), which was closely followed by M<sub>12</sub> treatment modules (3.63:1). So, the M<sub>16</sub> modules. As a result, this M<sub>16</sub> module is recommended to farmer for increasing the availability of nutrients and the maximum load of beneficial bacteria in the soil, which helps to improve the performance of African marigold cv. 'Pusa Narangi Gainda' in Himachal Pradesh's mid-hill conditions.

**Keywords:** African marigold, available NPK, economics, viable microbial count, natural farming, RDF

### **Influence of pruning and growth regulators on growth and flowering for off-Season flower induction in Udupi Mallige (*Jasminum sambac* var. *aeयaneanum*)**

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#### **ABSTRACT**

Udupi Mallige (*Jasminum sambac* Var. *Aeyaneanum*) is an important flower crop of coastal Karnataka possessing a GI tag having peak season during March-April and an off-season from November to February. A study was conducted to induce off-season flowering using growth regulators and pruning in Udupi Mallige at Heggunje village, Bramhavar taluk, Udupi Dt. during 2019-21. Experimental treatment comprises of growth regulator (GA3 @ 125 and 150 ppm) and growth retardant (CCC @ 1000 and 1200ppm) along with pruning during October and November using Factorial Randomized Complete Block Design (FRCBD). The data on vegetative, flowering and yield parameters were recorded at 90 days after pruning. Effect of pruning, growth regulators and interaction of both revealed significant differences among the treatments. The effect of pruning P1 (pruning in October) recorded the highest plant height (110.62cm), number of primary shoots (23.6), number of secondary shoots (111.53), number of days taken for first bud bearing (31.67), number of flowers per shoot (6.59) and flower weight per plant (434.27g). The effect of plant growth regulator G2 (GA3 @ 150ppm) recorded the highest plant height (117.05cm), number of primary shoots (31.50), number of secondary shoots (131.67), number of days taken for first bud bearing (21), flower bud length (1.32cm), number of flowers per shoot (9.05) and flowers weight per plant (780.23g). Interaction between pruning and growth regulator P1G2 (GA3 @ 150 ppm) reported the highest plant height (122.10 cm), number of primary shoots (33.33), number of secondary shoots (135.33), number of days taken for first bud bearing (20.67), total flower bud length (2.84cm), flower bud diameter (1.51mm), number of flowers per shoot (9.13) and flowers weight per plant (810.56g) in October pruning over control (P1G5 and P2G5).

**Keywords:** Udupi Mallige, pruning, growth regulator (GA3), growth retardant (CCC).

### **Standardising of planting densities on growth, fruiting and yield of Apple Cv. Jeromine under mid-hills of Himachal Pradesh**

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#### **ABSTRACT**

The present investigation to “Standardising of Planting Densities on Growth, Fruiting and Yield of Apple Cv. Jeromine under Mid-Hills of Himachal Pradesh” was carried out at Fruit Research Farm, Department of Fruit Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh during the year 2018 and 2019. The plantation was made at four spacing viz, 2.5 m × 0.75 m, 2.5 m × 1.0 m, 2.5 m × 1.25 m and 2.5 m × 1.5 m with a density of 5333, 4000, 3200 and 2666 trees/ha. The experiment was laid out in a randomized block design with four densities and each replicated six times. The results revealed that planting density of 2666 (2.5 × 1.5 m) recorded maximum increase in tree height, annual shoot growth, tree spread, tree volume, pruned wood weight, stock and scion girth. Fruiting parameters viz., number of spurs, fruit set, yield, productivity and yield efficiency was highest in planting density of 2666 (2.5 × 1.5 m). Fruits harvested from planting density of 2666 (2.5 × 1.5 m) was superior in fruit quality parameters viz., fruit size, weight, volume, total soluble solids, sugar contents, ascorbic acid and anthocyanin content. The planting density of 2666 (2.5 × 1.5 m) was recorded highest in light interception, photosynthesis efficiency, chlorophyll content and leaf nutrient contents as compared to other planting densities.

**Keywords:** Apple, planting densities, growth, fruiting, yield





## Artificial intelligence in Agriculture

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### ABSTRACT

Agriculture is the backbone of the economic system of India. The Indian economy is heavily dependent on Agriculture as it contributes to 16.5% of India's gross domestic product (GDP) and employs the largest *i.e.*, 43% of the Indian workforce. Over the years, Indian agriculture has undergone a shift from the basic farming to more efficient, sustainable and productive farming. Artificial intelligence (AI) is the simulation of natural intelligence by the machines and is the game changing tool in Indian agriculture. The introduction of AI in the field of agriculture is one of the emerging technological interventions which includes the use of drone technology, robotics, sensors, Internet of Things (IoT) and cameras to improve crop production and quality. The various applications of AI in the field of agriculture includes use of autonomous tractors for various cultural operations with accuracy, management of crop and soil quality by monitoring nutrient deficiencies in soil, crop sowing, disease management and identification of pest outbreak, helps in precision nutrient management, spray of chemicals via drones, soil fertility mapping, monitoring of soil moisture content and land cover and IoT enabled soil testing. Remote sensing technology, using the concept of GPS (Geographical Positioning System) and GIS (Geographical Information System) helps in mapping of vegetation indices, land cover and in predicting crop productivity. Most common sensors in use are thermal sensors, visible light sensors, multispectral sensors and hyperspectral sensors. In the context of increasing population and rising food demand, use of AI in agriculture has become a necessity to make agriculture more efficient and intensify crop productivity.

**Key words:** Artificial, intelligence, Agriculture.



## Effect of varieties and transplanting dates on yield and quality of *kharif* Onion (*Allium cepa* L.)

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### ABSTRACT

A field experiment was conducted at research farm of the Department of Vegetable Science, College of Horticulture, Mandasaur (M.P.) during 2016-17 to find out the effect of varieties and transplanting dates on yield and quality of *kharif* onion. The treatments comprising of two transplanting dates viz., D1 (10<sup>th</sup> August) and D2 (25<sup>th</sup> August) and eight varieties viz., V1 (Arka Kalyan), V2 (Arka Bheem), V3 (Bhima Red), V4 (Bhima Raj), V5 (Bhima Super), V6 (Bhima Dark Red), V7 (Bhima Shubhra) and V8 (Agrifound Dark Red) were tested in a factorial randomized block design with three replications. The results revealed that the transplanting date D2 and variety V8 recorded maximum polar diameter of bulb (4.8cm), equatorial diameter of bulb (5.9cm), average weight of bulb (78.09g), total yield of bulb (310.17 q/ha), yield of marketable bulbs (292.28 q/ha), highest bolting percentage, grade A & grade B bulbs and days taken for maturity. Whereas, number of doubles, grade C and grade D are more with transplanting date D1. Combined effect of treatment D2V7 recorded maximum neck diameter, D2V2 found maximum TSS and D1V8 with more number of doubles and pyruvic acid.

**Keywords:** Transplanting dates, varieties, polar diameter of bulb, yield of bulb, pyruvic acid, TSS



## Vertical farming for commercial cultivation of *Lilium*

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### ABSTRACT

Rapid growing population along with ever decreasing arable lands pose as one of the greatest challenges in farming. Vertical farming is considered as an innovative approach to produce more crop from small area/space throughout the year. This distinctive method of farming aims at higher productivity in smaller spaces making efficient use of the available vertical space and uses soil-less farming methods. The present experiment was conducted at ICAR- Indian Institute of Horticultural Research, Bengaluru during 2021-2022. The study was undertaken to design and fabricate vertical farming structures which are suitable for commercial cultivation of high value flower crops like *Lilium* and to evaluate the performance of *Lilium* in fabricated vertical farming structures. The vertical farming structure which was designed and fabricated have four major sub structures viz., Main / Base frame, Vertically stacked support frames, Growbags with flaps and Irrigation system. The support frames was attached to the main base frame in a slanting manner for proper harvest of light in all layers of growbags. 11 such supports were mounted on both sides, 5 each on both side and one on top (5+5+1=11 tiers) for supporting 11 numbers of grow bags. Drip irrigation system was adopted to irrigate the crops which was precisely operated to reduce the wastage of water. Performance evaluation of three *Lilium* varieties viz., Scipione (Yellow), Corleone (Red) and Caesars Palace (Orange) was carried out in vertical farming structures against control (Conventional farming -in horizontally placed growbags for *Lilium*). Weather parameters, Light intensity measurements and observations on growth, flowering and yield of *Lilium* were analysed to compare and evaluate the performance of the crop in different tiers of vertical farming structures. No significant difference in growth, flowering and productivity was observed in plants kept in lower bags and upper bags in 11 vertical layers as well as control (Horizontal Conventional farming). Vertical farming system developed was found highly suitable for soil less commercial production of *Lilium* as it reduces the amount of water and land required to produce the crop and is a boon to urban horticulture.

**Key words:** Vertical farming, *Lilium*, High value crops, vertical layers

### **Effect of exogenous application of auxin on leaf cuttings of Mexican Snow Ball (*Echeveria elegans* Rose)**

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#### **ABSTRACT**

Succulents are on the rising trend of popularity due to its compromising behaviour with watering and durability indoors, creating a peaceful and healthy living condition. Thus it is the need of the hour to find a suitable propagation method or use of exogenous substances with propagation to assist regenerating new plants. Hence finding a better Rooting hormone combination. The present investigation entitled Effect of IAA and IBA Application on leaf cuttings of Mexican Snow Ball (*Echeveria elegans*). Was conducted in Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during February, 2021 to April, 2021. The experiment was laid out in randomized block design (RBD) with 3 replications. The treatment in each replication was randomly allotted. There are 9 treatments having one variety were used in this experimental design. The results revealed that among all the treatments, application of IAA + IBA (100 ppm + 500 ppm) in treatment (T<sub>8</sub>) took minimum days to rooting (9.00), number of leaves (16.56), number of shoots (2.56), shoot height (15.56 mm), shoot diameter (16.44 mm), root length (29.00 mm) and in economic point of view treatment T<sub>8</sub> IAA + IBA (100 ppm + 500 ppm) was found to be most economically viable in terms of gross return (Rs. 17,000), net return (Rs. 11,100) and benefit cost ratio (2.88).

**Keywords:** IAA, IBA, Mexican snow ball, propagation, growth

### **Weather monitoring network and data information for precision agriculture in Karnataka state.**

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#### **ABSTRACT**

Weather monitoring network and the data/information with advancement of technology is need and derive in precision agriculture to enhance profitability, sustainability and efficiency. In precision agriculture, the former community cannot ignore the weather phenomena in order to avoid incurring losses. Weather monitoring sensors network and data/information plays a crucial role in more and better yields will translate into bigger profit margins. The Karnataka State Natural disaster Monitoring centre established and highly dense network of telemetric weather stations and rain gauges to monitoring the real near time climatic conditions and disasters. Feeding the real near time weather and climatic conditions data information's for farmer community is foremost step in implementation of precision agriculture practices. The information technology, data management and integration geographical information system (GIS) and Combining real time weather monitoring and soil moisture measuring and of information technology interventions has the potential to generate significant benefits of timely, accurate, specific and complete information for forming community increased the value of information towards efficiency in productivity, cost control, improve operation/execution, and insurance claims and made forming community easier and less stressed. KSNDMC enabled dedicated team to monitoring of weather conditions with the Internet of Things makes it possible for farmers to better collect weather condition data.

**Keywords:** Precision Agriculture, weather monitoring network, IoT



## Optimization of design parameters of an induction based electrostatic nozzle using Artificial Neural Network (ANN)

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### ABSTRACT

The need for novel and efficient pest management and control tactics against insect pests, diseases, and weeds has challenged researchers and Industries to respond to growing public concern about the possible harm of chemical inputs in agricultural production systems. By choosing the best droplet size and density for maximum retention and coverage, the latest electrostatic spraying approach aims to spray the target insect more effectively. The main issues limiting the adoption of this technique in Indian farming settings are the sprayer's huge size, greater initial cost brought on by the voltage multiplying circuit, and its unsuitability for charging various chemical sprays. To increase productivity and cut costs, design parameters must be optimized if electrostatic spraying is to be used on a large scale. The effect of electrode material, flow rate, applied voltage on charge to mass ratio was evaluated. Aluminum, brass and copper electrode were selected for the for laboratory evaluation. Artificial neural network (ANN) model, with a back propagation learning algorithm, was developed to predict charge to mass ratio of charged droplets under varying operating and design conditions. The developed model predicted the charge to mass ratio (CMR) of spray droplets an error < 4.5% when compared to the measured CMR. CMR showed a constant curve after a voltage of 4.0 kV. From RSM, an optimized value of Voltage, Flow rate and electrode type was selected Voltage = 4.0 kV, Flow rate = 80 ml /min and type of electrode material = Copper.

**Key words:** Pest management, ANN, electrostatic spraying, CMR

## Technological innovation in farm mechanization- A strategy for sustainable food security

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### ABSTRACT

In this article, authors have tried to establish the relationship between farm mechanization and its impact on agriculture sector. It is a fact that there exist a shortage of labour due to migration from rural to urban areas in search of better wages, secured income and better job opportunities. Of course, it has affected farming community to find labours for timely agricultural operations. As an alternate, farmers are moving towards farm mechanization though it is a costly affair but, bring a significant improvement in agricultural productivity. This has resulted a potentially vast opportunity for farm equipment makers. The population dynamics and labour shifts have led to changing farm landscape in India. There is a strong evidence to indicate that the technological parameters such as cultivated area, cropping intensity, higher use of inputs, etc., have increased numbers/ quantities of labour while mechanization and use of herbicides significantly reduced employment opportunities in these parameters. The interplay of these factors resulted in net decline in the human labour requirements. As compared to the traditional farm, less number of labours per hectare is required to complete the production process in the mechanized farm. However, farm mechanization has to go a long way in identifying, designing, manufacturing, and up scaling of the specially designed machines suitable to local topography and crop structure in consideration with social and environmental factors. The increased use of farm machines have found an expression in the phenomenal expansion of cropped area, cropping intensity and the country's agricultural yield. This shift has also helped in diversification of agriculture from conventional crops to commercial crops. It is also found that the farm mechanization improves the utilization efficiency of inputs like fertilizers, agro-chemicals and reduces the negative impact on environment. The study revealed that, the average cost of cultivation of paddy was Rs.117323 per hectare in partially mechanized farms which was higher than that of mechanized farms (Rs.105406/ha). The gross and net returns of paddy were higher in case of mechanized farms (Rs.157738/ha and Rs.51278/ha). The returns over variable cost and the returns per rupee of expenditure were higher in case of mechanized farms (2.35 and 1.48) than partially mechanized farms (2.17 and 1.39). In jowar, the cost incurred on human labour was Rs. 6941 in partially mechanized farms, while it was Rs. 5922 in the case of mechanized farms. The cost of cultivation of jowar was Rs.48759 per hectare in partially mechanized farms which was slightly higher than that of mechanized farms (Rs. 48068/ha). The gross returns from partially mechanized and mechanized farms of jowar were Rs. 73425 and Rs. 75327 per hectare, respectively.



## Onion detopping machine: Bench work to Start up

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### ABSTRACT

Onion is the one of the important vegetable crops cultivated in India. Multiplier type onion (*A. cepa* var. *aggregatum*) is one among the three (common onion, rose onion and multiplier onion) major types onions. Detopping is one of the on farm processing carried out after harvest and it is removing of the leaves from the onions. Presently this is done manually by farm women, individual onions are picked and detopping is done by using sickle. This is time consuming and highly drudgery in nature. ICAR-Indian Institute of Horticultural Research, Bengaluru designed and developed an onion detopping machine to detop the harvested and cured onion crops. The prototype machine had a capacity of 50 kg/h against 20 kg/h of manual practice. The machine was demonstrated to the onion growing farmers and it was expressed that the machine needed to be scaled up for commercial adoption. Hence, a commercial model with a capacity of 300 kg/h was developed, demonstrated and the video was uploaded in youtube. The machine is operated by three electrical motors of 3 kW, three phase electrical power. The electrical energy consumption is 1 kWh. This *aggregatum* type onions are grown in Nagamangala (Tq.), Mandya (Dist.) of Karnataka State. An entrepreneur from this region installed this machine during 2019 and running asuccessful custom hiring enterprise to the onion growing farmers of this region. By witnessing the success of this enterprise, another entrepreneur from the same region installed another machine during 2020 and was also successful enterprising. The entrepreneursstated that the operational cost by machine is Rs. 2000/tonne against Rs. 5000/t by manual detopping. As the onion growing farmers of this region are marginal and small farmers, the farmers are highly benefited by these startups by using the machine on custom hiring basis.Fabrication and supply of detopper is also another agristartupavenue for the unemployed youth by taking license from ICAR-IIHR, Bengaluru.

**Keywords:** Multiplier onion, onion machinery, onion detopping, onion cleaning, Agri-enterprising, Agri start-up



### **Optimizing sowing and fertilizer applicator parameters by ANN model**

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### **ABSTRACT**

Increasing population with increasing demand for food is a major problem for the world. Advancement of agriculture becomes necessity for meeting global food demands and maximizing crop yield. Precise sowing and fertilizer application are important factors for maximizing crop yield. Seed drills and planters with different type metering mechanisms are used for sowing operations. Artificial Neural Network (ANN) is suitable for dealing with complex systems than that of traditional mathematical methods. A 3-5-1 ANN model was developed for predicting the cell fill of an inclined plate seed metering device, and the Particle Swarm Optimization (PSO) algorithm was applied to obtain the optimum values of the operating parameters corresponding to 100 per cent cell fill. The results found that the most appropriate optimal values of the forward speed of operation, the seed metering plate inclination and the seed level in the hopper for achieving 100 per cent cell fill were found to be 3 km h<sup>-1</sup>, 50-degree and 75 per cent of total height, respectively. The proposed integrated ANN-PSO algorithm was capable of predicting the optimal values of operating parameters with a maximum deviation of 2 per cent compared to the experimental results.

**Keywords:** ANNs, PSO, sowing, fertilizer application





### **Soil and plant health management by artificial intelligence**

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### **ABSTRACT**

Agriculture plays a significant role in the economic sector. The automation in agriculture is the main concern and the emerging subject across the world. The population is increasing tremendously and with this increase the demand of food and employment is also increasing. The traditional methods which were used by the farmers, were not sufficient enough to fulfill these requirements. Thus, new automated methods were introduced. These new methods satisfied the food requirements and also provided employment opportunities to billions of people. Artificial Intelligence in agriculture has brought an agriculture revolution. This technology has protected the crop yield from various factors like the climate changes, population growth, employment issues and the food security problems. Analysis of soil properties essential nutrients and micronutrients affects the growth of crops by using Back Propagation Neural Network (BPNN) was used for correct correlation percentage among these properties. The results showed that modal accuracy of one region and recognising the soil properties relevant to plant growth and protection compare to traditional used methods. These technologies saves the excess use of water, pesticides, herbicides, maintains the fertility of the soil, also helps in the efficient use of man power and elevate the productivity and improve the quality.

**Keywords:** ANNs, BPNN, herbicide, plant health management, pesticide

**Pollination potentiality of stingless bee, *Tetragonula iridipennis* (Smith) in Capsicum (*Capsicum annuum* L.) under protected cultivation at GKVK, Bengaluru, Karnataka**

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**ABSTRACT**

Capsicum (*Capsicum annuum* L.) is cultivated and consumed worldwide, due to its economic and nutraceutical importance and intensively cultivated under controlled conditions (Reifschneider, 2000; Nannetti, 2001). Although its flowers are largely self-pollinated, studies show that bee pollination will have a positive impact on fruit quality (Jarlanet *al.*, 1997). Therefore, this study aimed to investigate the utility of stingless bee, *Tetragonula iridipennis* (Smith), on fruit yield parameters of capsicum, hence three hybrids (“*ArkaAthulya*”, “*Gemgold*” and “*Delisha*”) were raised under polyhouse and bee colonies were introduced during flowering and control treatments without stingless bee colonies were also maintained for comparison. In all the three hybrids, bee visitation was negligible and there was no significant difference between the treatments and control w.r.t. fruit yield, fruit length, fruit diameter and number of fruits/plant. The possible reasons for low bee visitation of capsicum could be poor nectar quality (greater pungency) and the self-pollinated nature of the crop. Similarly, McGregor (1976) also reported that relatively lower visitation of foragers on capsicum could be due to less attractiveness of capsicum flowers to pollinators, while Crane (1990) also reported low attractiveness of capsicum nectar to bees due to its lower sugar composition and concentration, since honeybees do not usually collect nectar with less than 13 per cent sugars (Lensky, 1964).

**Key words:** Capsicum, Stingless bee, pollination, polyhouse,

**Study on stigma receptivity and effect of fruit picking in King Chilli (*Capsicum chinense* Jacq.) for hybrid seed production**

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**ABSTRACT**

This study was proposed and conducted to standardized the best time of pollination and stage of picking fruits in King Chilli (*Capsicum chinense* Jacq.) under low cost polyhouse conditions. Both the parameters *viz.*, time of pollination and stage of picking are important as it positively influence fruit set and seed yield. The results of the study indicated that for hybrid seed production of King Chilli under polyhouse conditions, the pollination carried out between 9.00 to 10.00 am exhibited higher fruit set (40.1%), average fruit weight (14.2g), 1000-seed weight (3.20g), average seed weight per fruit (0.15g), number of seeds per fruit (73), fruit yield per plant (4.96 kg) and seed yield per plant (4.54g) as compared to the pollinations done before and after this time. Also, second picking fruits were found better in these seed yield parameters when compared to early and late pickings. The interaction effect was also significant for these two parameters.

**Key words:** King Chilli, seed yield, pollination, fruit set percentage, polyhouse



**Cryobiotechnological tool: Cryopreservation of *in vitro* grown shoot tips of grape  
(*Vitisvinifera* L.) cv. Fantasy seedless**

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**ABSTRACT**

Cryotherapy is a relatively new application of plant cryopreservation techniques that consists in a promising tool, coupled with meristem culture, for achieving in a short time, high frequency of regenerating plants free of viruses. Cryoprotectants should be prevention of intracellular ice crystal formation, should be biologically acceptable, must be able to penetrate into the cells and should be less toxic. Vitrification, encapsulation – dehydration, encapsulation – vitrification and droplet vitrification are approaches to achieve a successful cryopreservation. Cryotherapy based procedures can be easily implemented in healthy plant production and long term germplasm conservation. This technique facilitates the treatment of large numbers of samples, result in remarkable frequencies of pathogen-free plants and prevent the difficulties associated with the excision of small shoot tips. Axillary shoot tips of *in vitro* grape (*Vitis vinifera* L. cv. Fantasy Seedless) were successfully cryo-preserved by vitrification. Axillary shoot tips were excised from 5 month old plantlets and were cultured on solidified MS medium. Shoot tips were pre cultured on 0.3 M sucrose for 3 days and then treated with dehydrated with PVS2 for 60 min at 0<sup>0</sup> C before plunged into liquid nitrogen for 1 hr. Samples were then warmed rapidly in water. The recovery of shoot tips 70 per cent. Half strength PVS2 solution was used to improve the further recovery and longterm storage of shoot tips.

**Key words:** Cryotherapy, Cryo-protectant, Vitrification, Encapsulation, Cryopreservation and shoot tip



**Studies on red and white type Dragon fruit as influenced by organic manures and bio-fertilizers on flowering attributes**

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**ABSTRACT**

An investigation was carried out to study the flowering behavior of red and white types of dragon fruit as influenced by different organic manures and bio-fertilizers. The experiment was conducted in farmer field at Suradhenupura village, Bengaluru Urban during 2019 to 2021. The experiment consisted of thirteen treatments and replicated thrice using Randomized Complete Block Design (RCBD). The pooled data from two successive years for red fleshed and white fleshed dragon fruit revealed that treatment T<sub>13</sub> comprising of 100 per cent N through vermicompost + PSB at 10 kg ha<sup>-1</sup> + VAM at 10 kg ha<sup>-1</sup> had significantly greater impact on flowering parameters like days to first flower open (418.74 and 441.77 days), duration of flowering (9.61 and 9.32 hours), number of flowers per plant (12.17 and 9.33), length of the flower (27.24 and 25.63 cm) and breadth of the flower (15.158 and 15.058 cm).

**Keywords:** Dragon fruit, organic manures, bio-fertilizers, VAM, PSB



**The performance of papaya (*Carica papaya* L.) on application of different growth promoting substances under different growing conditions**

Jasmitha, B. G., Honnabyraiah, M. K and Manjunath, G.

**ABSTRACT**

An experiment entitled “The performance of papaya (*Carica papaya* L.) on application of different growth promoting substances under different growing conditions” was carried out during 2020-22 at Yelwala, Mysuru. The experimental was laid out by adopting Factorial Randomized Block Design (FRBD) comprising of two factors with three replications. The experiment was carried out to study the comparative performance of papaya cv. Arka Prabhath under two different growing conditions viz., insect proof net and ( $G_1$ ) and open condition ( $G_2$ ) with an application of different growth promoting substances ( $T_1$ ). Among the different growing conditions and treatments, the application of 100 per cent of RDF through Fertigation + Trichokavach (50g/plant) + Chitosan (20 g/plant) and spray (0.2%) + Seaweed extract (20 g/plant) and spray (0.2%) + *Penicillium pinophilum* (20 g/plant) + *Pseudomonas putida* (4 ml/L) + Phosphoric acid (20 ml/ plant) + Salicylic acid (300 ppm) + Neem cake (250 g) + VAM (5 g/plant) + Power plus (5 ml/L) + Vermicompost (3 kg) + Micronutrient spray (4 g/L) recorded the maximum plant height (272.61 cm) and plant girth (48.23 cm) at 360 DAP under insect proof net. Further, the same treatments recorded the maximum number of fruits per plant (65.36), fruit set percentage (81.16 %), average fruit weight (1845.25 g), yield per plant (134.01 kg) and hectare (335.03 t), fruit length (26.75 cm), volume (1824.10 ml), firmness (6.64 kg/cm<sup>2</sup>), seed content (515.26), pulp and peel weight (1745.23 and 100.02 g respectively) as compared to open condition.

## Field evaluation of *in vitro* derived mutants of different varieties of banana on biochemical and quality traits

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### ABSTRACT

Banana is an important fruit crop with year round availability it is also called Adam's fig. Botanically, banana fruit is a wonder berry, which forms the staple food of millions of people across the globe providing more balanced food than any other fruit or vegetable. As a dessert, banana is more filling, easy-to-digest, fat-free, rich source of carbohydrates and free from sodium, making it salt-free food fruit. They are rich in easily digestible carbohydrates with a calorific value of 67-137/100 g fruit. It is a monocotyledonous herbaceous plant belonging to the section *Eumusa* under the family Musaceae. It is a monocot with underground modified stem. Physical and chemical mutagenesis is a simple approach to create mutation in plants for the improvement of yield traits like bunch weight, length of finger and quality parameters like TSS, Total sugars and pulp weight. The main advantage of induced mutations in vegetatively propagated plants is the ability to change one or a few characters of an outstanding cultivar without altering the remaining genetic background (Kulkarni *et al.*, 2007). The physical mutagens of different dosages of 25Gy, 30Gy, 35Gy, 40Gy 45Gy and chemical mutants like EMS@0.60%EMS@0.90% Sodium Azide@0.02%&0.03%, BAP@15mg/L and BAP@20mg/L were used and *in vitro* lines of Yelakkibale, (75 mutant lines) Rajapuri bale (53 mutant lines) & Nanjanagudu Rasabale (28 mutant lines) are field evaluated. Among the different lines YB40Gy-06 (28.60 °B) recorded maximum TSS among all mutant lines. whereas in Rajapuri bale RAJ40Gy-02 (26.70 °B), in Nanjanagudu rasabale NR40Gy-05 (26.10 °B). The maximum total sugars was recorded in YB45Gy-15 (25.58%), the minimum total sugars was recorded in RAJ45Gy-10 (15.40%), in ratoon crop, the maximum total sugars was recorded in YB40Gy-06 (24.78%) the minimum total sugars was recorded in YB45Gy-06 (16.25%). In plant crop, The maximum reducing sugars was recorded in RAJ35Gy-12 (22.34%). the minimum reducing sugars was found in RAJ45Gy-10 (11.82%). In plant crop, the maximum non reducing sugars was recorded in RAJ40Gy-02 (8.50%) the minimum non reducing sugars was recorded in YB BAP20-2 (1.21%).

**Keywords:** Banana, *in vitro*, physical mutants, TSS, total sugars, chemical mutagens



### **Hi-tech horticulture: Way forward**

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#### **ABSTRACT**

In recent years, with the increase in population, there is also rise in the demand for food and nutritional security. Modernizing horticulture technologies is necessary since the traditional farming practices cannot meet the rising demand. Hi-tech Horticulture is a knowledge-based horticulture system which makes use of technology to increase the value and quality of farm produce. It is a modern technology that is less environment-dependent and capital intensive and capable of improving productivity and farmers' income. It has overcome a barrier of agro-climates making most of the vegetables and other horticultural products available to the consumers in all calendar months at a premium price. The techniques encapsulated in hi-tech horticulture include use of genetically modified (GM) crop varieties derived from biotechnology and genetic engineering, protected cultivation, organic farming, precision horticulture, micro-propagation, integrated nutrient, water, weed and pest management, use of modern immune-diagnostic techniques for quick detection of viral diseases, high density planting, post-harvest techniques including cold chain, hydroponics, aeroponics, vertical farming, robots, drones, sensor networks, cloud computing, controlled area network and technologies like Geographical Information System (GIS) Global Positioning System (GPS) etc. It has many advantages over conventional horticultural practices such as yield increased up to 3 to 4 times, input saving (fertilizers saved up to 25 %), off-season production, reduced impact on the natural ecosystem etc.

**Keywords:** Hi-tech, horticulture, productivity, techniques, nutritional security

## Effectiveness of different mordants and concentrations on the dyeing properties of cashewnut peel on silk

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### ABSTRACT

Considering the different health and ecological benefits of natural dyes over the synthetic dyes, recently commercial dyers and textile export houses have started re-looking to the maximum possibilities of using natural dyes for dyeing and printing of different textiles and for targeting niche market. Cashewnut peel (red skin) is an important food processing waste and at the same time has dyeing characteristics. It is reported that 1 kg cashew kernel contains about 80 g peel. If this can be channelized for preparation of natural dyes, it can add to the income of the processor and also reduce the problems of disposal of these products. In view of this, a study was carried out for studying the dyeing characteristics of cashewnut peel on silk.

Aqueous extraction method was employed for obtaining the dye. The extraction parameters were studied and optimum dye extraction condition was examined under UV-Visible spectroscopy. The dye was used on silk fabric without mordant and with five different mordants using different concentrations. The mordants used were alum ( $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ ), copper sulphate ( $CuSO_4$ ), aluminum sulphate ( $Al_2(SO_4)_3$ ), citric acid ( $C_6H_8O_7$ ), and Ferrous sulphate ( $FeSO_4$ ), each at concentrations of 1%, 3% and 5%. The color strength, values and washing fastness, rubbing fastness and light fastness properties of the dyed samples were analysed as per international standards. It was observed that the cashewnut peel could be used for dyeing the silk fabric with good fastness properties. The effects of different concentrations for the mordants was also studied.





**Conjunctive use of microbial and seaweed extract-based bio-stimulants improved soil fertility, fruit yield, quality and net returns in pomegranate (*Punica granatum* L.)**

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**ABSTRACT**

Continuous use of chemical fertilizer has created stagnation in pomegranate yield besides impacting the environment adversely. Being environment friendly, now-a-days bio-stimulants are increasingly used as an effective means of improving productivity of crops but their uses in pomegranate have not been fully explored. Two years field experiments were conducted on a 5-years old pomegranate cv. Bhagwa orchard to investigate the effects of different doses combination of commercial bio-stimulant products namely, microbial based Cradle (5 kg ha<sup>-1</sup>), seaweed extract based Nanozim xtrude (30 kg ha<sup>-1</sup>), Nanozim drip (625 and 1250 ml ha<sup>-1</sup>) through soil application, Nanozim delite (1 and 2 g l<sup>-1</sup>) and Nanozim fruit (1 ml l<sup>-1</sup>) through foliar sprays on soil fertility, trees' nutrition, fruit yield and quality of pomegranate. The results indicated that use of bio-stimulants significantly increased the number of bisexual flowers. However, the combined use of Cradle @ 5 kg ha<sup>-1</sup>, Nanozim drip @ 625 ml ha<sup>-1</sup> and Nanozim delite @ 1-2 g l<sup>-1</sup> increased fruit yield by 41.97-51.61% with increase in the proportion of exportable grade fruit (by 23.08-33.38%) and improved fruit quality attributes viz. ascorbic acid, anthocyanin, non-reducing sugar, protein, and mineral content of P, K, Fe, Mn and Zn in the fruits through enhancement in soil fertility and trees' micronutrient status. Their use gave rise to higher net return and benefit-cost ratio of 2.10-2.34:1. So, the microbial and seaweed extract based bio-stimulants could be used in right dose combination to enhance quality pomegranate production while keeping environment green and clean.

## Intelligent process automation in phenotyping drought stress response in horticultural crops

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### ABSTRACT

High throughput plant phenotyping platforms revolutionized the assessment of plant growth dynamics and identifying its prominent traits through imaging technique. Image-based plant phenotyping is highly successful due to the high resolution imaging and novel sensor technology. Existing phenotyping platforms that are designed for controlled and field conditions are highly expensive. UAV based phenotyping are popular in field phenotyping whereas it captures only the top view images of the crop. In this study, we designed an automated high throughput plant phenotyping platform for field-based horticultural crops with an option to mount different spectral cameras on a tripod and operated through the laptop. The adjustable tripod captures the side view images as well the top view images of the plant and gets stored. An image analysis pipeline has been built incorporating the machine vision technique to automatically analyze the captured images to derive valuable genotypic information. Using this platform, 26 tomato genotypes grown at 100% and 50% field capacity were screened using visual as well as infrared spectral cameras. The genotypic differences under control, stress and recovery with respect to the digital parameters viz., digital biomass, convex hull area, compactness and canopy temperature observed in the study are discussed.

**Keywords:** Machine vision, automated platform, digital biomass

## Study on the compatibility of the tomato scions with different solanaceous rootstock

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### ABSTRACT

To study the compatibility of tomato scions with different solanaceous rootstocks, an experiment was conducted in the field of Centre of Excellence and PCPF, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the year 2020-21 and 2021-2022. Two scions of tomato Yuvraj and Suraj and five rootstocks viz., Pant T3, *Solanum lycopersicum* var. *cerasiforme*, *Solanum torvum*, Solmel brinjaland Garcia chilliwere used. Among the rootstocks Pant T3 took less time to germinate and shows maximum germination percentage after sowing whereas, in between scions Yuvraj took less days to germinate and shows highest germination percentage. Less number of days for graft union as well as for graft hardening was observed in the graft combination YT3 (Yuvraj grafted onto *Solanum lycopersicum* var. *cerasiforme*). Maximum graft success percentage as well as minimum mortality rate shows in graft combination YT1 (Yuvraj grafted on *Solanum torvum*). After transplanting the grafted plants the maximum survival percentage was shown in graft combination YT1 (Yuvraj grafted on *Solanum torvum*). Performance of the combination of Yuvraj grafted with *Solanum torvum* rootstock performed well under field condition after transplanting.

**Keywords:** Compatibility, germination, graft, hardening, *Solanum torvum*, tomato, Yuvraj.

## Screening of mango germplasm against different pests of mango

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### ABSTRACT

The field experiment was conducted at the College of Agriculture, Anand Agricultural University, Jabugam (Middle Gujarat, Zone - III) in 2021. The germplasm of Kesar, Dasher, Rajapuri, Alphanso, Neelam, Sonpari, Jabugam Mango Selection, Ratna were screened against pests such as, Mango Hopper, Thrips, Leaf Gall Midge, Fruit fly. The result indicated that the lowest mango hopper population (3 hoppers/twig or panicle) was observed in Dashehari followed by Kesar and Amrapalli. The remaining germplasm were moderately susceptible whereas the highest infestation of hoppers (11 hoppers/twig) was recorded in Alphanso. However, Fruit fly damage was highest (approx.38.13%) in Alphanso followed by Kesar and were considered as highly susceptible entries. The remaining entries were found moderately susceptible to the pest indicating lowest damage (approx.9.64%) in Totapuri. However, the highest infestation of thrips (21.00/ twig or panicle) was recorded in Neelam. They were considered as highly susceptible entries. The lowest infestation was found in Totapuri. Moreover, all the Mango germplasm suffered heavy infestation from Mango Leaf Gall Midge damage and were considered highly susceptible entries, however lowest damage (approx.15%) was observed in Jabugam Mango Selection - 4, while it was highest (approx.59.16%) in Sonpari.

**Keywords:** Hopper, thrips, leaf midge, fruit fly

### **Constraints faced by the Mango Growers in adoption of selected mango production technologies**

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#### **ABSTRACT**

The present study was conducted in Ratnagiri and Sindhudurg districts of Konkan region of Maharashtra state with the major objective to study the constraints faced by the mango growers in adoption of selected mango production technologies developed by DBSKKV. The sample was comprised of randomly selected 240 mango growers from 48 villages in six tahsils from two districts, which was personally interviewed with the help of specially designed interview schedule. The statistical tools like frequency and percentage were used for analysis. The constraints analysis revealed that majority of the mango growers had faced the constraints like, dependency on nature, non-availability of skilled labour during peak period, difficulty in getting inputs in time, no choice for selection of input, high fluctuations in the market price, market price depend on broker and difficulty in get branded insecticides and pesticides.

**Key words:** Constraint, adoption, mango production technologies

### **Effect of bio-digester liquid manure on growth, yield and quality of capsicum under polyhouse condition”**

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#### **ABSTRACT**

The present investigation was carried out in the completely randomized block design with eight treatments and three replications during the *Kharif* season in the year 2018. Growth parameters *viz.*, plant height (75.4, 111.53, 124.20, 134.7 cm at 30, 60, 90 and 120 DAT respectively) and number of branches per plant (8.51, 15.74, 21.37 at 60, 90 and 120 DAT respectively), number of leaves per plant (23.67, 55.07, 83.33 and 98.67 at 30, 60, 90 and 120 DAT respectively) were higher under polyhouse condition in plants received with 100% RDF+20% RDF through bio-digester liquid manure at 7 days interval through drip fertigation compared to other treatments and the same treatment (T<sub>4</sub>) recorded significantly higher leaf area (101.3 cm<sup>2</sup>) and dry matter accumulation per plant (162.67 g). The highest number of flowers per plant (35.93), per cent fruit set (39.00), less number of days taken for first flowering (29.00 days), first fruit set (6.33 days) and first harvest (56.46 days) were recorded in capsicum with the treatment consisting of application of 100% RDF+20% RDF through BDLMat 7 days interval through drip fertigation under polyhouse condition. The investigation revealed that, application of 100% RDF+20% RDF through BDLM at 7 days interval recorded the highest growth, yield and quality of capsicum under polyhouse condition.

**Key words:** Capsicum, polyhouse, bio-digester liquid manure, growth, yield, quality

**Effect of integrated nutrient management on productivity and profitability of underexploited vegetable Yardlong bean (*Vigna unguiculata sub sp. sesquipedalis* (L.) *Verdc.*)**

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**ABSTRACT**

The present experiment was conducted during *Kharif* 2020-21 and 2021-22 at Zonal Agricultural and Horticultural Research Station, Shivamogga, Karnataka, to evaluate the effect of Integrated Nutrient Management on growth and yield of underexploited crop Yardlongbean cv. Arka Mangala under naturally ventilated polyhouse. The experiment was laid out in Randomized complete block design (RCBD) with three replications and eight treatments viz.  $T_1$  – 100 % Recommended Dose of Fertilizer (RDF),  $T_2$  -100 % RDF + Effective Microbial Consortia (EMC) + Vegetable Special (VS),  $T_3$  - 125 % RDF,  $T_4$  - 150 % RDF,  $T_5$  - 175 % RDF,  $T_6$  - 125 % RDF + EMC + VS,  $T_7$  – 150 % RDF + EMC + VS,  $T_8$  - 175% RDF + EMC + VS. The integrated treatment combinations involve both organic and inorganic source of nutrients which significantly influenced the growth and yield attributes. The results from the pooled data of two years revealed that, all the growth and yield traits were markedly affected by the integrated nutrient management practices. Among different treatments, significantly higher plant height (247.96 cm), number of primary branches (8.54), initiation of flowering (38.29 d), fifty percent flowering (43.48 d), days to first harvest (52.83d), number of pods per plant (25.17), pod length (74.56 cm), pod girth (3.98 cm), average pod weight (35.54g), yield per plant (664.17 g) and higher pod yield per 1000 m<sup>2</sup> (2171.96 kg) were recorded with treatment 150% RDF + EMC + VS. Thus Integrated Nutrient Management practices increased the growth and yield attributes of Yardlongbean and among compared treatments,  $T_7$  – 150% RDF + EMC + VS, found to achieve the maximum productivity of Yardlong bean. The evaluation of production economics revealed that growing of Yardlong bean with said treatment ( $T_7$ ) could be the most remunerative option with a highest benefit: cost of 3.15.

**Key words:** Microbial consortia, nutrient management, protected cultivation, Yard long bean

**IMPACT OF DIFFERENT COLOUR LOW TUNNEL SHADE NETS AND MULCHES  
ON GROWTH AND YIELD OF CHRYSANTHEMUM (*Chrysanthemum indicum* L.)  
UNDER RAICHUR CONDITIONS**

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**ABSTRACT**

India is a land of diverse agro climatic zones and each of these zones offer a great potential for cultivation of wide range of crops across all seasons. Flowers form major and important part of our daily requirement, which are widely grown in the rural and peri-urban areas. Low tunnel horticulture technology including protected cultivation of high value and exotic flowers has been on the increase, targeting high end domestic and export markets. The present experiment was conducted to study the impact of different colour low tunnel shade nets and also different mulches on chrysanthemum. The experiment consisted of twenty treatments and two replications. The design adopted for this experiment was split plot design consisting of different colour low tunnel shade nets and mulches. The main treatments were white, green, black shade nets and open field conditions. The sub treatments were white, silver, black colour plastic mulch, jute mulch and no mulch. The result exhibited maximum plant height (38.52 cm), number of branches per plant (10.70), plant spread (40.88 cm), leaf area index (2.04) and chlorophyll content (48.78), yield per ha (8.72 t ha<sup>-1</sup>) and WUE (28.78 kg ha<sup>-1</sup> mm<sup>-1</sup>) in the treatment consisting of white colour low tunnel shade net. The black colour low tunnel shade net exhibited minimum values for all these parameters. Among the different mulches, the maximum plant height (39.89 cm), number of branches per plant (11.70), plant spread (40.88 cm), leaf area index (2.04) and chlorophyll content (47.38), yield per ha (8.81 t ha<sup>-1</sup>) and WUE (24.36 kg ha<sup>-1</sup> mm<sup>-1</sup>) in the treatment consisting of white colour plastic mulch. Without mulch treatment exhibited minimum values for all these parameters. The maximum benefit cost ratio (2.77) was recorded under white shade net with white plastic mulch. The minimum benefit cost ratio (0.87) was recorded under black shade net with no mulch.



## **ENVIRONMENTAL PARAMETERS UNDER DIFFERENT COLOUR LOW TUNNEL SHADE NETS WITH DIFFERENT MULCHES INFLUENCING THE GROWTH AND YIELD OF CHRYSANTHEMUM**

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### **ABSTRACT**

Low tunnel provides congenial environmental conditions for optimum growth and yield of crops particularly in dry arid regions. A research was taken up to study the effects of different colour low tunnel shade nets and different mulches on growth and yield of chrysanthemum at the fields of college of Agricultural Engineering, Raichur, University of Agricultural Sciences, Raichur. The experiment was conducted in split plot design consisting of low tunnel with different colour shade nets i.e., white colour, green colour, black colour and open conditions as main treatment and different colour plastic mulches i.e., white colour, silver colour, black colour, jute mulch and un mulched conditions. The treatments were replicated twice. During the experiment period, maximum temperature (37.90 °C) was recorded under control condition followed by black shade net (35.80 °C) and green shade net (34.60°C). Minimum temperature (33.00°C) was recorded under white shade net. Maximum relative humidity (86.20 %) was recorded under white shade net followed by green shade net (82.30 %) and black shade net (79 %). Minimum relative humidity (77 %) was recorded under control condition. Maximum light intensity (49600 Lux) was recorded under control condition followed by white shade net (46800 Lux) and green shade net (37,000 Lux). Minimum light intensity was recorded under black shade net (33210 Lux). The results of biometric parameters depicted higher growth and yield parameters for chrysanthemum grown under white shade net with white plastic mulch. Chrysanthemum grown in open fields and and without mulch produced lower growth and yield.

**Theme - 3**  
**Advances in Aquaculture Research towards**  
**Food and Nutritional security**



## Effect of milkfish produced Greenwater on fish growth, water characteristics and microbial load at varying stocking densities

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### ABSTRACT

A three-week experimental study was undertaken to assess the influence of stocking density of *Chanoschanos* fingerlings on their growth performance, production of greenwater, and water quality maintained at a low salinity of 10ppt. Milkfish fingerlings ( $1.98 \pm 0.15$ g) were stocked in 500 L FRP circular tanks at four stocking densities viz., 20 (T1), 40 (T2), 60 (T3), and 80 (T4) fish/tank using a completely randomized design. Regular sampling was done to assess the fish growth, water quality, microbial load, and algal density. At the end of the experimental period, T1 (20/tank) had higher growth performance, but not significantly different ( $P > 0.05$ ) from T2 (40/tank). FCR was recorded better in T1 and T2 and tend to increase at higher stocking density. Water quality parameters such as temperature, pH, and dissolved oxygen were maintained within the optimal range throughout the experimental period. Ammonia and nitrite showed an increasing trend with an increase in stocking density. The total heterotrophic bacterial count (THB) in the water was highest in T2 ( $4.49 \pm 0.17$ ) whereas, the THB count in mucus was higher at increased stocking density in treatment-T4, which indicates that fish mucus harbors diverse and complex microbial community. The algal density among the different stocking densities were observed to be similar. Thus, it is concluded that *Chanoschanos* fingerlings stocked at a density of 40 fish/500 litre ( $80 \text{ fish/m}^3$ ) at 10ppt is optimal for better growth performance and production of greenwater with higher total heterotrophic bacterial count without affecting the water quality of the system.

**Keywords:** *Chanoschanos*, Stocking density, Growth, Microbial load, Greenwater, water quality.



## Role of lipids on fish reproduction

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### ABSTRACT

Lipids play important physiological roles in providing energy, essential fatty acids and fat soluble nutrients for normal growth and development of fish. Deficiency of dietary lipid may increase the use of protein for energy and result in the increase of ammonia excretion and thus water pollution. The key nutritional components of broodstock diet that affect effective reproduction and progeny survival have been identified as lipid and fatty acid content. Even during the spawning season, several fish species rapidly absorb dietary unsaturated fatty acids into eggs. The dietary protein and lipids levels influence oocyte development and egg quality. Lipids and their fatty acid composition have essential and dynamic roles in the maintenance of optimum growth, feed efficiency, health, kidney and gill function, neural and visual development, reproduction, and flesh quality (market size) of finfish species. Provision of lipids to oocytes, followed by storage and accumulation in the yolk and subsequent utilisation by developing embryos are essential processes in reproduction and development. Studies in the past two decades involving a variety of farmed fish species have identified lipid and in particular polyunsaturated fatty acids (PUFA), as key nutrients affecting broodstock reproductive performances. Polyunsaturated fatty acid (PUFA) plays an integral role in regulating levels of eicosanoids, which in turn control selected stages of reproduction such as steroidogenesis and ovulation. EPA (eicosapentenoic acid) is known to be a precursor of prostaglandins (PG) from series III, whereas AA (Amino acids) is a precursor of PG from series II. AA, EPA or DHA, stimulates testicular testosterone in goldfish testis through its conversion to prostaglandin PGE<sub>2</sub>.

**Key words** – Reproduction, Broodstock, Poly-unsaturated fatty acid.

## ASSESSMENT OF SOCIO-ECONOMIC STATUS OF FISHERMAN COMMUNITIES OF THE KOLAR RIVER AT BHOPAL REGION.

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### ABSTRACT

The Kolar River's banks are home to several fishing settlements where fishing is a significant source of income. The purpose of this study was to gather data on the economic and livelihood circumstances of these fishing villages in order to identify important concerns that might be taken into consideration in sustaining their way of life and ensuring their engagement in fish biodiversity conservation. An administered questionnaire to the fisherman was used to gather data households residing along the chosen river's both banks in a single "snap-shot" survey.

**Key words:** Kolar river , fish biodiversity, socio economic status, fisherman livelihood .

### Establishment and Characterization of Cell Culture System from Gill Tissue of *Amphiprionpercula* (Lacepede, 1802)

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### ABSTRACT

The orange clownfish, *Amphiprionpercula* is one of the most popular marine ornamental fish on the international market. The primary cell culture system was developed from the gill tissue of *A. percula* through the explantation method. The developed primary cell culture was maintained in Leibovitz's L-15 medium supplemented with 20 % Fetal Bovine Serum (FBS) and successfully subcultured for up to three passages. The established cells were characterized for species authentication by the amplification of mitochondrial genes such as Cytochrome oxidase subunit I (COI) and 16s RNA. The growth optimization of developed cells reveals their maximum growth at 28°C and 20 % serum. Karyotyping analysis of cells revealed 2n=48 diploid chromosomes. The cells were tested for gene expression studies by using pmaxGFP vector DNA and showed 8 % of transfection efficiency after 48 h post-transfection. The study revealed that the established cells would be important as *in vitro* tools for carrying out toxicological and biotechnological studies.

**Keywords:** *Amphiprionpercula*; Characterization; Gill; Transfection

## Utilization of fish processing waste for collagen production

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### ABSTRACT

The objective of the present study is to extract collagen from solids fish processing by-products like refiner discharge. Generally, scales and skins are mainly used for collagen production. Refiner discharge is a solid waste produce from surimi processing industries. Refining is a screening mechanism, where the minute scale, connective tissues and bones are separated from the mince. Refining mechanism in surimi manufacturing produces 15-22 % refiner discharge which constitutes 4-8 % connective tissue of the whole fish. Collagen was extracted from the pink perch surimi processing industries refiner discharge and examined their physicochemical properties. The refiner discharge constitutes muscle and connective tissues as major component (61.38 %). The yield of collagen was 11.00%. The denaturation temperature of the extracted collagen recorded from the DSC thermogram was 77.20°C respectively. The SDS-PAGE revealed that the collagen contain  $\alpha$  chain and their cross-linked chains ( $\beta$ ). The extracted collagen was rich in glycine followed by alanine, glutamic acid and proline. The FTIR spectra confirmed the presence of amide peak in the extracted collagen. The collagen was found to have foaming capacity and foaming stability of 50.55 and 44.79 % respectively. This result demonstrates refiner discharge can be exploited as an alternate raw material of collagen production.

**Keywords:** collagen, fish, surimi, refiner discharge, processing waste



## Physico-chemical, functional and sensory quality of coconut flour as influenced by drying method and its application in *Oreochromis niloticus* Tilapia fish sausage

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### ABSTRACT

Coconut-flour (CF) is produced from the meat residue of coconut milk industry. It is rich in dietary fibre and anti-oxidants. Effect of different drying methods on the properties of CF and its use in fish sausage has not been reported. In this study, physico-chemical, functional and sensory acceptability of coconut-flour as influenced by drying methods (sun drying-SCF, oven drying-OCF, vacuum drying-VCF and freeze drying-FCF) was evaluated. Compared to commercial-CF (11%), lab-produced CFs had almost 4 fold higher fat. The physico-chemical properties of CFs were unaltered significantly by the method of drying. However, sensory analysis of the CFs revealed that OCF was better. Later, OCF was incorporated in Tilapia fish-sausage (OCS) and the properties were compared with corn-flour (CNS) and commercial-CF (CCS). Addition of commercial-CF and OCF increased protein content of OCS and CCS from 12.67% to 21.33 and 20.26%, respectively. Highest gel-strength and springiness index was recorded for OCS and CNS, respectively. Folding test and sensory analysis suggested that the CCS was better in terms of texture and organoleptic properties. The fat content and particle size of CF should be controlled to produce organoleptically acceptable fish sausage and CF could be a better alternative to corn flour in fish sausage.

**Key words:** Coconut milk industry waste; coconut flour; value addition; functional ingredient; healthy fish sausage; and Tilapia sausage.

### SUSTAINABLE FISHERY RESOURCE MANAGEMENT & DEVELOPMENT IN HALDIA, WEST BENGAL

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### ABSTRACT

Freshwater aquaculture is one of the fastest-growing sectors in Haldia, West Bengal and has the potential for large scale employment. The present case study is based on the field survey in different villages of Haldia Block of Purba Medinipur District of West Bengal. It is found that, by adopting an integrated diversification strategy consisting of the culture of endangered indigenous fishes, new species & genetically improved fishes along with Carps in composite culture ponds is resulted in more production & extra income. Haldia's fish farmers are the pioneer in the state to start such type fishes i.e. Pengba, Amur Common Carp, Milk fish, Karimeen, Labeo fimbriatus, GI Scampi, Genetically Improved Farm Tilapia (GIFT), American Pomfret etc fish farming which is becoming very acceptable to fish farmers across the state. Not only male fish farmers, female fish farmer also recognized as the best fish farmers in the state and nationally which further motivates farmers' community. It is concluded that the success of fish farming as a business depends mostly on its scientific culture practice and efficient farming strategy, which is assist not only in individual socio-economic development but also the economic growth of the this area as a whole.

**Keywords:** Sustainable aquaculture, Haldia, Rural livelihood.

**First report on isolation of *Aeromonas salmonicida* subspecies *salmonicida* from aquaculture environment in India: Polyphasic identification, virulence characterization and antibiotic susceptibility**

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**ABSTRACT**

This study reports for the first time the polyphasic identification, characterization of virulence potential, and antibiotic susceptibility of *Aeromonas salmonicida* subspecies *salmonicida* COFCAU\_AS, isolated from an aquaculture environment in India. The physiological, biochemical, 16s rRNA gene sequencing, and PAAS PCR test identified the strain as *Aeromonas salmonicida*. The MIY PCR tests established the subspecies as '*salmonicida*'. The *in vitro* pathogenicity tests showed the test bacterium as haemolytic with casein, lipid, starch, and gelatine hydrolysis activity, indicating its pathogenic attributes. It also showed the ability to produce slime and biofilm, and additionally, it possessed A-layer surface protein. *In vivo* pathogenicity test was performed to determine the LD<sub>50</sub> dose of the bacterium in *Labeorohita* fingerlings, which was found to be 10<sup>6.9</sup> cells fish<sup>-1</sup>. The bacteria-challenged fingerlings showed skin lesion, erythema at the base of the fins, dropsy, and ulcer. Almost identical clinical signs and mortalities were observed when the same LD<sub>50</sub> dose was injected into other Indian major carp species, *L. catla* and *Cirrhinus mrigala*. Out of the twelve virulent genes screened, the presence of nine genes viz., *aerA*, *act*, *ast*, *alt*, *hlyA*, *vapA*, *exsA*, *fstA*, and *lip* were detected, whereas *ascV*, *ascC*, and *ela* genes were absent. The *A. salmonicida* subsp. *salmonicida* was resistant to antibiotics such as penicillin G, rifampicin, ampicillin, and vancomycin while highly sensitive to amoxycylav, nalidixic acid, chloramphenicol, ciprofloxacin, and tetracycline. Taken together, the findings revealed that the *A. salmonicida* subsp. *salmonicida* was a virulent pathogen and could cause significant mortality and morbidity in Indian major carps. The presence of this virulent pathogen in a tropical aquaculture environment is alarming and thus has great economic significance.

**Keywords:** COFCAU\_AS; *in vitro* and *in vivo* pathogenicity, virulence genes, antibiotics susceptibility, Indian major carps

## Impact of high temperature stress on growth and yield cauliflower

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### ABSTRACT

India is the third largest producer of cauliflower with a productivity of 18.85 Mg ha<sup>-1</sup>. But as it is very sensitive to temperature changes, the quantified information on temperature effects on growth, development and yield of cauliflower is needed for varietal improvement and management optimization. Thus, the present study was conducted to quantify the growth, development, yield and physiological response of cauliflower to temperature stress. In a field experiment during winter season (October-December) of 2018, cauliflower cultivars, Pusa Sharad, Pusa Hybrid 2 and Pusa Ashwini were subjected to six treatments viz., i) ambient temperature (26.9/10.1°C), ii) high temperature (~2 °C above ambient) from planting to curd initiation iii) high temperature (~2 °C above ambient) during curd development phase iv) plants grown in temperature tunnels from transplanting to harvest at ~1.5°C, v) ~2.0°C, and vi) ~3.0°C higher than ambient in three replications in a total of 54 plots that were maintained in open field, temperature chambers as well as in temperature gradient tunnels. Results indicated that the high temperatures coinciding curd development phase resulted in premature bolting of curds, enhanced leaf area index, but reduced total dry matter and the curd yield, though the harvest index is high. From the results it is concluded that yield in plants exposed to high temperature stress during curd development phase is affected more than in those exposed during vegetative phase, which have no significant influence on curd yield but the curd initiation is delayed. However, crop exposed to high temperature stress (28.4-30/12.1-14.1°C) for entire growth period has less yield as compared to that grown in ambient (26.9/10.1 °C) conditions. Among the cultivars, Pusa Hybrid 2 is more suitable for changing climatic conditions as it out performed other two cultivars when exposed to high temperature stress (28-30/11-14 °C).

**Key words:** Cauliflower, temperature stress, dry matter, harvest index, yield, LAI



## Health and Growth Analysis of *Litopenaeusvannamei* in Semi Recirculatory Aquaculture Biofloc System and Normal Biofloc System

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### ABSTRACT

This research compares a traditional Biofloc system to a Semi Recirculatory Aquaculture Biofloc system. The latter like the conventional Biofloc system, follows the same culture pattern, with the exception of a recirculatory mechanism integrated into the culture process, which could cause considerable differences. For this study, we chose two farms in Kerala's Ernakulam district: Kodungaloor and Aroor, which use Semi-RAS and Normal Biofloc systems, respectively. Water quality indicators, cultured species productivity, 70-day FCR ratios, disease frequency, feed intake intensity, TSS and TDS, feed digestibility, investment, and profit percent in both culture farms were examined from day one to day thirty. Dissolved oxygen levels were 7 ppm and 5 ppm, ammonia levels were 0 ppm and 1 ppm, TDS-TSS levels were 50-100 ppm and >200 ppm in Semi RAS and biofloc systems, respectively. On the 30th day of the culture phase, according to the data, Semi-RAS yielded 3.6kg/m<sup>3</sup>, while biofloc yielded 1.6kg/m<sup>3</sup>. Stress and microbial contamination were reduced in Semi RAS, while digestibility increased. Although the Semi RAS system costs more than Biofloc, farmers that use it can earn three times as much and have a greater profit percentage. According to our findings, Semi RAS technology offers aquaculture farmers more possibilities.

**Keywords:** Semi RAS system, Biofloc, Water quality, Aquatic Health, *L.vannamei*, Digestibility.





## Competency of an indigenous re-circulatory coldwater aquaponics model for pilot scale production of rainbow trout (*Oncorhynchus mykiss*) and lettuce (*Lactuca sativa*)

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### ABSTRACT

The nutrient makeovers including fish and plants performance are the major concerns of a recirculatory coldwater aquaponics. To address this issue, the growth performance of rainbow trout and lettuce have been evaluated in an indigenously developed affordable prototype with multifunctional components, comprising various integral set-ups along with the hydroponic cum bio-filter sub-systems i.e., media beds and deep water culture (DWC) systems. The rainbow trout juveniles and the plantlets, germinated in plastic and egg trays, were randomly allocated in respective experimental units, maintaining prudent density with different hydraulic loading rates (HLRs). Stocked trout were fed @ 3-5% of their body weight with grow-out pelleted feed and the lettuce biomass gain was based on the generated effluents without any additional supplementation. The total ammonia nitrogen (TAN), nitrate and phosphate including other nutrients removal or conversion varied significantly among different hydroponic cum bio-filter treatment units. The yield of fish and plants were significantly better in higher HLR and DWC unit respectively with three lettuce crops production within one fish cycle. Therefore, this model with subsequent optimization according to the geo-biological conditions, will definitely be proficient in enhancing the productivity, especially in space limited hilly terrains, roof tops and urban area farming.

**Keywords:** aquaponics, indigenous, trout, lettuce, HLR, DWC

## Genetic variation analysis for root traits in cowpea (*Vigna unguiculata* L. Walp) core collection

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### ABSTRACT

Selection and breeding for better root phenotype can improve acquisition of soil resources and thus crop production in marginal environments. Cowpea is one of the important legume crops in arid and semi-arid regions, grown mostly in marginal environments. The present investigation was carried to study the variation among root trait in 110 cowpea genotypes. The experiment was conducted under controlled green house conditions using poly vinyl chloride (PVC) columns. The genotypes were evaluated for thirteen root-shoot traits (root depth, root volume, fresh root weight, fresh shoot weight, dry root weight, dry shoot weight, root shoot ratio, adventitious root number, tap root diameter, stem diameter, basal root number, branching density and root biomass density). Substantial variation was recorded for all root-shoot traits. The genotype “TVu-14890” was found to possess longest root depth (114 cm) and the genotype “TVu-14172” was found superior for different traits including root volume (84.9 cm<sup>3</sup>), fresh root weight (99.5gm), fresh shoot weight (206 gm), dry root weight (25.5 gm), dry shoot weight (119.5 gm), tap root diameter (15 mm), stem diameter (21.5 mm) and root biomass density (0.00307 gmcm<sup>-3</sup>). Root shoot ratio was found to be highest (0.59) in genotype “TVu-13778”. Highest number of adventitious roots (20) was found in genotype “TVu-1477” and highest branching density (45) in genotype “TVu-9620”. The genotype “TVu-113” was found to possess highest (25) basal root number. Overall result of the present study revealed significant variation for all the studied root traits. The promising genotypes identified during the present study will prove useful in future cowpea improvement programs.

**Keywords:** Cowpea, root traits, core-collection, variation.

## Effect of a host-gut derived potential probiotic *Bacillus subtilis* COFCAU\_BSP3 on growth, immunity and resistance of *Labeo rohita* to *Aeromonas hydrophila* infection

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### ABSTRACT

*Bacillus subtilis*, a gram-positive, non-pathogenic and spore-forming bacterium, is widely used as a microbial feed additive to compete with pathogens. *B. subtilis* is Generally Recognized as Safe (GRAS) by the FDA, meaning this bacterium is not harmful to animals or humans. *B. subtilis* supplementation can improve fish growth, immune response, antioxidant function and disease resistance. In this study, *Labeo rohita* fingerlings (20–25 g) were fed with *B. subtilis* COFCAU\_BSP3 supplemented feed at the concentrations of (T1)  $1 \times 10^7$ , (T2)  $1 \times 10^8$ , and (T3)  $1 \times 10^9$  CFU/ g for 20 days and different growth, haematological, immunological, biochemical parameters and immune-related gene expressions were assessed on 0<sup>th</sup>, 10<sup>th</sup> and 20<sup>th</sup> days interval. In a separate similar experiment, after 20 days of feeding, fish were challenged intraperitoneally by *Aeromonas hydrophila* (ATCC 7966) and fed with basal diet and survival percent was observed for 14 days. The immunological responses (NBT assay, myeloperoxidase content, antiprotease, total protein content, albumin and globulin), biochemical responses (ALP), haematological (TEC, TLC, haemoglobin, PCV, MCV, MCH, MCHC) and growth parameters (LI, MWG, SGR, CF) were significantly ( $p < 0.05$ ) enhanced, particularly in T2 diet after 10 days of feeding. Parameters, such as blood glucose, albumin-globulin ratio, SGPT and SGOT were significantly ( $p < 0.05$ ) decreased. Immune-related genes such as IL-1 $\beta$  and TNF-1 $\gamma$  were found to be significantly higher in the head kidney. All the *B. subtilis*-supplemented diets significantly ( $p < 0.05$ ) improved *L. rohita* survival against *A. hydrophila*. The findings indicate that *B. subtilis* COFCAU\_BSP3 may be useful as an aquaculture probiotic. The strain's ability to reduce *A. hydrophila*-induced mortalities is also noteworthy.

**Keywords:** *Bacillus subtilis*, *Labeo rohita*, Disease resistance, Immune response, *Aeromonas hydrophila*

## Effect of different carbon sources on the growth and survival of critically endangered peninsular carp *Hypselobarbus pulchellus* during fry to fingerling rearing in biofloc system

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### ABSTRACT

Biofloc Technology (BFT) is an emerging tool for sustainable development in aquaculture. A 90 days experiment was conducted to investigate the effect of addition of different carbon sources on the growth and survival of the peninsular carp *Hypselobarbus pulchellus* during fry to fingerling rearing in biofloc based facility. Hatchery produced *H. pulchellus* early fry (average length: 1.2 cm and weight: 0.0068 g) were randomly distributed in circular fibreglass tanks each having water volume of 1000 L. The experimental design was completely randomized, with five treatments in triplicate; T1 (jaggery); T2 (tapioca flour), T3 (rice flour), T4 (corn flour) and C (control, without external addition of carbon source). Results showed that growth performance of *H. pulchellus* was the best with jaggery followed by corn flour, rice flour and tapioca carbon sources. The weight gain and specific growth rate of *pulchellus* were significantly higher ( $P < 0.05$ ) in biofloc treatment with jaggery as carbon source compared to control. The survival was higher in BFT treatments as compared to control. Treatment with jaggery addition showed highest survival ( $95.67 \pm 0.88$  %) compared to control ( $93.00 \pm 0.58$  %). However, no significant difference ( $P > 0.05$ ) was observed in the experimental groups in survival percentage. The microbial dynamics studies indicated that the supplementation of carbohydrates in the biofloc treatment increased the total heterotrophic bacterial (THB) count compared to control. The highest THB load was found in corn flour followed by jaggery treatments among the biofloc groups. The plankton studies indicated that the biofloc groups had higher plankton biomass compared to control. The highest plankton biomass and diatoms belonging to Bacillariophyceae were found in jaggery treatment which favoured the higher growth of fish. Overall, the fish growth and survival, microbial dynamics and plankton studies indicated that jaggery is a good carbon source for fry to fingerling rearing of *H. pulchellus* in biofloc system.

**Keywords:** Biofloc, BFT, *Hypselobarbus pulchellus*, Carbon source, Sustainability, Aquaculture

## Comparative Study on the Nutritional Evaluation of Fish Flesh and Fish Waste Protein Hydrolysates Prepared from Mackerel fish (*Rastrelliger kanagurta*)

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### ABSTRACT

Aquaculture sector is a rapidly expanding food-producing sector entirely reliant on high-quality aquafeeds. Protein is the key nutrient that directly impacts the growth and well-being of fish in a high-quality diet. For protein-rich feed components, we rely on wild-caught fishmeal (FM). While the fish processing industries create and discard a substantial volume of the trash, estimated to be up to 60% of harvested biomass globally. There is considerable potential for turning such protein-rich waste materials into more valuable and accessible nutritious food items like fish protein hydrolysate (FPH). For this investigation, mackerel fish (*Rastrelliger kanagurta*) were brought from the Versova landing center in Mumbai, Maharashtra. Fish were cleaned, and the meat was separated for making fish meat protein hydrolysate, and the waste parts such as head, fins, bone, and viscera were collected for fish waste protein hydrolysate and both were grind into a paste. The meat and fish waste protein hydrolysate was prepared using 1% papain enzyme (w/w). After drying, the proximate composition of both fish meat protein hydrolysate and fish waste protein hydrolysate were analyzed. The yield of fish meat and waste protein hydrolysate was about 8.142% and 4.87%, respectively. Moisture content, crude protein, ether extract, and total ash content of fish meat and waste protein hydrolysates were 3.25%, 76.78%, 4.72%, 6.80%, and 4.51%, 65.95%, 4.48%, 6.19%, respectively. The results indicate that the fish flesh protein hydrolysate has more protein than fish waste hydrolysate. As a result, fish flesh protein hydrolysate can be utilized to replenish protein in fish feed. A fish waste protein hydrolysate is less expensive to produce than a fish flesh protein hydrolysate, and both have enormous potential as a feed attractant in fish feed.

**Keywords:** Fish feed, Fish Protein hydrolysate, Enzymatic hydrolysis, Feed attractant, Mackerel.



## Characterization of virulence potential of *Aeromonas hydrophila* strains isolated from carp culture pond

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### ABSTRACT

*Aeromonas hydrophila*, a prominent fish pathogen that inhabits aquatic habitats and widespread around the world, is accounted for a considerable economic loss in aquaculture. This study assessed the virulence potential of four *A. hydrophila* strains COFCAU\_AH1, AH2, AH3 and AH4 (GenBank accession number, MK907589, MK9075890, MK907591, and MK907595, respectively) isolated from carp culture ponds. The identities of the isolates were confirmed by a series of biochemical tests and assessing the 16S rRNA gene sequence. All the four isolates were highly sensitive to azithromycin, oxacillin, tetracycline, cephalixin, amoxycylav, vancomycin, and streptomycin. However, AH1 was resistant to kanamycin, tobramycin; AH2 was resistant to polymyxin B, ticarcillin, tobramycin, and AH3 and AH4 were resistant to ampicillin, erythromycin, penicillin G. The strains AH3 and AH4 showed significant hemolytic, DNase, and amylase activity. The AH1, AH3, and AH4 strains produced exoenzymes like caseinase and gelatinase. All four isolates showed noticeable lipase activity. The presence of *Act*, *Alt*, *Ast*, *ExsA*, *AscC*, and *Lip* genes were detected in both the AH3 and AH4 strains. Additionally, AH3 showed presence of another virulence gene, *aerA*. The results of the study of virulence determinants indicated the strain AH3 being the most virulent. An *in vivo* pathogenicity test of the strain (AH3) was conducted to determine the LD<sub>50</sub> dose of the bacteria in *Labeo rohita* fingerlings. The LD<sub>50</sub> dose for *A. hydrophila* AH3 was estimated to be 10<sup>4.1</sup> cells fish<sup>-1</sup>. The infected fingerlings showed exophthalmia, scale erosion, fin and tail rot, hemorrhages, and abdominal dropsy, as prominent clinical signs. The presence of virulent *A. hydrophila* in carp aquaculture environment is alarming and thus has great economic significance.

**Keywords:** *Aeromonas hydrophila*, *Labeo rohita*, pathogenicity, antibiotics sensitivity test, virulence genes, median lethal dose (LD<sub>50</sub>)

## Differential protein expression profiling of rohu kidney in response to *Edwardsiella tarda* infection

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### ABSTRACT

*Edwardsiella tarda* (*Et*) is a Gram-negative pathogen with a wide range of hosts, including fish and resulted in inconceivable economic losses in aquaculture. Fish immune response at the proteome level in the early stage of infection could aid in the development of novel methods for better understanding of disease management. In this study, we investigated the kidney proteome of *Labeo rohita* intraperitoneally challenged with *Et*. Comparative proteomic analysis of the infected rohu kidney was performed by using label free quantification (LFQ) approaches. A total of 1240 proteins containing 2 unique peptides were identified by LC-MS/MS data. Moreover, a total of 96 differentially expressed proteins (DEPs) were found, of which 44 proteins were significantly upregulated and 52 were downregulated. We performed Metascape and STRING analysis to identify the key pathways, gene ontology (GO), and protein-protein interaction (PPI) networks for DEPs. In PPI, upregulated pathways were metabolic pathways (pipox, hao1, glud1a) and oxidative phosphorylation (atp5j, uqcrfs1), while downregulation included ribosomes (rplp2, rpl11), protein processing in ER (hspa8, hsp90aa1.1), innate and immune system (ptgdsb.1, muc2), and metabolism of proteins (cct3, cct5). The top dysregulated proteins, bmp1a and timp3, were found to be involved in the host invasion mechanism. Histopathology of infected rohu kidney consisted vacuolation and necrosis and enriched DEPs GO showed highest expression for wound healing, phagosome, IL-3 signalling pathway, chaperon-containing T-complex, innate immune system and metabolic process. Altogether, the current study is the first to report the kidney proteome of rohu, providing insight into the immune response to *Et* infection.

**Keywords:** *Edwardsiella tarda*, *Labeo rohita*, wound healing, phagosome, IL-3 signalling pathway, innate immune system

## Frozen Storage Characteristics of Battered and Breaded Genetically Improved Farmed Tilapia (GIFT) Fillets Packed in PEST/PE and PE Pouches

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### ABSTRACT

GIFT (*Oreochromis niloticus*) is one of the promising candidate species in aquaculture and its production has increased through diversified farming techniques. There is an impelling need for the industry to adopt new processing technologies to develop ready-to-eat or ready-to-cook convenient products to meet the growing consumer demand in domestic as well as international markets. Considering the above scenario, present study deals with 1) Development of a high-end product “Battered and Breaded GIFT fillets (ready-to-fry)” and 2) its shelf life evaluation in two different packages – Polyester Polythene Laminate (PEST/PE) and PE Pouches. Results of microbiological, biochemical and sensory evaluation indicated that the product was in acceptable condition up to 12 months of frozen storage (-18°C). There was no significant difference in Total Plate Count between the products packed in PEST/PE and PE pouches. *E.coli*, *Staphylococcus aureus*, *Salmomella*, *Virio cholera*, *Vibrio parahaemolyticus* and *psychrophiles* were not detected in both samples. Biochemical parameters such as Total Volatile Base Nitrogen (TVB-N), Trimethylamine Nitrogen (TMA-N), Peroxide Value (PV), Free Fatty Acid Value (FFA) and Thiobarbituric Acid Value (TBA) showed higher rate of increase in products packed in PE pouches. Products packed in PEST/PE pouches showed higher sensory acceptability.

**Keywords:** GIFT, Battered and Breaded Fillets, Frozen Storage, PEST/PE, Biochemical and Sensory





## **Captive Maturation and Multiple Breeding Technology of Endangered Golden Mahseer (*Tor putitora*) for Its Sustainable Conservation and Rehabilitation**

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### **ABSTRACT**

Golden mahseer has been a pride and glory of the Himalayan sub-continent, generating livelihood through ecotourism and conservation aquaculture. Due to various anthropogenic and species-specific inherent reasons, it has become endangered and listed in IUCN red book. Hence, its conservation and rehabilitation was a grave concern for the scientists/researchers, environmentalists and policymakers. Stock enhancement/ranching of fingerlings produced using captive brooders is one of the best sustainable conservation strategies. Until recently, the breeding and seed production of endangered golden mahseer was being done using wild-collected gravid brooders, a destructive and non-sustainable practice with full of uncertainties and risks. This dependence on wild-collected brooders was because golden mahseer females fail to complete ovarian development and maturation in captive conditions due to endocrine dysfunctions. Recognizing the compounding challenges before the captive maturation and breeding of endangered golden mahseer to produce mahseer seed on a large scale for conservation and rehabilitation, ICAR-DCFR, Bhimtal, embarked upon conducting a series of experiments (photo-thermal manipulation, sex segregation, substratum intervention, broodstock diet, etc) for over last seven years and finally succeeded in developing the captive maturation and multiple breeding technology for golden mahseer. This technology has resulted in producing a substantial number of fry of golden mahseer round the year, which otherwise had been a major bottleneck for large scale rehabilitation efforts to conserve this esteemed species in sustainable manner.

**Keywords :** *Tor putitora*, Captive Maturation, Multiple Breeding, Endangered Species, Ranching, Conservation

## Captive Maturation and Multiple Breeding Technology of Endangered Golden Mahseer (*Tor putitora*) for Its Sustainable Conservation and Rehabilitation

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### ABSTRACT

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**Keywords :** *Tor putitora*, Captive Maturation, Multiple Breeding, Endangered Species, Ranching, Conservation



**Higher intake of  $\beta$ -glucan impairs reproduction in a female teleost, *Tor putitora* (Hamilton, 1822)**

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**ABSTRACT**

Although the immuno-modulatory and stress relieving properties of  $\beta$ -glucan is well elucidated in humans and other animal models, including fish, its role as a dietary supplement on reproduction is extremely scarce. Therefore, in this study, adult female fish were fed one of four test diets having 0 (control), 0.5, 1, and 1.5%  $\beta$ -D-glucan for 130 days and its effect on reproductive performance, ovarian histology, sex hormones, and transcript abundance of selected reproduction-related genes was assessed. Low dietary intake of  $\beta$ -glucan (0.5%) enhanced fertilization and hatching rates. Surprisingly, even after 130 days, spawning did not occur in 1.5%  $\beta$ -glucan fed individuals. Higher  $\beta$ -glucan intake down-regulated brain *kiss2* expression, while up-regulated aromatase genes without a parallel increase in  $17\beta$ -estradiol. Irrespective of  $\beta$ -glucan intake, all the brooders recorded similar plasma  $17\beta$ -estradiol and maturation-inducing hormone. However, plasma vitellogenin increased with increasing  $\beta$ -glucan up to 1.0% then declined at 1.5%. Histologically, higher follicular atresia and leaking of yolk material was evidenced in 1.5%  $\beta$ -glucan fed group. This study shows that higher  $\beta$ -glucan intake could perturb normal reproductive function in a fish model by altering the expression of kisspeptin and caused an increased number of atretic follicles leading to spawning failure.

**Keywords:**  $\beta$ -glucan; steroid hormones; kisspeptin; cyp19; reproduction; histology



## METABOLIC AND HAEMATOLOGICAL RESPONSE OF RAINBOW TROUT TO NELUMBO NUCIFERA LEAF EXTRACT.

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### ABSTRACT

Antimicrobial defence strategies have evolved in aquatic ecosystem in response to competition for space and nutrients. There is an escalating requirement for new antibiotics not only in human but also in veterinary medicine. The discovery of new phyto-chemicals to control bacterial diseases is one of the promising areas to explore. Owing the ability to synthesise many bioactive compounds, the plants are one of the potential sources of new drugs. Lotus is known for its functional properties and its use is popular in traditional medicine.

To evaluate the antioxidant, antibacterial properties of lotus leaf extract and to investigate the metabolic, haematological response of *Oncorhynchus mykiss* to *Nelumbo nucifera* leaf extract.

Extract from lotus leaves was evaluated for its antioxidant activity using DPPH scavenging method. Antibacterial property was estimated by micro-dilution against *Aeromonas hydrophila*, *Pseudomonas fluorescens* and *Staphylococcus aureus*. 250 Rainbow trout fingerlings were randomly distributed into 5 treatment groups in triplicates. Each group was fed iso-nitrogenous and iso-energetic diets containing extract to satiation for a period of 75 days. Data was analysed considering  $P < 0.05$ .

DPPH scavenging capacity and phenolic content of extract varied significantly depending on the concentration. Broth micro-dilution method showed significant bactericidal activity of NNLE. Extract was found to significantly reduce malate dehydrogenase and aspartate aminotransferase activity in the liver tissue. Alanine aminotransferase activity in the muscle tissue of NNLE fed groups was significantly higher than control. The liver and gill SOD activity was significantly reduced in the NNLE fed groups compared to the control. Catalase activity in the liver and gill was significantly lowered in the T4 group. Superior haematological status in the groups fed with lotus leaf extract was observed.

Lotus leaf extract possess significant antioxidant activity and antibacterial compounds, which may be used as feed additives and therapeutics in fish nutrition and aquaculture industry. NNLE significantly affects the activities of the important metabolic enzymes of the fish. The extract can improve the haematological status of the fish. It may be concluded that NNLE added as feed additive can provide benefits besides immunostimulation to the cultured fish.

**Keywords:** Antioxidant, Antibacterial, Physiological response, Lotus extract, *Oncorhynchus mykiss*.

## Utilization of indigenous extractive species for environmental remediation and improved performances of fed species in brackishwater integrated multi-trophic aquaculture (BIMTA) system

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### ABSTRACT

A 60-day experimental trial was conducted to examine the effect of two extractive species on the performances of fed species and environmental mitigation under different types of integrated multi-trophic aquaculture (IMTA) systems in brackishwater. Milkfish, *Chanos chnaos* fingerlings and Pacific white-leg shrimp, *Penaeus vannamei* juveniles at 25 and 50 no., respectively were stocked together as fed species in 1000 L tanks. There were four treatments in triplicate containing both the fed species and estuarine oyster, *Crassostrea cuttakensis* as an organic extractive species @1.8 kg/m<sup>3</sup> (T1), green seaweed, *Enteromorpha intestinalis* as an inorganic extractive species @ 1.5 kg/m<sup>3</sup> (T2), both *C. cuttakensis* @1.8 kg/m<sup>3</sup> and *E. intestinalis* @ 1.5 kg/m<sup>3</sup> (T3), and control with no extractive species. A common diet (30% crude protein) was provided at 5% of biomass daily to feed milkfish and shrimp. Nitrogenous and phosphorus compounds, particulate organic matter, and chlorophyll-a contents decreased significantly in all three IMTA systems in comparison to control (P<0.05) and those were least in T3, the complete IMTA. The highest percentage weight gain of milkfish (422.76 ± 3.76%) and shrimp (283.01 ± 7.38%) was obtained in T3 treatment. There was no variation in milkfish survival, whereas, the highest survival of shrimp was in T3 (82 ± 1.7%). This study suggested that the complete IMTA system containing both seaweed and oyster proved to be the best in terms of water quality remediation, productivity and economic return.

**Keywords:** BIMTA, Extractive species, Oyster, Green seaweed, Environmental remediation



**Effects of red bell pepper (*Capsicum annum*) on pigmentation and growth performance of rainbow trout (*Oncorhynchus mykiss*)**

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**ABSTRACT**

The coloration of flesh in salmonids is one of the most crucial quality criteria because of consumer preference for red-pink flesh color. The present work was conducted to study the effect of dietary inclusion of red bell pepper powder, a natural source of carotenoids on the growth and pigmentation of rainbow trout (*Oncorhynchus mykiss*). The experiment was conducted for 8 weeks, one control and three treatments with four replicates each. In the treatment groups namely; T1, T2 and T3, red bell pepper powder was added @5%, 10% and 15% i.e. 0.62g, 1.24g and 1.86g (%) to the basal feed respectively. The control group (T0), was fed basal feed without any inclusion of red bell pepper powder. All the treatments were fed @5% of body weight which was split into two equal doses, morning and evening. At the end of the experiment, the result showed that the T3-group (1.86g/100g red bell pepper powder) in the feed showed a positive response in terms of growth performance. Growth parameters including Final weight, Body weight gain, Percentage weight gain, Specific growth rate and Feed conversion ratio showed significant difference ( $p < 0.05$ ) between the experimental groups. In terms of pigmentation between experimental groups, the carotenoid accumulation in flesh increased with an increase in inclusion level. The T3-group (1.86g/100g) was found to have highest carotenoid accumulation. From the present study, it can be concluded that the use of natural carotenoid sources in diets of rainbow trout can result in increase in flesh pigmentation. The most appropriate dietary dose of red bell pepper powder was recorded as 1.86g/100g feed. Concerns regarding the usage of synthetic chemicals and their expensive cost have made natural carotenoids more popular as an alternative to synthetic carotenoids.

**Keywords** - red bell pepper, rainbow trout, natural carotenoid, growth, pigmentation.



## Diversity of *Sclerotiumrolfsii* and Analysis of Collar Rot Disease Epidemics

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### ABSTRACT

Collar rot is one of the plant diseases that affect cultivation of cucurbits and ultimately leads to yield loss. The disease-causing *Sclerotiumrolfsii* is a facultative parasite that lives in the soil and is common in nearly all agro-ecological system types. There is significant variety in the kinetics of collar rot, which is unaffected. Research has been done to examine the differences between this pathogen's isolates in relation to its cultural and biochemical characteristics. Regular and peripatetic growth of fluffy and compact types of mycelia with growth rates ranging from 10 mm/day to 50 mm/day, as well as varying times for sclerotia to form and maturity were noted. The isolates' melanin content ranged from 0.120 to 0.501. (OD<sub>405</sub>). In the inoculated cucumber plants, the defence substances such phenol and peroxidase showed wide fluctuation and were more prevalent at the collar region than at the stem and apical foliage.

**Key words** Biochemicals, Collar rot, *Sclerotium rolfsii*, Variability

## DIGITAL BIOCHEMISTRY OF NONE-DISEASES HAVING LOW-PROTEIN DIETS, DURING THE OLD-AGES

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### ABSTRACT

Hydrophobicity of Isoprene, Fats etc are well known, Moisture below 60 percent is ideal too for avoiding germs and pathogens. More hydrophilic proteins often get spoiled and is prone to many diseases, like arthritis, uric acids, guts etc unless it is converted to Amino-acids or else added with fatty bio-molecules. This practices are ever been followed in Ayurveda. In recent-days Diseases-therapy with selective Amino acids, are now being possible avoiding hazardous and risky surgeries, and this may be entirely the opposite process in recent days very popular gene-editing techniques. Diseases-free with vegetable may be possible in two ways first by lowering protein percentage and secondly by adding Isoprene Lets conclude with an example in fisheries science, all herbivore species have almost zero-diseases problems, unlike carnivore species. Since Vegetable contains not only minimum amount of proteins but the other method of escaping diseases being vegetarian additionally vegetable produce Isoprene more the holly biomolecule to spoiled germs at their genomic breakages, revealed in recent times identified by the Author.

Keywords: Low protein diets, Hydroponics, Isoprene with plankton and vegetables, Curing and preventing diseases, Advanced Ayurvedics



## AMINO ACIDS' THERAPY IN MANKIND

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### ABSTRACT

All we may know that proteins are most prone to diseases to every animals and mankind. Also we may know every other foods substances like Carbohydrates, Fats, Vitamins, Waters and Essential minerals are always safer from pathogens, germs or viruses only exceptions are proteins. Proteins gets decayed owing to germs pathogens or viruses and many detrimental effects occur owing to pathogenic organisms. Proteins can be however stored longer periods if this can be converted in amino acids forms. Amino acids can be obtained from strategic hydrolysis of proteins through scientific means, one such process is acid hydrolysis. Acid hydrolysis followed by amino acid separations with their iso-electric points, known can be used in all disease-therapies as well as preventive measures to mankind. With given example whoever may be suffering cartilage or bone-joint or knee problems may be cured with preferred and selective amino acids viz. Proline, Hydroxyl Proline, Glycine and Alanine etc., the major composition of collagen. People may have cardiac problem can be restored with other selective amino acids known to its constituents. Where as environment wise the most pathogens are airborne since air may contain maximum nitrogen derivatives like  $\text{NO}_2$ ,  $\text{NO}_3$  etc and hence inductive to pathogens to the environment with adequate moisture viz. having more than 60 percent relative humidity. This Available nitrogen in air gets more when there is more oxygen in air  $\text{NO}_3$  forms acts. Ammonium nitrogen helps pathogens under anaerobic conditions. Atmospheric available nitrogen may have relations with available nitrogenous compounds in soil and water environments and may pathogens prevail. Author microbial or pathogenic control or prevention can be possible with Isoprene and simplest hydrocarbon found there can be zero pathogen in the environments when Isoprene or hydrocarbon, or fatty foam derivatives found around more than 30 ppm in air or water or may be in soil environments. Beside Isoprene digitally Ayurveda totally can spoil all evil-proteins, *virions*, *microbes* mere *foreign-proteins*, unlike multi-cellulars, can easily get denatured with plants acids ( $\text{pH} < 6.5$ ) or with plants alkaloids ( $\text{pH} > 8.0$ ) and Isoprene in between. This research study found in fisheries and mankind, The very well known fact to mankind is that pathogenic or foreign-proteins, namely virus and bacteria can be denatured with mild Ayurvedic acids or Alkaloids along with Amino acids. In Fisheries research we may find even a low priced Tilapia species can become wonders when we obtained essential amino acids with scientific hydrolysis and in this process a non fish eaters may obtain Amino acids as life saving medicines.

**KEY-WORDS:** Amino acids therapy, Medicinal fisheries, Biotechnology for mankind

### **Aquatic weed as a protein source in the diet of Common carp (*Cyprinus carpio* var. *communis*) fingerlings**

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#### **ABSTRACT**

In the present study, the aquatic plants were obtained from various water bodies of Kashmir. The nutritional value of each aquatic plant was assessed in the fish nutrition lab. The best nutritionally balanced aquatic weed were incorporated in the fish diet. The test diet was analyzed according to the standard methods for moisture, protein, fat and ash. Four experimental diets were formulated containing different percentage of aquatic plants (0%, 10%, 20%, 30%). One hundred and sixty advanced fingerlings (160) of *C. carpio* were placed in plastic tubs (50 litre) which were randomly distributed in four distinct experimental groups, in four replicates T0, T1, T2 and T3 following a completely randomized design. The experiment was conducted for a period of 60 days, with four treatments and four replicates (10 fishes/tub). The experimental groups were fed with their respective diets @ 5% of body weight twice a day. The study revealed that *Ceratophyllum demersum* (Coontail) showed good result as compared to other aquatic weeds. Thus, primary goal of this research was to develop feed that includes aquatic weeds as a key ingredient.

**Keywords:** Aquatic weeds, common carp, plant protein source, *Ceratophyllum demersum*, nutritional value

### **Shrimp genomics and its application for genetic improvement programmes in aquaculture**

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#### **ABSTRACT**

Aquaculture plays a major role in global food security, and has become an increasingly important source of seafood. The application of genomics is helping aquaculture sector to enhance production through selective breeding programs. Genomics is also helping to understand infectious diseases and their relationship between environmental biotic and abiotic stress factors and shrimp/fish health. With the genomics revolution, there is great interest and focus to decipher the whole genome sequence of several aquaculture species with an aim to integrate genomic information into breeding programmes with desired economically important traits. In this study, we describe the approach, difficulties and the challenges encountered in sequencing and assembly of genome of shrimp. The assembly of *Penaeus indicus* genome was of 1.93 Gb length with scaffold N50 of 34.4 Mb and contained 28,720 protein-coding genes. The *Penaeus indicus* genome assembly has applications in shrimp genetic improvement programs for increased productivity with desirable traits.

**Keywords:** Genome, *Penaeus indicus*, genome assembly

## Benzophenone-3, an emerging aquatic pollutant

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### ABSTRACT

In recent years, more attention has been paid to personal care products (PCPs) described as “emerging contaminants” as they cause potentially adverse impact on many ecosystems and organisms. Benzophenone-3 (BP-3) also called as oxybenzone is an ingredient in sunscreen lotions and personal-care products that protects against the damaging effects of ultraviolet light. BP-3 can enter the aquatic environment indirectly from wastewater treatment plants after entering sewage systems following bathing or from industrial discharge and directly from recreational activities. With an increasing use of sunscreens, an estimated 14,000 tons of BP-3 is released into aquatic environment every year. The indiscriminate release of emerging pollutants (EPs) into the aquatic ecosystem is a major health concern due to their persistence in aquatic bodies and toxicity to aquatic organisms. The ubiquity of BP-3 has received increasing attention due to its endocrine disruption effect, performing estrogenic and anti-androgenic activities. BP-3 has been detected ubiquitously in various environmental matrices such as surface water, sediment, and soil. Owing to their lipophilicity ( $\log K_{ow} > 3$ ), they show bioaccumulative potential and have been detected in aquatic organisms at low (e.g., mussels) to high trophic levels (e.g., fishes and dolphins). Recent studies have reported adverse effects in aquatic organisms after exposure to BP-3, such as causing immobilization in *Daphnia*, affecting reproduction in fish, affecting development in coral larvae, and inducing coral bleaching. So, we need to focus on co-exposure toxicity studies with other compounds, develop Potential bioremediation strategies to remove this pollutant in aquatic system, and establish organ-based biomarkers for assessing toxicity in future.

**Keywords:** Benzophenone-3; Personal care products; Emerging pollutants; Toxicity



## Anti-Saprolegnia activity of Chloramine-T

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### ABSTRACT

Saprolegniosis is one of the most catastrophic diseases of farmed and wild freshwater fishes. This disease has been associated with high morbidity and mortality causing huge economic losses globally in aquaculture industry. It is caused by pathogenic species of oomycetes of the genus, *Saprolegnia*. Earlier the infection was effectively controlled using malachite green but the chemical has been banned for use in aquaculture due to its harmful side effects. This has led to recrudescence of *Saprolegnia* infections in fish. Since then, many chemicals and natural compounds have been tested for anti-*Saprolegnia* activity but are found to have issues such as low efficacy and health risks for the user. Considering this, this study has been carried out to evaluate the anti-*Saprolegnia* of Chloramine-T, an investigational new animal drug. *In silico* analysis revealed that Chloramine-T binds with *Saprolegnia parasitica* host-targeting protein 1 (SpHtp1), plasma membrane ATPase and TKL protein kinase hydrogen bonds and hydrophobic interactions indicating possible growth inhibitory potential. Its anti-*Saprolegnia* activity was evaluated *in vitro* against *S. parasitica* and *S. australis*. The minimum inhibitory concentration (MIC) of Chloramine-T against *S. parasitica* and *S. australis* are 400 ppm and 500 ppm respectively. The same concentration was also found to produce fungicidal effect in *S. parasitica* whereas a higher dose was required to produce the similar effect in *S. australis*. The findings in this study indicate that Chloramine-T can bind with vital proteins of *Saprolegnia* and can inhibit its growth. Therefore, this chemical may further be evaluated for its efficacy in disinfection of fish eggs and treatment of *Saprolegnia* fish.

**Keywords:** Saprolegniosis, Chloramine-T, *in silico* study, minimum inhibitory concentration



## Sustainable aquaculture production antimicrobial compound-producing *Pseudomonas stutzeri* isolated from three spotted crab, *Portunussanguinolentus*

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### ABSTRACT

Aquaculture is a rapidly growing fisheries sector in India with an annual growth rate over 7%. Freshwater aquaculture contributes over 95% of the total aquaculture production of 5.77 million tonnes. However, infectious diseases in aquaculture are of major concern to the Market, Intention of this study is to identify the gut microbiota load which are present in the cultivable crab in aquaculture and to establish antimicrobial activity against human bacterial pathogens. For this study, ten crab samples were collected and aerobic forms of gut bacteria were isolated. The TPC (total plate count) of crab gut sample were ranged from  $2.6 \times 10^5$  to  $3.1 \times 10^5$  cfu/g and morphologically different strains were isolated and screened for the antimicrobial activity against a broad range of human bacterial pathogens. The strain SJ3 showed maximal antimicrobial activity against human pathogenic bacteria viz., *Vibrio cholerae*, *V. parahaemolyticus*, *V. flavius*, *Salmonella typhi*, *S. paratyphi*, *V. fischeri*, *Escherichiacoli*, *Aeromonashydrophila*, *Pseudomonas aeruginosa* and *Pseudomonas fluorescens* was subjected to characterization using biochemical tests and 16s rRNA sequencing and identified as *Pseudomonas stutzeri*. Optimization study shows that antimicrobial compound production was found to be growth dependent. Hence, the *P. stutzeri* isolated from the gut of the *Portunussanguinolentus* was a potential candidate for the production of antimicrobial compound against the human and fish bacterial pathogens.

**Keywords:** Aquaculture health management, Pathogens, *Portunussanguinolentus*, Antimicrobial activity



## DISEASE MANAGEMENT – antimicrobial activity against human bacterial pathogens

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### ABSTRACT

Aquaculture is the field where the fisheries sector is growing more in India, which is of 7% in its annual growth. Freshwater aquaculture is of around 95% than the other aquaculture production as 5.77 million tonnes. However, the infectious diseases in the aquaculture are of major concern to the markets. Present study is to identify the gut microbial load which is usually present in the edible or most cultivable crabs in aquaculture and it is for establishing the antimicrobial activity against human bacterial pathogens. In this current study, only ten crab samples were collected and in the aerobic condition the gut bacteria were isolated. The TBC (total bacterial count) of the samples were ranges from  $2.6 \times 10^5$  to  $3.1 \times 10^5$ , after that antimicrobial compound production was found to be growth dependent. Hence, the *pseudomonasstutzeri* were isolated from the gut of *portunussanguinolentus* shows the potential for the production of antimicrobial compound against the human and fish bacterial pathogens.

**Key words :** Aquaculture, gut microflora, pathogenic bacteria, *portunussanguinolentus* , antimicrobial activity, *pseudomonasstutzeri*.



## Ecological transitioning of agrifood systems to ensure food and nutritional security in South Asia

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### ABSTRACT

Indo-Gangetic plains (IGP) of South Asia supports bulk of human and bovine population through rice/wheat agrifood systems since ages. Increasing population and resources (soil, water, energy) degradation in the region alarms the challenges of malnourishment, factor productivity, soil degradation and air quality. Furthermore, monotonous cereal (rice-wheat; RW) system reduced the dietary diversity towards carbohydrate rich foods which resulted in nutritionally imbalanced food and causing malnourishment and health issues. To address these challenges, a study was conducted on conservation agriculture (CA)-based crop diversification options to ensure food and nutritional security. On 3 years mean basis, CA-based diversified production scenarios increased the system yield by 15.0%, net return by 29.6%, protein yield by 32.0% and irrigation water saving by 52.6% compared to CT-based RW system (Sc1). CA based maize-mustard-mungbean (Sc4) recorded the highest productivity (+44.4%), profitability (+66.1%) and saved 80.4% of irrigation water compared to Sc1 (12.02 Mg ha<sup>-1</sup>; 2223 USD ha<sup>-1</sup>; 2592 mm ha<sup>-1</sup>) and closely followed by maize-wheat-mungbean (Sc5). With respect to nutritional values, Sc5 was more balanced and produced 64.4, 16.4 and 213.3% higher protein, carbohydrate and fat yields, respectively compared to Sc1 (1.01, 9.09 and 0.15 Mg ha<sup>-1</sup>) and able to meet out the nutritional demand of 23, 26 and 35 extra persons ha<sup>-1</sup> year<sup>-1</sup>. The soybean-wheat-mungbean (Sc6) system was more economic in protein and fat yield. In South Asia, pulse/oilseed based diversification is an option to ensure quality and nutritious food for the dwelling communities in the region.



**Incidence of cyst in *Epinephelusdiacanthus*(Spinycheek grouper) from  
West Coast of India**

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**ABSTRACT**

The groupers are the topmost hunters assumed to play significant roles in ecosystemfunction.In this present study, the fish samples are collected from different landing centers such as the New ferry wharf in Maharashtra, Veraval in Gujarat, and Cochin in Kerala.Generally, the outer appearance of fish is good and it has taken to the lab to dissect and check the internal organs. As a result, we found that some of the fishes from Mumbai are having cysts inside of their body and the cyst is not present in the fishes from Veraval and Kerala regions.The presence of cysts is due to more pollution load in Mumbai water compared to Kerala and Veraval regions.Therefore, some measures have to be taken for reducing the pollution load in natural water bodies so that the ecosystem and the health of the aquatic organism can be improved.Therefore, future studies should focus on reducing the pollution load in natural water bodies and maintaining the health of the aquatic organisms.

**Keywords:**Grouper, Maharashtra, Gujrat, Kerala, Cysts, Water pollution, Health



## Incidence of pink water in Chennai, Tamil Nadu- An alarming bloom

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### ABSTRACT

The sample water was collected near Perungudi garbage dump yard in Chennai, Tamil Nadu, which was included in Pallikaranai marshland. 22 water quality parameters analyzed for the pink water sample including Appearance, Odour, Turbidity, Temperature, pH, Salinity, Dissolved Oxygen, TDS, TSS, Total solids, Electrical Conductivity, BOD, COD, Hardness, Alkalinity, Total ammonia, Nitrite, Nitrate, Calcium, Magnesium, Organic Phosphate, Oxidation-reduction potential. The water appeared reddish pink colour with a rotten egg odour. The results showed that the calcium and organic phosphate were presented in higher amounts with the values of 200 mg/L and 101.37 mg/L respectively. The other physico-chemical parameters include BOD, Total ammonia, alkalinity, Total hardness, salinity, magnesium, COD, total solids also showed their presence at high concentration. A total of 21 algal species were identified from the sample. Cyanobacteria (blue-green algae) dominated the pink water. The commonly occurring genus identified in this study were *Merismopedia*, *Oscillatoria*, *Chroococcus*. Various pigments such as Chlorophyll a, Chlorophyll b, Carotenoid, Total Chlorophyll, Phycocyanin, Phycoerythrin were estimated. Phycoerythrin and Phycocyanin pigments have been abundant in cyanobacteria. Phycoerythrin pigment was responsible for the pink colour of the water. This clearly depicts that the sample water turned pink colour due to Cyanobacterial bloom.



## The potential of microbes in aquaculture

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### ABSTRACT

Aquaculture is the fastest-growing sector of agriculture. It's the primary source of fish food available for human consumption and also provides employment. In aquaculture industry, fish are traditionally kept in high densities in a medium that facilitates the transfer of microbes. The microbiome is seen as an integral part of keeping fish raised for food healthy and productive. A microbiome is the community of microorganisms and their role within a specific environment considering environmental conditions and interaction with each other. Microbiomes exhibit symbiosis relationship with fish. They present in the whole body, particularly in the gut system of finfish and shellfish, not only contribute to digestion but also have an impact on nutrition, growth, reproduction, immune system and vulnerability of the host fish to diseases. Beneficial microbes can be a safer alternative to harmful antibiotics used in aquaculture, which can thereby prevent the emergence of superbugs and also enhance the production rate. The microbiota of fish is influenced by the environment, season, host genetics, development stages, nutritional level and diet. It has been observed that microbiomes hold great promise not only as a cure for ailments but also as a preventive measure for the number of infectious diseases. This kind of exploration of new breeds of microbes with their miraculous ingredients will definitely help to accelerate the development of the drugs, pharmaceutical and other biological related industries. Further, emphasis has also been made to carry out microbiome research on priority basis not only to keep healthy environment of the fish farming sector but also for the sustainable growth of biological related industries, including aquaculture.

**Keywords** – microbiome, antibiotics, aquaculture, pharmaceutical, sustainable, immune system.



### **The potential of microbes in aquaculture**

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#### **ABSTRACT**

Aquaculture is the fastest-growing sector of agriculture. It's the primary source of fish food available for human consumption and also provides employment. In aquaculture industry, fish are traditionally kept in high densities in a medium that facilitates the transfer of microbes. The microbiome is seen as an integral part of keeping fish raised for food healthy and productive. A microbiome is the community of microorganisms and their role within a specific environment considering environmental conditions and interaction with each other. Microbiomes exhibit symbiosis relationship with fish. They present in the whole body, particularly in the gut system of finfish and shellfish, not only contribute to digestion but also have an impact on nutrition, growth, reproduction, immune system and vulnerability of the host fish to diseases. Beneficial microbes can be a safer alternative to harmful antibiotics used in aquaculture, which can thereby prevent the emergence of superbugs and also enhance the production rate. The microbiota of fish is influenced by the environment, season, host genetics, development stages, nutritional level and diet. It has been observed that microbiomes hold great promise not only as a cure for ailments but also as a preventive measure for the number of infectious diseases. This kind of exploration of new breeds of microbes with their miraculous ingredients will definitely help to accelerate the development of the drugs, pharmaceutical and other biological related industries. Further, emphasis has also been made to carry out microbiome research on priority basis not only to keep healthy environment of the fish farming sector but also for the sustainable growth of biological related industries, including aquaculture.

**Keywords** – microbiome, antibiotics, aquaculture, pharmaceutical, sustainable, immune system.



## **Expression profiling of genes associated with Omega-3 fatty acid biosynthesis in Olive barb a freshwater fish**

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### **ABSTRACT**

Omega-3 fatty acid is the most important content of fish which determines the value of fish species in the domestic market. Freshwater fishes have lower levels of omega-3 content than marine fish species. However, freshwater fish species can produce omega-3 from C18-PUFA. Although dietary supplementation of fatty food has been successfully demonstrated to enhance fatty acid, but increasing omega-3 fatty acid in freshwater fish species remains a challenge. The process of omega-3 fatty acid biosynthesis contains desaturation and elongation steps which are related to various key genes. RNA seq approach was made to identify the genes related to the synthesis of Omega-3 fatty acid in *Systomus sarana* after dietary supplement of Resveratrol. Resveratrol was used as Omega3 fatty acid enhancer in the treatment feed. The identified genes were validated using qPCR analysis. Most of the genes responsible for omega-3 fatty acid biosynthesis were observed in the liver tissue. Two experimental groups were set in triplicates which were feed with experimental diets (control and treatment) for 30 days. In control, fish were fed without Resveratrol while in the treatment fishes were feeded with 0.3% Resveratrol. It was found that there is an increased in the expression of omega-3 fatty acid biosynthesis genes in liver tissue of olive barb from 0 days to 30 days. The genes can be used for further study on improving omega-3 fatty acid biosynthesis in freshwater teleost.



**Effects of low fishmeal diets supplemented with amino acids and phytase on the apparent digestibility and phosphorus retention of Pacific white shrimp, *Penaeus vannamei***

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**ABSTRACT**

A 4-week digestibility trial was undertaken to assess the impact of amino acids and phytase supplementation on the apparent digestibility coefficients and the phosphorus retention of *Penaeus vannamei* fed low fishmeal diets. Nine isonitrogenous and isolipidic diets were formulated and fed to shrimp in three replicates. Control diet (fishmeal 200g/kg) was compared against eight low fishmeal (50g/kg) diets such that four diets composed of soy protein concentrate-soybean meal protein (SPC-SBM) viz., SPC1 (without supplementation), SPC2 (DL-methionine), SPC3 (Phytase) and SPC4 (DL-methionine and phytase) and four diets composed of corn gluten meal-soybean meal protein (CGM-SBM) viz., CGM1 (without supplementation), CGM2 (DL-methionine+L-lysine), CGM3 (Phytase) and CGM4 (DL-methionine+L-lysine and phytase). Protein digestibility was significantly higher in diets fed with amino acid and phytase supplemented diets (SPC2, SPC4, CGM3 and CGM4). Phosphorus digestibility was significantly higher in SPC4 in SPC-SBM fed shrimp groups, while it was higher in CGM3 and CGM4 in CGM-SBM fed shrimp groups. Phosphorus retention was significantly higher in SPC4 and CGM4. Thus, it is concluded that supplementation of amino acids are essential for the overall better performances of *P. vannamei* in low fishmeal diets and phytase for improving the phosphorus digestibility and retention.

**Keywords:** Low fishmeal diets, Soy protein concentrate, Corn gluten meal, Apparent protein digestibility, Phosphorus retention.

## Phytochemical analysis, HPTLC Profile, and invitro Antioxidant and Antibacterial activity of *Cyperus rotundus* L. rhizome extracts

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### ABSTRACT

*Cyperus rotundus* L. (family: Cyperaceae) is a perennial weed and widely used in traditional medicine in Asian countries. The present study deals with the methanolic, ethanolic, and aqueous extracts obtained from the rhizome part of *Cyperus rotundus* to investigate the preliminary phytochemical analysis, High-Performance Thin Layer Chromatography (HPTLC) profiling, and in-vitro antioxidant properties and antibacterial activities against the fish pathogenic bacteria *Edwardsiella tarda* (ATCC 15947). The qualitative phytochemical analysis showed the presence of alkaloids, flavonoids, phenols, terpenoids, tannins, cardiac glycosides, saponins, and steroids in methanolic and ethanolic extracts. Quantitative estimation of the total phenolic and flavonoid contents in methanolic extracts was higher than in other extracts. HPTLC profiling was carried out to visualize the unknown secondary metabolites on densitometry scan at 254nm, 366nm 550nm respectively. In addition, the antioxidant activity was determined by free radical inhibition of the 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) assay. In the result, in-vitro antioxidant and antibacterial activities against *E. tarda* (ATCC 15947) exhibited a zone of inhibition of about 12mm in methanolic extract of *C. rotundus*. Therefore, the current study provides baseline information for exploiting the extract of *C. rotundus* rhizome for treating the *E. tarda* infection in the aquaculture system.

**Keywords:** *Cyperus rotundus*, Phytochemical, HPTLC techniques, *Edwardsiella tarda*, Phytoceutical applications

## Evaluation of Cluster Bean [*Cyamopsis tetragonoloba* (L.) Taub] Genotypes for Drought Stress Adaptation and its Effects on Yield

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### ABSTRACT

Cluster bean is mostly grown in dry land arid zone areas for various purposes as vegetable, seed, fodder and other industrial uses because of its gum presence in endosperm. An experiment was conducted under the rain out shelter for the evaluation of drought adaptability of selected 10 genotypes of cluster bean. The physiological parameters were used to screen the drought resistance and also recorded various yield and yield attributing parameters at the time of harvesting. Among the genotypes, Pusa Navbahar was observed well adaptability having adequate relative water content, maximum chlorophyll content, stomata per unit area and higher dry matter accumulation followed by genotype IC116866. Furthermore, yield and yield attributing parameters also showed significant differences; Pusa Navbahar was recorded maximum plant height (188.6 cm), leaves per plant (173.9), pods per plant (123.9), pod length (7.1 cm) and test weight (14.3 g) and well adaptability of primary and secondary root with deep in nature under the drought stress among the genotypes. Therefore, this study would be very helpful in the proper selection of genotypes as a source of drought resistance lines in future breeding and crop improvement programmes.

**Key words:** Cluster bean, Drought, Genotypes, Relative water content, Yield.



## Improving survival of fish larvae through better weaning strategies

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### ABSTRACT

Early larval mortality is a major constraint in larval rearing of most of the catfishes. In hatcheries, there will be a shift of food from live food to a manufactured feed during the weaning period. It is the most critical stage in the rearing of fishes. Weaning age and weaning strategies differ for different species, however not much research has been done in this line so far. The critical points in weaning process include the underdeveloped digestive system of larvae and poor activity of enzymes during hatching. Moreover, the rudimentary eyesight and smaller mouth size of larvae allows them to consume only of small organisms ranging from 50-150  $\mu\text{m}$  which are constantly in motion. Hence, live feed is considered as best diet for larvae. However, they act as carriers of pathogens to hatchery and their production is time consuming and costlier. Therefore, it is the need of the hour to make a proper strategy to utilize artificial feed along with live feeds. Hence, co-feeding is general strategy employed before the larvae is completely weaned, which is species specific. Similarly, the feeding frequency is another important strategy to enhance larval feeding. Understanding on ontogenic development of enzyme activities can direct production of strategic feed that can support digestibility and nutrient utilization. Application of specific light intensity or understanding the feeding behavior of fish can also improve diet acceptability. Additionally, intervention in feed technology to make feed with slight vibration can attract sluggish feeders. Thus, intervention in microdiets and applying various feeding strategy can improve larval survival during weaning.

**Keywords:** Live feed, Weaning, Microdiets, Larval diet



## **Aptamers - An emerging class of molecules that rival antibodies**

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### **ABSTRACT**

The rapidly expanding scale of aquaculture has resulted in frequent pathogen outbreaks. There is an urgent need to develop rapid diagnostic assays and effective therapeutic agents against aquaculture pathogens. Aptamers are single-stranded DNA or RNA oligonucleotides or peptide sequences that are artificially synthesized by an in vitro technology known as the Systematic Evolution of Ligands by Exponential Enrichment (SELEX). SELEX generates highly specific aptamers for chosen targets via a repeating cycle process. Once the aptamer sequence has been identified, the aptamer can be chemically synthesized in nanomole to micromole (i.e., mg) quantities using an automated synthesizer. Similar to antibodies, aptamers bind specifically to their targets. Aptamers are being used to advance antibodies in various applications, including disease diagnostic, prophylactic, and therapeutic. Aptamers can be used to build sensitive biosensors to detect aquatic diseases through signal amplification because of their high selectivity. Some aptamers have antiviral effects without impacting cell viability, making them ideal candidates for novel antiviral therapeutics. Aptamers are also excellent molecular tools for cell biomarker detection and pathogenesis studies because of their small size and specific recognition of targets. Despite these benefits, aptamers are not widely employed in commercial applications, and aptamer-based diagnostic research is still in its early phases. With the increasing use of aptamers in diagnostics, treatments, and other applications, the perspective of nucleic acid therapies is predicted to evolve, and aptamers may form the basis of the future in aquatic animal health management.

**Keywords** - Aptamers, SELEX, Oligonucleotides, Biosensor, Therapeutic, Diagnosis.



**Scale microstructure study of *Pomacanthus annularis*(Bloch, 1787)from Veraval harbour, Gujarat, India**

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**ABSTRACT**

First attempt was made to document various scale characteristics of *Pomacanthus annularis*(Bloch, 1787) from Veraval harbour, Gujarat, India. To acquire these objectives, scales from three different parts of the body; head, belly and caudal were obtained and prepared for scanning electron microscopy. The contemporary analysis of scale morphology in *P. annularis* recorded spinoid type cycloid scale in all over body regions. The study evaluated some consistent scale characteristics from different body regions such as; semi-circular shaped and posteriorly located focus, a striate form of interradial circuli, rectangular shaped and round ended lepidonts on circuli of anterior field, elongated and triangular shaped spinous structure (triangular) on the posterior field. These noted characters appear to be good taxonomic criteria for *P. annularis*. Moreover, the present work elucidates some morphometric indices i.e., J-Indices related to scale morphology, which additionally found significant in the distinction of considered species.

**Keywords:** Scale, *Pomacanthus annularis*, Spinoid, cteni, scanning electron microscopy, focus

**Cytokines with special reference to inflammation**

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**ABSTRACT**

Inflammation is the protective immune response involving immune cells and molecular mediators of the body towards any harmful stimuli produced by pathogens or irritants. Cytokines are small protein molecules which work as signalling to various cells and pathways by attaching to receptors present on the surface of the cells. When any stimuli occur, Pathogen recognizing receptors (PRRs) get signals from Pathogen-associated molecular patterns (PAMPs) and Damage-associated molecular patterns (DAMPs) and induce immune cells to release cytokines. Cytokines work as pro-inflammatory and anti-inflammatory agents. After removing the triggers, it gets back into its normal homeostasis. Still, sometimes due to a large number of pathogens or stimuli, continued secretion of cytokines leads to harmful effects. The uncontrolled dysregulation of the host immune defence in response to infection leads to the cytokine storm. It damages the body's healthy organs and leads to multiorgan failure and death. Further, there are apparent differences in cytokine expression between fish species. Although cytokines have been identified in numerous fish species, further work is needed to understand their function in fish immunity. The divergent functions and different forms of cytokines could be beneficial for addressing some of the knowledge gaps in fish disease purposes. It can be used to develop vaccines and/ or immunostimulants application in fisheries.

**Keywords –** Inflammation, Cytokines, Cytokine storm

### Role of gut microbiome on gut health and nutrient dynamics

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#### ABSTRACT

Fish are the most diversified vertebrate group and are the key drivers of global economy as a component of agriculture sector. The current trend of increasing production from agriculture and aquaculture sector is assisted with the improvement of health of the culturing species. Moreover, recent studies revealed that microorganisms with their vast diversity and ecological adaptation form a fascinating group to explore and study as it forms a key link between productivity and disease management. Deepening our knowledge on host-microbe interactions is essential to manage or avoid dysbiosis in aquaculture. The gut microbiome not only reinforces the digestive and immune systems in fish but is itself shaped by several host-associated factors. High-throughput sequencing technologies increase our understanding on the role of microorganisms in health, development and physiology of host. Diet has a very important role in shaping the gut microbial community. Studies revealed that the herbivore gut microbiota is dominated by Brevundimonas, Massilia, Acinetobacter genus and dominated by Brevundimonas, Delftia etc genus in omnivore species. The search for alternative feed ingredients and additives like protein isolates, pre and probiotics bring in a huge scope of exploring the effects of them on gut health and in promoting balanced microbiota. Most of the studies in fish gut microbiome are descriptive and are only concerned with composition of the microbiome and studies on gnotobiotic zebra fish models focused on functions of whole microbial community. Development of management strategies towards preserving the microbial balance, including maintaining or increasing diversity in the host, is critical for the health of cultured aquatic animals and will likely be critical for the expansion of aquaculture.

**Keywords:** Aquaculture, Gut microbiome, Dysbiosis, Host-microbe interactions

## Financial Feasibility Analysis of Indian Major Carp (IMC) Aqua farms in Andhra Pradesh

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### ABSTRACT

The paper focuses on the financial feasibility analysis of Indian Major Carp (IMC) aqua-farms in Andhra Pradesh, India. The study was purely based on primary data, which was collected from East-Godavari, West-Godavari, Krishna and Nellore districts of Andhra Pradesh. These four districts contribute around 90 per cent of total inland fish production in the state. In total of 120 aqua-farms were considered for the study, with 30 farms from each district. Pretested questionnaire was used to collect the data from aqua farmers. The results for financial feasibility of investment was expressed in Net Present Worth (NPW), Benefit Cost Ratio (BCR), Internal rate of Returns (IRR) and Payback period. Net Present Worth (NPW) and Benefit Cost Ratio (BCR) was found to be positive and was found more than one at 12, 16 and 20 percent discount rates, indicating aqua-farms to be economically more viable. Internal Rate of Returns (IRR) is higher than the discount rates which taken into account for the study, implying that investment was feasible in the study area. Payback period revealed that, aqua farm respondents were able to recover their initial investment with 2.0 to 3.5 years. The results of sensitivity analysis revealed that, even though costs increased by 5% (Case-I) or returns decreased by 5% (Case-II) indicated NPW remained positive and BCR was more than one on all the three discount rates. IRR is higher than that of the discount factor which taken into account for the study. Whereas in Case-III (costs increased by 5% and returns decreased by 5%), net present worth becomes negative at both 16 and 20 per cent discount rates indicates financial infeasible for investment. But BCR remained positive and more than one and IRR was less than the discount rate of 16 percent (15.39 %) indicates economically and financially non-viable for investment. Based on NPW, BCR, IRR and Payback period, aqua-farms were most profitable agribusiness enterprise in the study area and there is scope for growth and demand for inland aqua-products in the country as well as export.

**Keywords:** Financial Feasibility, Net Present Worth (NPW), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) and Payback Period

## Assessment of Sea Water Intrusion in Ground Water Samples of different inland blocks of Cuddalore District, Tamil Nadu, India

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### ABSTRACT

Block wise categorization of groundwater quality in inland region of Cuddalore district was undertaken during May 2017 for its optimal usage. A total of 108 ground water samples representing different coastal blocks viz., Panruti (11 samples), Cuddalore (25 samples), Annagramam (12 samples), Kaatumannarkoil (10 samples), Kammapuram (10 samples), Mangaloor (10 samples), Virudhachalam (10 samples), Nallur (10 samples), Keerapalayam (10 samples) were collected, analyzed for quality parameter and categorized into different water quality as per the standard procedure. The investigation revealed that groundwater samples with respect to pH and EC ranged from 6.43 to 10.83 and 0.14 to 3.77 dS m<sup>-1</sup> respectively. Residual Sodium Carbonate (RSC) varied from 0.10 to 2.86 meq L<sup>-1</sup> and Sodium Adsorption Ratio (SAR) ranged from 1.77 and 5.55 based on the CSSRI, Karnal water quality classification. The good quality water distribution in different inland blocks of Cuddalore district were in the order of Panruti (90.9 %), Cuddalore (92 %), Annagramam (100 %), Kaatumannarkoil (100 %), Kammapuram (100 %), Mangaloor (90 %), Virudhachalam (100 %), Nallur (90 %), Keerapalayam (90 %) Overall in Cuddalore district, 94.76 per cent of groundwater samples were in good quality, Saline water (48.53%) distributed in the blocks of Panruti, Cuddalore, Annagramam, Kaatumannarkoil, Kammapuram, Mangaloor, Virudhachalam, Nallur, Keerapalayam. Alkali water found in Cuddalore block to the extent of 4 per cent.

**Keywords:** Groundwater quality, Cuddalore district, SAR and RSC

## Land Use/Land Cover (LULC) Changes and Mapping of Potential Areas for Climate Smart Aquaculture in PeechiReservoir, Kerala

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### ABSTRACT

India stands first position in the vulnerability to climate change risks among 67 developed, emerging and frontier market countries, and is particularly very sensitive to extreme weather events impacts on inland fisheries. Due to the detrimental effects that human activities have on the normal operation and dynamics of freshwater resources, understanding and modelling changes in land use and land cover (LULC) have become one of the main topics of concern for environmental management. The present study assessed the land use/land cover changes and water spread dynamics of Peechi reservoir, Kerala, India using multi-temporal satellite imagery during the period 1990–2020. Mapping of the spatial extent of the water spread area for identifying the potential sites for fish culture using supervised classification and multi-criteria analysis was also performed. The study showed a significant change in the settlement area from 1990 to 2020 as most of the agricultural and barren land has been converted into settlement areas. Based on frequency of water presence during 2000–2020, water spread areas with potential for fish culture were determined in Peechi reservoir. The LULC changes point towards decrease in the availability of land hence stringent regulations must be implemented with the use of GIS and remote sensing. The results of the current study will be useful for prioritising reservoirs with potential for fish culture and for developing suitable strategies for management of reservoirs.

**Keywords:** Land use, land change, multicriteria analysis, reservoir, fish culture

### Estimation of amylose content in maintainer lines of rice (*Oryza sativa* L.)

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### ABSTRACT

To assess the amylose content, the current experiment was carried out with 40 rice genotypes. Rice amylose concentration varies from 0 to 30% depending on the presence of various Wx alleles. In contrast to rice with an intermediate amylose level (20-25 percent), which tends to be softer and stickier, and rice with a low amylose content (20 percent), which is typically rather soft and sticky, rice with a high amylose content (25-30 percent) tends to cook firm and dry. Waxy rice, which is also known as sticky rice, contains no amylose. Most customers throughout the world choose products with an intermediate amylose level between 21 and 25 percent. Because firmness and stickiness, two characteristics of cooked rice, affect consumer preference for and use of various classes of rice, amylose content is crucial. Amylose content varied among the genotypes from 16.1% to 27.6%, with a mean value of 22.2 percent. Amylose content was highest in the genotype RNR 26119 (27.6%), followed by TP 30494 (26.2%) and CT - 18615-1-S-1-2-4 (26.2 percent). CMS 23B (16.1 percent) was the genotype with the lowest amylose content, followed by JMS 11B (16.5), Sharbati (16.7), RNR 26061 (17.5), CMS 52B (17.6), and CMS 64B. (17.6). Checks, RNR 15048 and MTU 1010 recorded 23.8 %, 23.7 % of amylose content respectively. Out of 40 genotypes 18 genotypes had recorded intermediate amylose content. Whereas CMS 23B (16.1 %) had low amylose content and genotype RNR 26119 (27.6 %) had high amylose content.

**Keywords:** Amylose, alleles, genotypes, and waxy rice

**Toxicity evaluation of Mithi river water samples in zebra fish (*Danio rerio*) embryos**

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**ABSTARCT**

The Mithi River, which flows through the heart of Mumbai's industrial hub, is one of the most polluted rivers in Maharashtra due to various industrial and domestic discharges. The current study was conducted to determine the toxicity of Mithi River water in zebrafish (*Danio rerio*) embryos. Water samples were taken from two locations namely Military Road Old Bridge (S1) and BKC Flyover (S2). To assess the lethal dilution 50 (LDil 50) of samples, Zebrafish Embryo Toxicity Test (ZFET) was performed with 8 different dilutions. After 120h, the lowest and highest LDil 50 values of 0.855 & 4.824 were obtained for the S1 and S2 respectively. Several teratogenic endpoints such as egg coagulation, pericardial edema, yolk sac edema, tail bend, and body curvature were recorded. The comet assay revealed a significant difference in DNA damage in terms of Olive tail moment (OTM) in the embryos exposed to S1, S2 samples and control with values of  $2.073 \pm 0.19$ ,  $3.022 \pm 0.13$  &  $0.89 \pm 0.04$  respectively. The histopathological analysis of the embryos revealed lesions viz. improper notochord development, septal disintegration, disrupted myofibril architecture and epidermal layer detachment. The findings of this study indicated that Mithi River samples were polluted and could induce toxic effects in aquatic organisms.

**Keywords:** Comet assay, Lethal Dilution 50, Histopathology, Mithi River, Teratogenicity, Zebrafish



## Implications of gender inequality in Food and Nutritional security

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### ABSTRACT

India has witnessed gender inequality from its early history due to its socio-economic and religious practice that resulted in wide gap between the position of men and men in the society. In fact, gender has been the most statistically significant determinant of malnutrition among young children and is an underlying cause of death among girls below age 5. Girls are breast-fed less frequently and for a shorter duration of time. In many rural families, the girls and women face nutritional discrimination within the family and are anaemic and malnourished. The intra-household food distribution seems to follow the rule that the children get the first priority, then the adult men and then the women. The probability of going without enough food on a given day as high as 40-50 percent for the women. The maternal mortality in India is the second largest in the world. Inequality in access to and control of assets have severe consequences for women's ability to provide food, healthcare and sanitation services to themselves, their husbands and their children, especially their female children. Women with less influence or power within the household and community are unable to guarantee fair food distribution, malnutrition in women contributes significantly to growing rates of maternal deaths and is directly related to faltering nutritional status and growth retardation in children.

**Keywords:** Food and nutritional security, gender inequality, malnutrition, nutritional discrimination, nutritional status, food distribution



**Theme - 4**  
**Climate Change Resilient Agriculture**



**Effect of land configurations and pigeon pea based strip intercropping on soil moisture storage under rainfed ecosystem**

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**ABSTRACT**

A field experiment was conducted at Agricultural College and Research Institute, Coimbatore in Western Zone of Tamil Nadu during June 2017 to January 2018 to study the pigeon pea based crop intensification under different land configurations with supplemental irrigation to achieve sustainability in rainfed ecosystem. The experiment was laid out in split plot design with three main factors of land configurations L<sub>1</sub> - compartmental bunding, L<sub>2</sub> - broad bed furrow and L<sub>3</sub> - ridges and furrow and seven sub factors as S<sub>1</sub> - pigeon pea + Blackgram (4:5), S<sub>2</sub> - pigeon pea + Greengram (4:5), S<sub>3</sub> - pigeon pea + cowpea (4:5), S<sub>4</sub> - pigeon pea + groundnut (4:5), S<sub>5</sub> - pigeon pea + sesame (4:5), S<sub>6</sub> -pigeon pea + cotton (4:4) and S<sub>7</sub> -pigeon pea sole crop and were replicated thrice. Test varieties were Co (Rg) 7, Co 6, Co 8, VBN 1, TMV 13, TMV 7 and Co 14 for pigeon pea , blackgram, greengram, cowpea, groundnut, sesame and cotton respectively. Observations were recorded on soil moisture with digital soil moisture meter and per cent of soil moisture was worked out. From the soil moisture results following findings were arrived. Among the different land configurations, ridges and furrow (L<sub>3</sub>) method of sowing recorded maximum soil moisture storage of 27.9, 18.6, 39.3, 27.7, 22.3 and 17.4 per cent at 30, 60, 90, 120, 150 DAS and at harvest stage respectively. In various intercropping system pigeon pea + cowpea (S<sub>3</sub>) recorded higher soil moisture of 18.5 per cent at 60 DAS. At 60, 90, 120, 150 and harvest stage higher soil moisture content of 39.7, 31.0, 24.0 and 18.5 per cent was estimated in pigeon pea + cotton (S<sub>6</sub>) intercropping system.

**Key Words:** Rainfed, Pigeon Pea, Land configuration, soil moisture, Strip intercropping



**Impact of climate change on water requirement and yield of tomato  
over different agro-climatic zones of Tamil Nadu**

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**ABSTRACT**

The study was aimed to assess the impact of Climate change on water requirement and yield of tomato over different agro climate zones of Tamil Nadu. Tomato is the world's largest vegetable crop which is considered an important commercial and dietary vegetable crop.. Efficient cropping districts were identified in different agro-climatic zones of Tamil Nadu based on the maximum area covered under tomato cultivation from Season and Crop Report, Department of Economics and Statistics, Government of Tamil Nadu and considered for the current investigation. Rainfall and Temperature data (1990 to 2019) was obtained from IMD and employed in the AquaCrop model for simulating the crop water requirement and yield of tomato. Results showed the spatial and temporal variations in tomato production across different agro-climatic zones of Tamil Nadu. Water use efficiency was higher (65.55%) in the High rainfall zone and lower (50.96%) in the Cauvery Delta zone. The northwestern zone was found to have more water requirement (580 mm) while the lowest water requirement of 447 mm was observed in the northeastern zone. The western zone produced the highest fruit yield (33.9 tones/ha) and the Cauvery delta zone exhibited the lowest yield (29.2tones/ha). The elevated temperature harmed tomato yield and the water requirement of s tomato was increased due to an increase in temperature.

**Keywords** – AquaCrop, tomato yield, Water use efficiency (WUE), Water requirement (WR)

**Bio-fertilizers—a tool in mitigating greenhouse gas emission in puddled rice (*Oryza sativa*.L)**ChelviRamesh<sup>1</sup>, R. Durai Singh<sup>2</sup>, P.Kannan<sup>3</sup> and R.Surya<sup>4</sup>

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**ABSTRACT**

A field experiment was conducted at Agricultural College & Research Institute, Tamil Nadu Agricultural University, Madurai during 2021 to quantify the GHG emission in puddled rice, ADT 54. The experiment was laid out in Randomized Block Design with four replications with the treatments, T<sub>1</sub> - SRI method of rice cultivation with organic farming SOP, T<sub>2</sub> - SRI method of rice cultivation with inorganic farming SOP, T<sub>3</sub> - T<sub>1</sub>+BGA application @ 10 kg ha<sup>-1</sup>, T<sub>4</sub> - T<sub>2</sub>+ BGA application @ 10 kg ha<sup>-1</sup>, T<sub>5</sub> -T<sub>1</sub>+Azolla application @ 250 kg ha<sup>-1</sup>, T<sub>6</sub> -T<sub>2</sub>+ Azolla application @ 250 kg ha<sup>-1</sup>. Among the treatments, SRI method of rice cultivation with inorganic farming (T<sub>2</sub>) has recorded significantly taller plants (133 cm), higher number of tillers plant<sup>-1</sup> (19.8), maximum LAI (5.73), more productive tillers (328 m<sup>-2</sup>) and maximum grain yield (5285 kg ha<sup>-1</sup>). However, with regard to methane emission, SRI with inorganic farming + Azolla 250 kg ha<sup>-1</sup> (T<sub>6</sub>) recorded with very less methane during active tillering (4.14 mg m<sup>-2</sup> hr<sup>-1</sup>) and flowering stage (2.77 mg m<sup>-2</sup> hr<sup>-1</sup>) with higher post-harvest soil fertility status. As regards BCR, it was maximum at SRI with inorganic farming and was closely followed by SRI with inorganic farming + Azolla 250 kg ha<sup>-1</sup>. Hence, SRI with inorganic farming + Azolla 250 kg ha<sup>-1</sup> (T<sub>6</sub>) may be recommended for getting higher yield, reduced methane emission, higher post-harvest soil fertility status and higher BCR (2.37) for rice variety, ADT 54.

**Key words:** Azolla, methane, quantify, Cyanobacteria, Fertility and puddled

## **Identifying the trends in Agrobiodiversity and factors responsible for it across different states of India.**

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### **ABSTRACTS**

Agrobiodiversity is a major contributor to agricultural productivity and food security. It also plays a role in stability of farming systems and reduces pressure of agriculture on fragile areas, forest and endangered species. It can further enhance the diversity in food and nutritional value. Various anthropogenic activities over the years have modified the environment, contributing to the agrobiodiversity loss. Environmental conditions are the major drivers of change in biodiversity, which could be direct factors (historical legacy, environmental changes) or indirect factors (Economy, social value & awareness, technological intervention, Policy & regulations). The agricultural intensification post green revolution has impacted the agrarian transition by changing the choices of crops as well as the land use pattern.

This study was aimed to estimate the Agrobiodiversity Index for 20 states of India for the period 1990 to 2017 and to identify the trends in agrobiodiversity index that have occurred over the years. The study also focuses on assessing the factors that may have influenced the trend of Agrobiodiversity Index. The data on total area under production was used to calculate the agrobiodiversity index for the selected agricultural crop groups (Cereals, Pulses, Oilseeds and Fruits & vegetables). Temporal trend was analysed using mathematical and statistical methods.

It was found that there is constant decrease in trend of the Agrobiodiversity index over the years for 20 states in India. This clearly indicates that the agricultural biodiversity loss occurring throughout India. Agrobiodiversity loss can have a long-term impact on agricultural sustainability causing food security issues. Crop diversification, road connectivity, market and storage can also contribute towards improving the agrobiodiversity. There is a need to have a policy level intervention to focus on area-wise diversified cropping. Overall biodiversity and agrobiodiversity can enhance the agro-ecosystem resilience.

**Keywords:** Agrobiodiversity index, biodiversity, agricultural sustainability

## Effect of Nanoscale CaO and MgO on Bio-ethanol Production from Sweet Sorghum

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### ABSTRACT

Application of nanoscale materials already revolutionized the medicine, textile industry and energy sectors but its applications are still at immaturity stage in agriculture and fermentation studies. The metal ions like calcium and magnesium playing a key role in growth and metabolism. These nutrients when added during fermentation impact significantly on the progress and efficiency of industrial fermentations. The ethanol content and ethanol yield estimated at 24 hours of successive intervals from start of the fermentation experiment showed the influence of addition of nanoscale CaO and MgO at different concentrations on altering the ethanol content by enhancing the rate of fermentation compared to their bulk counter parts *i.e* CaNo<sub>3</sub> and MgSo<sub>4</sub>. Significantly higher values of ethanol content and ethanol yield were obtained with treatments added with combinations of nanoscale CaO @ 10 ppm and nanoscale MgO @ 20 ppm. After 48 hours of fermentation, the higher percentage of mean ethanol content 7.37% and 7.63% was associated with addition of nanoscale CaO @ 10 ppm and nanoscale MgO @ 20 ppm respectively.

Keywords: nanoscale, ethanol, sweet sorghum, calcium and magnesium

**Effect of exogenous melatonin on the water stress alleviation in black pepper  
(*Piper nigrum* L.)**

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**ABSTRACT**

Black pepper (*Piper nigrum* L.) is highly sensitive to water deficit stress especially during summer, resulting in significant losses in yield; therefore, strategies aimed at enhancing water deficit tolerance are essential. Melatonin improves stress tolerance in plants; however, its mechanism in black pepper rooted cuttings under water deficit stress remains unknown. Therefore, we conducted a two pot culture experiment in March, 2022 and April, 2022 using the variety Panniyur-1 to investigate the effects of foliar-sprayed and root-irrigated melatonin (50, 100 and 150  $\mu\text{M L}^{-1}$ ) on the recovery per cent, photosynthetic pigments, photosynthetic gas exchange, efficiency of photosystem II, proline accumulation, antioxidant defence system in black pepper leaves under water deficit stress. The application of exogenous melatonin significantly relieved the inhibitory effects of water deficit stress on leaves. The melatonin-induced enhanced tolerance could be attributed to improved leaf water content, photosynthetic activity, photosynthetic pigments, reduction of water stress-induced oxidative damage by increasing the activity of antioxidant enzymes (SOD, POD, and CAT), and ultimately improved recovery percent of rooted cuttings under water deficit stress. After rehydration, melatonin-treated plants recovered more quickly than untreated plants. In addition, melatonin counteracted the water stress induced accumulation in proline content. Overall, the results of this study demonstrated that melatonin at 100  $\mu\text{M L}^{-1}$  (Foliar spray and root irrigation) significantly alleviated the adverse effects of water deficit stress on the black pepper plants compared to 50  $\mu\text{M L}^{-1}$  and showed on par with 150  $\mu\text{M L}^{-1}$ . In addition, the results showed that application of exogenous melatonin combined with root and foliar application is superior to foliar spraying alone. And also melatonin (in all the concentrations) maintained higher photosynthetic rate diurnally than water stressed plants from 7AM to 5PM.

**Key words:** Black pepper-water stress-melatonin-antioxidant enzymes-diurnal photosynthesis



### **Afforestation drives and its success in cold desert regions: A review**

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#### **ABSTRACT**

Desertification is one of the world's most alarming processes of environmental degradation. The issue is often obscured, however, by a common misperception that it is a natural problem of advancing deserts in faraway developing countries. In fact, desertification is about land degradation: the loss of the land's biological productivity, caused by human-induced factors and climate change. Special efforts are required to improve the vegetation status of such places which, in turn improve the environmental conditions of the area. As such afforestation has been one of the most talked about method of dealing with desertification which is the result of climate change and human induced activities. While taking up afforestation in inhospitable sites like cold deserts, care should be taken to use a species known to grow in the same climate, modification of the site and various measures for the protection of plantation. Afforestation, on a large scale, has shown some negative effects such as soil desiccation, water scarcity and decrease in soil moisture content. In 2017, the UN recommended the Growboxx in their Global Opportunity Report, an Integrated Planting Technology (Plant Cocoon) whose first practical experience in India has shown 94% survival rate in Jaisalmer.

**Keywords:** Desertification, Climate change, Cold deserts, Afforestation





## **Investigation on Seasonal Rainfall Mass Curves & Development of Synthetic Seasonal Hyetographs for Middle Gujarat**

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### **ABSTRACT**

Scarcity of rainfall data is always remained a big hurdle for majority of R & D outputs in water sector. In absence of hourly rainfall data researcher and water resource managers quite usually adopt daily rainfall as one of the reliable approximations for its multiple utilities. In this study we have tried to generate vast sets of such mass curves offering a single envelope of them, followed by synthesis of 3 specific design mass curves retrieved from upper, middle and lower bands of envelope of mass curves which in fact comprises hundreds of observed mass curves for all the 6 stations adopted in this study. An effort was made to get transformed these envelop of curves, in to their respective dimensionless shape. The set of so arrived dimensionless standard mass curves for six different stations and 21 different years reflects the overall shape function to rainfall mass curve as well as their functional characterization. An additional attempt was made to compare the ultimate shapes of synthesised seasonal rain mass curves (data driven) with that of historic SCS mass curve (based on 4 standard time distributions of rains). The ultimate aim was set to just seek, learn and detect; that weather any of the standard SCS shape have any kind of matching or resemblances with data driven synthetic season design mass curves at daily time step. Results shows that out of four only one i.e. Type I matches up to certain extent (partially on time span), moreover, the extent of similarity in shapes were found significantly dispersed for different durations and locations.

**Key words:** Rainfall, Hyetograph, mass curve, SCS Curve, IMERG



**Screening of *Rabi* Sorghum Genotypes Under Varied Moisture Regimes for Physiological Performance and Adaptability to Drought Stress**

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**ABSTRACT**

Drought being one of the major abiotic factors influencing crop growth, identifying the ones with high tolerance and efficient growth capabilities has ever growing importance in view of food security and sustainable development. In view of the scenario, a study was conducted at the Regional Agricultural Research Station, Vijayapura in the *rabi* of 2021-22 under AICSIP. This included screening of 18 selected germplasm lines for drought and evaluated for their adaptability. RSV 1876 (53.65 g/plant) yielded higher in stressed regime. The performance of Phule Anuradha was comparable in both irrigated (62.12 g/plant) and stressed (52.09 g/plant) regime. Their yield performances largely correlated with most of the screening parameters. These germplasms revealed higher canopy temperature depression (CTD) with CRS 99 (2.2) having higher depression in irrigated regime while the CTD of Phule Anuradha remained mostly stable between irrigated (1.9?) and stressed (1.6?) regimes. Similar are the results with relative water content, Chlorophyll and SPAD values. RSV 1876 reached physiological maturity (105 days) earlier than other genotypes followed by Phule Anuradha (106 days). Similar positive relationships of grain yields with the plant height and other morphophenological parameters under the drought stress. RSV 1876 is most likely to have higher adaptability followed by Phule Anuradha among the selected germplasm lines.

**Key words:** Plant Height, Canopy Temperature Depression, Physiological Parameters, Physiological maturity.



## **Impact of climate change on crops adaptation and resilience of farming system**

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### **ABSTRACT**

Agriculture and climate change are internally correlated with each other in various aspects, as climate change is the main cause of biotic and abiotic stresses, which have adverse effects on the agriculture of a region. The land and its agriculture are being affected by climate changes in different ways, e.g., variations in annual rainfall, average temperature, heat waves, modifications in weeds, pests or microbes, global change of atmospheric CO<sub>2</sub> or ozone level, and fluctuations in sea level. The threat of varying global climate has greatly driven the attention of scientists, as these variations are imparting negative impact on global crop production and compromising food security worldwide. According to some predicted reports, agriculture is considered the most endangered activity adversely affected by climate changes. To date, food security and ecosystem resilience are the most concerning subjects worldwide. Climate-smart agriculture is the only way to lower the negative impact of climate variations on crop adaptation, before it might affect global crop production drastically. Climate-Smart Agriculture is guided by three main goals. Increased productivity (sustainably intensifying agriculture). Enhanced resilience (adapting to climate change). Reduced emissions (mitigating greenhouse gas emissions). Climate-Smart Agriculture includes many practices that farmers already use: Conservation tillage, Cover cropping, Nutrient management, Agroforestry. other practices to reduce GHG emissions.

**Keywords:** Climate-Smart Agriculture, Cover cropping, Nutrient management, Agroforestry and sustainably intensifying.



**Nutrient analysis of soil samples from different villages of Gandhinagar, Gujarat  
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**ABSTRACT**

Nutrient management is dependent on the collection and analysis of soil and plant samples for nutrient assessment. This study leads us to the conclusion of nutrient's quality present in soil of Gandhinagar district. The analysis of nutrient is done in order to measure the pH level, organic carbon, nitrogen, phosphorous and potassium that is present in the soil and it provides all the necessary information in order to set nutrient application. The results depends on quality of soil samples. The soil samples collected from different villages of Gandhinagar. The value of pH was observed from 6 to 7, EC and organic carbon in the range from 0.48 to 0.56 %. The available nitrogen ranges from 152 to 248 kg/ha. The available phosphorous was ranged from 11 to 18 kg/ha and potassium from 231 to 318 kg/ha. This information has significance for balanced nutrition in increasing crop yield. This information will helps farmers to solve the problems related to soil nutrients, amount of which fertilizers to be used to increase the yield of crops.

Keywords: Nitrogen, Phosphorus, Potassium, Soil analysis

## Evaluation of Air Pollution Tolerance and of Selected Roadside Tree Species in Ludhiana, India

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### ABSTRACT

Air quality has deteriorated in most big cities & becoming the fifth major cause of mortality in India. Among others, vehicle gaseous emission is a major contributor. Plants have different tolerance levels, which can be identified based on Air Pollution Tolerance Index (APTI). The objectives were to study the morphological and biochemical parameters for Air Pollution Tolerance Index (APTI) of selected roadside tree species (*Acacia auriculiformis*, *Alstonia scholaris*, *Chukrasia tabularis*, *Cassia fistula*, *Cassia siamea*, *Dalbergia sissoo*, *Heterophragma adenophyllum* and *Putranjiva roxburghii*) at control (PAU campus) and polluted sites (roadside) during summer and winter seasons. The total chlorophyll content, ascorbic acid, leaf extract pH and leaf relative water content from 0.59-4.16 mg g<sup>-1</sup>, 1.03-3.75 mg g<sup>-1</sup>, 3.16-7.04, 46.01-and 71.65%. Based on these biochemical parameters air pollution tolerance index (APTI) of the selected trees was worked out, ranged between 7.65 to 11.19 and followed an order of *Cassia fistula* > *Acacia auriculiformis* > *Dalbergia sissoo* > *Alstonia scholaris* > *Putranjiva roxburghii* > *Heterophragma adenophyllum* > *Cassia siamea* > *Chukrasia tabularis*. All trees were found suitable for roadside plantation in polluted areas with good APTI score with *Cassia fistula* at the top among selected trees.

**Key Words:** Air Pollution Tolerance Index (APTI), Biochemical parameters, Trees, Air Quality

### Sulphur-mediated modulation of lead stress by modulating oxidative stress adjusting ascorbate-glutathione cycle in *Brassica juncea* L.

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### ABSTRACT

The present study investigated the critical role of exogenous sulphur on physiological and biochemical responses of oxidative stress biomarkers and antioxidant scavenging defense systems in oilseed mustard (*Brassica juncea* L. Czern & Coss) seedlings exposed to lead (Pb) stress. Pb treatment of 100 mg Pb Kg<sup>-1</sup>, Pb<sub>2</sub>; 200 mg Pb Kg<sup>-1</sup> and Pb<sub>3</sub>; 300 mg Pb Kg<sup>-1</sup> led to significant reductions in plant growth. Increase in the levels of hydrogen peroxide and malondialdehyde; and increase in Pb uptake and accumulation in shoots in the pots grown in 60-day old seedlings. Moreover, it reduced ascorbate (AsA) content by 9, 21 and 32 per cent which has been correlated with the reduction in glutathione (GSH) content by 14, 38 and 45 per cent and its redox status. In contract, sulphur metabolites like ATPS and OASTL increased upon stress. However, exogenously applying Sulphur to Pb-exposed seedlings decreased the damage caused by oxidative stress and improved defense systems by increasing AsA, GR and GSH contents, and increased Pb uptake and accumulation in plant shoots. Therefore, the study concludes that additional S supply to the Pb plants enhances their capacity to reduce Pb toxicity, presumably through its efficient chelation via a significant increase in the levels of total thiols and antioxidants, and suggests that S at normal nutrient may promote As toxicity to plants by enhancing oxidative stress.

**Keywords:** Ascorbate-glutathione, *Brassica*, Oxidative stress markers, Lead toxicity, Sulphur.

## Organic matter as a foundation for ecosystem sustainability

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### ABSTRACT

Most agricultural soils are depleted of their organic matter reserves. A severe loss of soil organic matter (SOM) results in degradation of soil functionality, its capacity for provisioning of essential ecosystem services and soil health. Conservation agricultural practices should be taken into consideration to maintain the soil health and ecosystem sustainability. Balanced and integrated use of organic and inorganic fertilizers enhance the accumulation of soil organic matter and improves the soil physical properties. Among various treatments, soil carbon pool increased from 7.9 Mg ha<sup>-1</sup> in control to 11.6 Mg ha<sup>-1</sup> under 100% NPK + FYM treatment. Land use practices improve the soil organic carbon status and in turn the soil health. The highest OC (0.41 %) under plantation crops followed by forest land use (0.39 %) and crop land use system (0.37 %). The organic carbon and available N, P and K content viz. 13.75 (g/kg), 390, 131, 167 kg/ha, respectively was recorded highest under 100 % NPK + FYM treatment as compared to imbalanced use of fertilizers and control. Resource conservation practices like zero tillage, residue retention helps to reduce the soil erosion and nutrient losses. Organic matter maintains the soil biodiversity. Soil organic matter is also an important indicator of soil degradation. Topsoil loss of 2 cm was recorded in soils having 4.6-5 % OM, while it can be upto 20 cm in soils having 0.1-0.5 % soil organic matter content. Organic matter serve as a store house of plant nutrients, thus improves soil nutrient status, and agricultural productivity and maintains the overall ecosystem balance.

**Keywords:** Ecosystem, Organic matter, Sustainability, Zero tillage



## Carbon dioxide evolution and fruit yield in tomato under organic nutrition

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### ABSTRACT

Carbon dioxide (CO<sub>2</sub>), a major greenhouse gas is occurring in atmosphere and besides causing global warming, is altering the bio-chemical composition of plants. Soil respiration causes the release of CO<sub>2</sub> and its quantity of release will depend on type of soil organic matter present besides temperature and moisture content of soil. An experiment was conducted at College of Agriculture, Vellayani during December 2021 to March 2022 to assess the CO<sub>2</sub> evolution with organic manure application and its effect on fruit yield and quality in tomato (*Lycopersicon esculentum*, L). The experiment was laid out in CRD with six treatments in three replications. The treatments included T<sub>1</sub>: Farm yard manure (FYM); T<sub>2</sub>: Vermicompost; T<sub>3</sub>: Poultry manure; T<sub>4</sub>: FYM + Glyricidia leaves; T<sub>5</sub>: Vermicompost + Poultry manure and T<sub>6</sub>: Integrated Nutrient Management (INM). The carbon dioxide evolved due to decomposition of respective manures in these treatments were recorded at weekly interval up to the final harvest and yield and quality parameters were ascertained. Perusal of the data on CO<sub>2</sub> evolution revealed maximum release in the vermicompost + poultry manure applied treatment and the trend showed an increase up to five weeks of application and then started declining thereafter, until harvest. Fruit yield was significantly the higher in INM (2,215 g/plant), and was the lowest (604.33 g/plant) in vermicompost + poultry manure application. The number of fruits per plant and average fruit weight were also significantly the higher in INM (32.3 and 62.41g respectively), the former on par with vermicompost treatment (T<sub>2</sub>) and the later with poultry manure application (T<sub>3</sub>). The study revealed that INM was superior to organic nutrition in tomato in terms of yield and quality. However, quality showed on par with sole poultry manure and vermicompost application.

**Keywords:** Carbon dioxide, Greenhouse gas, Soil respiration, , Tomato, Integrated nutrient management



## Comparative performance of direct seeded rice genotypes by multivariate analysis

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### ABSTRACT

Global water scarcity in rice growing areas is threatening the sustainability of transplanted rice production. Aerobic rice has emerged as an efficient economically viable and environmentally promising alternative to transplanted rice. Twenty rice genotypes (10 genotypes each of basmati and non-basmati) were evaluated under direct seeded condition in a Randomized Block Design (RBD) with three replications in the research field area of Department of Genetics and Plant Breeding, College of Agriculture, Kaul during the Rabi seasons of 2018-19 and 2019-20. Performance of twenty rice genotypes under direct seeding had been evaluated by multivariate analysis and ANOVA showed highly significant differences among genotypes for yield and contributing traits studied. Principal component analysis accounted 59.7% and 65.8 % of the total variation by first two components during 2018-19 and 2019-20 respectively. Genotypes IR14L521, HKR-48, HKR 15-483, PB-1121, CR3983, 53-1-2-1-2 observed as distinctly placed in biplot. Days to fifty percent flowering, yield, chaffs per panicle, number of grains per panicles contributed more in first whereas number of panicles per meter square, yield was major contributors for second component. HKR 16-464, 15-488, HKR-47, NVSR-2107 achieved distinctiveness from other genotypes. Panicles per meter square expressed large variability as compared to other traits. Yield maintained significant positive correlation coefficient with number of grains per panicle and negative for days to fifty percent flowering. The high positive correlation has been observed between plant height, days to fifty percent flowering and yield to thousands grains weight & Chaffs per panicle. Days to fifty percent flowering, plant height, panicle length, number of panicles per meter square clustered together as opposite to cluster of yield, number of chaffs per panicle & thousands grains weight traits.

**Keywords :** Direct seeded, correlation coefficient, Multivariate analysis.





### **Extreme temperature and rainfall events trend over Varanasi**

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#### **ABSTRACT**

The regional level studies are vital to identify the existence, magnitude and statistical significance of different types of extreme weather events and to understand the regional-level climate change. A computation study was carried out with the objective to assess the trend in the temperature and precipitation extremes in the Varanasi district of Uttar Pradesh during the period 1980-2018 using ETCCDI indices through RCLimDex software and statistical significance are estimated using Mann-Kendall (MK) non-parametric test and linear regression. Out of the 13 temperature indices, 8 showed a significant trend. Similarly, out of the 11 rainfall indices, only 2 showed a significant trend. The annual mean maximum temperature, warm days, diurnal temperature range, and monthly minimum of maximum temperature have decreased significantly by 0.029°C, 0.159 days, 0.032°C, and 0.122°C per year, respectively whereas cool days and cold spell duration have increased significantly by 0.264°C and 0.372 days per year respectively, indicating an increasing cooling effect over the study area. The increasing drought over the study area is evident as the number of rainy days and consecutive wet days have decreased significantly by 0.262 days and 0.058 days per year, respectively and non-significant increasing consecutive dry days during the same period. The weak negative non-significant trend of maximum 5 consecutive day rainfall, very heavy rainfall days, and total annual precipitation indicate the decreasing trend of flood.

**Keywords:** Varanasi, Temperature extreme, Precipitation extreme, Mann-Kendall test, RCLimDex



## **Climate resilient technology to cope with climate change for sustainable production and livelihood**

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1. SRF NICRA, ATARI, Bengaluru, 2, 3, 4, 5,6- Subject Matter Specialists of KVKs Tumkur-II, Gadag, Kalaburagi-I, Chikkaballapur and Alapuzha, respectively.

### **ABSTRACT**

Climate resilient technologies viz., selection of climate resilient varieties, improved intercropping systems and goat management were demonstrated in the five most climatically vulnerable districts of Karnataka and Kerala during 2021. Selection of improved varieties viz., finger millet (ML-365), maize (MAH-14-5), Sorghum (SPV 2217) and pigeonpea (BRG-5) performed better with yield of 20.30 q/ha, 27.10 q/ha, 22.75q/ha and 9.30 q/ha, respectively than local varieties. Groundnut + pigeonpea (13.40 q/ha), maize + pigeonpea (71.95 q/ha), green gram + pigeonpea (8.63 q/ha), pigeonpea+ black gram (12.25 q/ha) and finger millet + pigeonpea (20.7 q/ha) intercropping systems recorded significantly higher yields compared to their sole crops (12.57 q/ha, 53.97q/ha, 6.25 q/ha, 4.90 q/ha and 20.1 q/ha, respectively). Improved goat shelter with raised platform, reducing the mortality from 40 per cent to 0 and increased number kid per year (17 kid/ year) with net return of ? . 57345 and B: C of 1.7 compared to traditional goat rearing shelter.

**Key word:** Climate change, climate resilient, climate vulnerable, goat rearing intercropping system, varieties

### Development and optimization of NIRS prediction models for simultaneous multi-trait assessment in diverse cowpea germplasm.

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#### ABSTRACT

Cowpea is one such legume which can facilitate to achieve goals on sustainable nutrition and climate change. Assessing nutritional traits conventionally can be laborious and time consuming. NIRS is a technique used for rapid determination of biochemical parameters for large germplasm. NIRS prediction models were developed to assess protein, starch, TDF, phenols and phytic acid based on MPLS regression. Higher  $RSQ_{\text{external}}$  values were obtained for different traits protein (0.903), starch (0.997), TDF (0.901), phenols (0.706) & phytic acid (0.955) in “2,4,6,1”, “2,8,8,1”, “2,4,4,1”, “3,4,4,1” and “2,8,8,1” mathematical treatments respectively. Models for all the traits displayed RPD values of  $>2.5$  except phenolics (1.78) and low SEP indicating the excellent prediction of models. Paired t-test and reliability analysis were used to determine the difference in the mean of analytical and predicted values. For all the traits worked, p value=0.05 implied the accuracy and reliability score  $>0.8$  (except phenol) ensured applicability of the models. The developed models will facilitate high throughput screening of large cowpea germplasm present in the national gene bank at ICAR-NBPGR, New Delhi for identification of traits specific germplasm and selection of desirable chemotypes in any genetic background with huge application in cowpea crop improvement programme across the world.

**Keywords:** MPLS regression, Germplasm Screening, Nutritional composition, Variability, RPD,  $RSQ_{\text{external}}$ .

### Root characterization and Identification of drought tolerant dicoccum wheat germplasm lines using Stress tolerance Index (STI).

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#### ABSTRACT

Dicoccum wheat germplasm lines/local collections from different eco-geographical zones were evaluated for their response to terminal drought stress. Assessing the genetic diversity for dicoccum wheat germplasm lines under stress and non-stress conditions was prime objective of the study conducted in Rabi 2020-21. Results of multivariate analysis on root traits revealed that the root length and root volume were highly influencing grain yield under stress conditions. A clustering analysis based on agro-morphological and root traits indicated a good level of genetic diversity among germplasm. Most yield and yield-attributing characteristics showed a significant decrease in mean performance under stress conditions. Drought tolerant germplasm lines were classified based on Stress Susceptibility Index (SSI) and Stress Tolerance Index (STI). Among the seventy dicoccum germplasm lines DDK-50378 showed good SSI with 0.21. Twenty germplasm lines performed better with STI ( $>0.9$ ). The germplasm lines DDK-50341, DDK-50380, and DDK-50381 produced better yield with increased root length and root volume under moisture stress than the top yielding standard check DDK 1025. These genotypes proven to be promising and carry genes for drought tolerance and can be further utilized in breeding program for drought tolerance.

**Key words:** Triticum dicoccum, Terminal Drought, Root Phenotyping, Drought Tolerance



## **Cryopreservation of shoot tips of *Allium hookeri* Thwaites – an underutilized species with multifarious uses**

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ICAR-National Bureau of Plant Genetic Resources

### **Abstract**

*Allium hookeri* Thwaites (Amaryllidaceae), globally distributed in India, China, Bhutan, Tibet, Sri Lanka, Myanmar and Nepal. In India, the species is distributed in the states of Assam, Meghalaya and Manipur and commonly known as Hooker Chive. It is an underutilized species with multifarious uses viz., medicinal properties (antioxidant, anti-cancer and anti-inflammation), as food and as feed for animals. This species is conserved as *in vitro* cultures in the *In Vitro* Genebank at ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi, India. In the present study, vitrification technique of cryopreservation was compared to droplet-vitrification technique. Shoot tips (~0.5-1 mm in length) were excised from four weeks old stock cultures *A. hookeri* (IC557018) and were precultured on Murashige and Skoog medium supplemented with 0.3M sucrose at 5 °C for 2 days. Thereafter, shoot tips were treated with loading solution for 30 minutes, following this shoot tips were dehydrated with PVS-2 solution for 17 minutes at 25 °C and cryopreserved using vitrification and droplet-vitrification techniques. The average post-thaw regeneration after 4 wks was 20 to 30% by vitrification technique and 40-50% by droplet-vitrification technique. Thus, standardized droplet-vitrification technique has been used for long-term conservation of germplasm of *A. hookeri* and the two accessions (IC557018 and IC623454) are now safely cryobanked at ICAR-NBPGR, New Delhi, India.

**Key Words:** *Allium hookeri*, *In Vitro*, Genebank, vitrification, droplet-vitrification, germplasm

## Assessment of leaf anatomical parameters to determine drought tolerance in coconut hybrids

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### ABSTRACT

Coconut, *Cocos nucifera* Linnaeus, (family Arecaceae) is a pantropical plant. The coconut plantations are usually located in the lowlands just above sea level. The weather conditions for optimum growth and development of coconut are well distributed rainfall of 130 and 230 cm, mean annual temperature of 27°C, with at least 120 hours per month of sun shine period. Coconut is mainly grown as a rainfed crop and the productivity is 50% more when cultivated under well irrigated areas. Drought is one of the main environmental factors that limit coconut productivity. Drought occurred in any of the critical stages of the inflorescence development affects the nut yield. Hence development of drought tolerant varieties to cope up with the changing climate is the pressing priority area of research. Simple and fast methods for the screening of the breeding material with respect to drought tolerance plays an important role in breeding programs of coconut. Among the different parameters, anatomical characteristics can be efficiently used as an indicator of drought tolerance. Hence, a study has been carried out to investigate the effects of drought on leaf anatomical characteristics in eight hybrids in order to reveal the origin of the variability in drought resistance. Among the hybrids higher thickness of upper and lower epidermis was observed in CODxLCT (46.02  $\mu\text{m}$  and 30.86  $\mu\text{m}$  respectively) followed by WCT (30.59  $\mu\text{m}$  and 27.55  $\mu\text{m}$  respectively). Thickness of epidermis was associated with drought tolerance, genotypes with higher epidermal thickness had lower water loss rates and thinner upper epidermis widths had higher water loss rates. Drought tolerance was also associated with thick palisade mesophyll layers. Among the hybrids the thickness of the palisade and spongy mesophyll tissues was more in CODxLCT (223.30  $\mu\text{m}$  and 88.04  $\mu\text{m}$  respectively). Greater xylem area is also associated with the ability to maintain functional conductance under stress, ensuring better water potential. Among the hybrids the diameter of the xylem is more in CODxLCT (44.41  $\mu\text{m}$ ) followed by CODxWAT (34.31  $\mu\text{m}$ ). These leaf morphoanatomical features could therefore be used as selection criteria in screening for drought-resistant coconut hybrids.

**Key Words:** Coconut, drought, resistance, hybrids, anatomical parameters, stomata.

## **Impact of flood resistant red rice variety - Sahyadri Panchamukhi on farmers prosperity of Coastal Karnataka**

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### **ABSTRACT**

In Dakshina Kannada, paddy is a major staple food crop mainly grown during kharif in medium and low laying fields. Area under paddy cultivation in the district has gone up by 8-10 % during this kharif season due to some farmers who had left their paddy fields fallow returning to farming and some youths who were working in cities and towns elsewhere returning to the roots of their family farming due to the COVID-19 situation. The area under paddy shot up by 10000 hectares to 12000 hectares in Dakshina Kannada. Coastal Karnataka has > 1500 ha of paddy land that inundates with flood for long duration creating unfavourable situation for paddy cultivation and resulting in low production. In coastal Karnataka more priority has been paid towards cultivation of indigenous red paddy varieties. But these varieties are tall with lodging problem, does not respond to fertilizer and provide less yield. Realizing this problem during 2020-21 ICAR-Krishi Vigyan Kendra, Dakshina Kannada, Mangalore took initiative to purchase the truthful labelled seeds for introduction and popularization of flood resistant red rice variety - Sahyadri Panchamukhi in the coastal district. During 2020-21 to 2022-23, 12 capacity building programmes were organized at different villages of Dakshina Kannada benefiting 267 farmers and 6.25 quintals of truthful labelled paddy seed as critical input was provided to motivate the farmers for adoption of new variety covering an area of 25 acre areas under Front Line Demonstration programme of ICAR – KVK Dakshina Kannada, Mangaluru. During the period from 2020 to 2022, KVK organized 3 FLDs, 2 seed production activity and seed source link connection to different line departments, NGOs, farmers group resulted an area expansion of 576 ha across the district with a production of 28800 quintals and increase in productivity from 18 to 20%. The total additional returns gained in the district is Rs. 891 Lakhs due to varietal replacement.

**Key words:** Flood, Sahyadri Panchamukhi, FLD, Production, Returns



## **GBS based linkage map of rice helps identify QTLs responsive for drought**

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### **ABSTRACT**

Nearly half the world's population eats rice as a staple food, especially in South Asian countries, where >90% of production and consumption occurs. Drought in the form of decreased rainfall and a falling ground water table is reducing rice harvest. The eastern and north-eastern parts of India are regarded hotspots of rice genetic diversity, which can assist in resisting drought.

In this context, a set of 210 Recombinant Inbred Line (RIL) mapping population was developed and advanced upto F7 stage from Banglami (medium duration, drought tolerant rice landrace) and Ranjit (long duration, photosensitive, drought susceptible, elite rice variety) and phenotyped along with 6 standard checks in Augmented-Randomized Block Design for identification of QTLs for 16 yield and agronomic traits under reproductive stage drought stress. The genotyping of 210 RILs and 2 parents were done by Genotyping by sequencing (GBS) technology.

A genetic map spanning 1306.4 cM was created with 4646 SNPs uniformly dispersed across the rice genome. 42 QTLs were identified that accounted 1.95-13.36% phenotypic variance (PVE). The finding of these QTLs is a huge breakthrough and can be exploited to generate drought-tolerant rice varieties in the future.

**Keywords:** Rice, Drought, QTL, RIL, GBS, SNP

## **Building Resilience through Root Research: From Phenes to Phenotypes for Enhancing Productivity under Water Stress in Legumes**

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### **ABSTRACT**

Water stress is major production constraint in food legumes. Global crop breeding efforts are mainly focused on the shoot, however, major yield limiting factors affect soil properties, directly influencing the root system. The unpredictable nature of rainfall and practical difficulty in creating managed stress conditions for screening large germplasm sets for drought tolerance reduces the efficiency of the selection program for drought tolerance on account of confounding effects. Despite the growing evidence for importance of root traits in drought tolerance, limited work has been done to include drought-adaptive root traits in breeding for drought-tolerant cowpea varieties. Crop breeding programs have largely ignored root traits due to tedious root recovery process and challenges in evaluating *in situ* root traits. In addition, large phenotypic plasticity of root traits in response to changes in soil conditions, and lack of high-throughput and cost-effective screening techniques make root studies highly challenging. Generating information on genetic variability of root traits and exploring genetic variability could assist legume improvement programs in developing varieties with desired root traits for drought tolerance. Also the relationship of root traits with shoot traits and physiological parameters that contribute to grain yield is essential to achieve improvements in productivity under water stress.

**Key words:** Legumes, Water stress, Root architecture, Physiological traits,



**Carbon footprints, energetic and economic budgeting of weed management under conservation agriculture system in maize (*Zea mays* L.) - wheat (*Triticum aestivum*) cropping system**

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**ABSTRACT**

Modern agricultural production systems are negatively affecting the environment and surrounding ecosystem. Therefore, conservation strategies and modern farming techniques must be incorporated in the indigenous production systems. Therefore, a study was conducted to evaluate the conservation agriculture (CA; ZTR-ZTR) and weed management practices on energy budgeting, profitability and C footprints during 2018-20. Five tillage *viz.* CT (conventional tillage) in maize - CT in wheat, CT-ZT (ZT, zero tillage), ZT-ZT, ZT-ZTR (ZTR, zero tillage + residue incorporation) & ZTR-ZTR and three weed management practices *viz.* H (recommended herbicide in maize)-H (recommended herbicide in wheat), IWM-IWM (IWM, integrated weed management) & HW-HW; (HW, hand weeding) were evaluated in maize-wheat cropping sequence. ZTR-ZTR had a maximum share (60-63%) in total energy input and higher net energy than conventional tillage (CT). Results revealed that with the adoption of ZTR-ZTR, system productivity, resource efficiencies and net returns were maximum, which remained statistically similar with CT-CT. Although, C footprints value increased with the application of residue with zero tillage and least under conventional tillage practices. However, application of recommended herbicides (H-H) resulted in higher system productivity, energy use efficiency and net returns ( $376 \times 10^3$  INR/ha) and lower C footprints. We found that CA can be adopted along with H-H in order to achieve sustainably high productivity, profitability and resource efficiencies in the Northwestern Himalayas.

**Key words:** Carbon footprint, climate smart agriculture, conservation agriculture, residue burning, weed management

## Reducing ammonia volatilization and denitrification losses in Wheat field by using microbial consortium

Sibananda Darjee<sup>1</sup>, Manoj Shrivastava<sup>1</sup>, Shivdhar Mishra<sup>2</sup>, Ashish Khandelwal<sup>1</sup>, Pooja LR<sup>1</sup>, Renu Singh<sup>1</sup>

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### ABSTRACT

One of the most important nutrients for wheat growth and productivity is nitrogen. Nitrogen losses from the soil and plant system not only reduce soil fertility and agricultural productivity, but they can also have significant environmental consequences. Nitrogen losses in agroecosystems are mostly caused by ammonia volatilization and denitrification. As a result, the integration of biofertilizers with inorganic fertiliser is urgently needed to improve the nutrient delivery system by incorporating the use of recommended dose fertilisers in conjunction with biofertilizer and reducing nitrogen losses. The objective of this research is to investigate the influence of microbial consortium on nitrogen losses in wheat crop and to evaluate its effect of on the yield of wheat crop. Under this research eight different treatment had been taken those are Control (unfertilised, Tc), Azotobacter (Ta), Mycorrhiza (Tm), Azotobacter + Mycorrhiza (Tam), NPK Recommended (Tr), NPK Recommended + Azotobacter (Tra), NPK (Recommended) + Mycorrhiza (Trm), NPK Recommended + Azotobacter + Mycorrhiza (Tram). An upsurge in soil microbial activity was reflected in the form of soil microbial biomass carbon (MBC) and soil microbial biomass nitrogen (MBN). Tram showed MBC and MBN value 146.9 mg kg<sup>-1</sup> and 45.2 mg kg<sup>-1</sup> respectively. In plot vigorous root growth was recorded, which helped in increasing the uptake of soil available nutrient ultimately it was reflected in higher nitrogen content in wheat straw and grain. The soil urease activity at flowering was found to be 24.4 mg urea g<sup>-1</sup> soil h<sup>-1</sup> for Tram which is significantly higher compare to Tr and Tc. The cumulative emission from ammonia flux varied from 10.4 to 10.6 kg ha<sup>-1</sup> and denitrification losses varied from 2.4 to 2.5 kg ha<sup>-1</sup> in Tram plot which is recorded minimal compare to the plot receiving Tr treatment. The yield obtained under Tram plot recorded as 6.4 t ha<sup>-1</sup> which is higher as compare to plot receiving treatment Tr i.e. 5.8 t ha<sup>-1</sup>. Thus integration of microbial consortium with inorganic fertiliser practices proved to be reducing nitrogen losses as well as increases crop yield compare to conventional agriculture practices.

**Keywords-** Ammonia volatilization, Denitrification, Microbial biomass carbon, Microbial biomass nitrogen.

## Reducing ammonia volatilization and denitrification losses in Wheat field by using microbial consortium

Sibananda Darjee<sup>1</sup>, Manoj Shrivastava<sup>1</sup>, Shivdhar Mishra<sup>2</sup>, Ashish Khandelwal<sup>1</sup>, Pooja LR<sup>1</sup>, Renu Singh<sup>1</sup>

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<sup>2</sup>Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi 110012, India

### ABSTRACT

One of the most important nutrients for wheat growth and productivity is nitrogen. Nitrogen losses from the soil and plant system not only reduce soil fertility and agricultural productivity, but they can also have significant environmental consequences. Nitrogen losses in agroecosystems are mostly caused by ammonia volatilization and denitrification. As a result, the integration of biofertilizers with inorganic fertiliser is urgently needed to improve the nutrient delivery system by incorporating the use of recommended dose fertilisers in conjunction with biofertilizer and reducing nitrogen losses. The objective of this research is to investigate the influence of microbial consortium on nitrogen losses in wheat crop and to evaluate its effect of on the yield of wheat crop. Under this research eight different treatment had been taken those are Control (unfertilised, Tc), Azotobacter (Ta), Mycorrhiza (Tm), Azotobacter + Mycorrhiza (Tam), NPK Recommended (Tr), NPK Recommended + Azotobacter (Tra), NPK (Recommended) + Mycorrhiza (Trm), NPK Recommended + Azotobacter + Mycorrhiza (Tram). An upsurge in soil microbial activity was reflected in the form of soil microbial biomass carbon (MBC) and soil microbial biomass nitrogen (MBN). Tram showed MBC and MBN value  $146.9 \text{ mg kg}^{-1}$  and  $45.2 \text{ mg kg}^{-1}$  respectively. In plot vigorous root growth was recorded, which helped in increasing the uptake of soil available nutrient ultimately it was reflected in higher nitrogen content in wheat straw and grain. The soil urease activity at flowering was found to be  $24.4 \text{ mg urea g}^{-1} \text{ soil h}^{-1}$  for Tram which is significantly higher compare to Tr and Tc. The cumulative emission from ammonia flux varied from  $10.4$  to  $10.6 \text{ kg ha}^{-1}$  and denitrification losses varied from  $2.4$  to  $2.5 \text{ kg ha}^{-1}$  in Tram plot which is recorded minimal compare to the plot receiving Tr treatment. The yield obtained under Tram plot recorded as  $6.4 \text{ t ha}^{-1}$  which is higher as compare to plot receiving treatment Tr i.e.  $5.8 \text{ t ha}^{-1}$ . Thus integration of microbial consortium with inorganic fertiliser practices proved to be reducing nitrogen losses as well as increases crop yield compare to conventional agriculture practices.

**Keywords-** Ammonia volatilization, Denitrification, Microbial biomass carbon, Microbial biomass nitrogen.

## **Nitrogen mineralization rate of different organic sources in inceptisol of Umiam, Meghalaya**

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### **ABSTRACT**

Study of the release pattern of nitrogen from locally available organic sources helps to reduce the chance of occurrence of nitrogen pollution of soil and water and determine the period of peak nitrogen release from organic amendments. These considerations are more relevant in the case of farming in the state of Meghalaya where the farming by default is organic in nature. An incubation study was carried out for a period of 100 days with four organic amendments namely farm yard manure, Poultry manure, Pig manure and Vermicompost and a control (at a rate of 120kg/ hectare) which were evaluated at every 10 Days interval with the aim to quantify the amount of Nitrogen mineralised and the rate of Nitrogen mineralisation at different time intervals. Initially, soil nitrate and ammonium contents were 17.5ppm and 28.0 ppm respectively but with advancement in the incubation period, nitrate and ammonium in soil were found to increase. Amendment with pig manure resulted in highest nitrate and ammonium content in soil (39.6ppm and 72.3ppm respectively corresponding to 126.2% and 158.2 % over the initial soil nitrate and ammonium content.). Unamended soil recorded the lowest amount of mineralised nitrogen in soil which were only 13.14% and 20.71 % higher over the initial soil nitrate and ammonium content. Change in rate of mineralizable nitrogen (dN/dt) with respect to incubation periods was found to be highest i.e., 0.39 mg/kg ammonium nitrogen at 60 Days after Incubation and 3.13mg/kg nitrate nitrogen at 10 Days after Incubation. Nitrogen release kinetics were worked out using two models, namely, first order and second order. The first order kinetics model was found to provide best fit equation for predicting nitrogen mineralization rate at any point of time.

**Keywords:** Nitrogen mineralisation rate, organic inputs, Nitrogen mineralisation kinetics.



## **Climate change Resilient Agriculture**

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### **ABSTRACT**

Climate resilience is a fundamental concept of climate risk management and resilience refers to the ability of an agricultural system to anticipate and prepare for, as well as adapt to, absorb and recover from the impacts of changes in climate and extreme weather. Climate variability and change have intensely affected agricultural systems, which are the major sources of livelihood for rural families in developing countries. Climate change holds the potential to radically alter agroecosystems in the coming decades, and devastating crop failures are already evident in several countries of the world. We may expect changes in land vegetation, ocean circulation, sea surface temperature and global atmosphere composition, which will in turn impact rainfall patterns. These changes will bring new challenges to farmers. The 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) suggests that tropical rice productivity is likely to decline at a 1.3% to 3.5% rate for each 1°C average global 32 Sustainable Development Goal 13 warming. Increased average global temperature may lead to increased thermal and water stresses and consequently, decreased productivity. It is estimated that climate change is already reducing global crop production by 1% to 5% per decade over the past 30 years, and will continue to pose challenges for agriculture in the coming decades. Therefore, in the face of global climate change, farmers must adapt their practices to deal with changing temperatures and more frequent extreme weather events. These adaptations must first and foremost build resilience within the agroecosystem, increasing its ability to continue functioning when faced with unexpected events. To ensure greater resilience and adaptability to climate risks, it will be important to quantify the risk to which agroecosystems will be exposed in the different ecological regions. Resilience can be enhanced by implementing short and long-term climate mitigation and adaptation strategies, as well as ensuring transparent and inclusive participation of multiple actors and stakeholders in decision-making and management processes. Climate vulnerability resulting from global changes implies the need to diversify production and to better explore opportunities and aptitudes of each ecosystem. In this context, climate change impacts can also be minimized by adopting diversified ecological systems. Creating such a system based on the available local natural resources meets a growing demand of part of the population for agroecological or strictly organic food production and meets a number of requirements linked to farmer's comfort and animal welfare. Some management practices must need to follow in order to enhance resilience in agriculture for climate change. The most important are Climatic Risk Climate Action Agricultural Zoning - which contributes to reduce risks by recommending more favourable times for sowing agricultural crops; genetic and animal breeding programs - which seek to adapt plants and animals to adverse climatic conditions; and intensive and integrated production systems, functional agroecosystems and aquaponics - which integrate aquaculture with plant production. Climate change poses a very high risk for food security if adequate mitigation and adaptation measures are not taken; it is therefore, fundamental to continuously develop and improve technologies, products and processes that ensure agroecosystem resilience and adaptation.

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**Keywords-** Climate Change, Resilience, Agroecosystem, Adaptation.



### **Climate Resilient Technology for Active Flood Plain**

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#### **ABSTRACT**

A climate resilient was developed and evaluated for the low lying flood prone zones of Tripura. These areas on an average are flooded 3-4 years over a span of 10 years. The extent of damage to crops is to the tune of 50-100%. To address this problem, we have developed a model “Resilient Technology for active floodplain”. The area of the model is 0.5ha and with certain targeted land development to address the flood, we have divided the area to three zones: Upland, Midland and Lowland. The difference in height of upland, midland and lowland was kept at 0.5m

All the beds were used for paddy cultivation during rainy season. In addition, lowland were also be used for fish culture where in high demand small indigenous and self recruiting species like Puntius, Mola and Kanla along with carps were cultured. In addition, the raised beds were used for vegetable cultivation during winter and summer season. A trench was dug at one side of the system so that the fishes can accumulate once the water level goes down. In addition, the trench also helped for the harvesting of fishes.

In this system of 0.5 ha, on an average annually, 1 ton of paddy, 2 ton of different vegetable crops and 200 kg of fish were produced.

**Keywords:** Climate Resilient, Flood Plain, Paddy, Vegetables, Fish, Food and Nutritional Security



## Climate Resilient Agriculture - Need of the century

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### ABSTRACT

Climate change impacts on agriculture are being witnessed all over the world, but countries like India are more vulnerable in view of the huge population dependent on agriculture, excessive pressure on natural resources and poor coping mechanisms. The warming trend in India over the past 100 years has indicated an increase of 0.60°C. Significant negative impacts have been projected with medium-term (2010-2039) climate change, eg. yield reduction by 4.5 to 9%, depending on the magnitude and distribution of warming. Since agriculture makes up roughly 15% of India's GDP, a 4.5 to 9.0% negative impact on production implies cost of climate change to be roughly at 1.5% of GDP per year. Planned adaption is essential to increase the resilience of agricultural production to climate change. Management practices that increase agricultural production under adverse climactic conditions also tend to support climate change adaptation because they increase resilience and reduce yield variability under variable climate and extreme events. Some practices that help adapt to climate change in Indian agriculture are soil organic carbon build up, in-situ moisture conservation, residue incorporation instead of burning, water harvesting and recycling for supplemental irrigation, growing drought and flood tolerant varieties, water saving technologies, location specific agronomic and nutrient management, improved livestock feed and feeding methods. Capacity building by extensive participatory demonstrations of location specific agricultural practices helps farmers gain access to knowledge and provides confidence to cope with adverse weather conditions.

Keywords: Adaptation, Climate change, Capacity building

## Climate smart agriculture for sustainable soil micro flora, food security and protein quality

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### ABSTRACT

In the current scenario of climate change, cereal system of South Asia are at risk due to amalgamation of natural resource (ground water, energy, soil) exploitation and population (human and bovine) pressure. Climate smart agriculture (CSA) practices with efficient rotations like maize-wheat system are considered as alternative of conventional rice-wheat systems and their management practices for the systems sustainability and resources stability in the domain. A study was conducted with six management scenarios to evaluate the effects of CSA practices in comparison to conventional management on soil microbial diversity, chemical properties, crop yields and grain protein in the IGP. Samples were collected after wheat harvest from CSA based cereal management scenarios (Sc) at CSSRI-CIMMYT strategic experimental platform. Shannon and Simpson diversity indices were found higher in maize-based scenarios as compared to rice-based CSA scenarios in both fungi and bacteria. The top five most abundant bacterial phyla, Proteobacteria, Acidobacteria, Actinobacteria, Bacteroidetes, and Chloflexi, were represented by nearly 90% of the total sequences. The relative abundance of Proteobacteria was 29% higher in rice-based CSA scenarios and 16% higher in maize-based CSA scenarios over farmers' practice. Actinobacteria was 100% higher in farmers' practice and 43% in partial CSA scenario than CSA based scenarios. In all six scenarios Pseudomonadales, Rhizobiales, Sphingomonadales, Burkholderiales, and Actinomycetales were the dominant orders, constituting approximately 49 -69% in different scenarios. A total of seven fungal phyla were present in all six scenarios. Ascomycota is the dominating phyla followed by Basidiomycota and Zygomycota. A higher abundance of Ascomycota was observed in rice-based CSA scenarios as compared to maize-based scenarios. Soil organic carbon was 111% higher in CSA based scenarios compared to farmers' practice and 31% higher than partial CSA practice. Available nitrogen (N) was 38% and 14% higher in CSA based scenarios than farmers' practice. Available phosphorus and potassium was 70 and 60% higher in CSA based scenarios over farmers' practice. Almost 1.0 and 3.0 Mg ha<sup>-1</sup> higher wheat and systems' yield was recorded with all the rice and maize CSA-based scenarios than the farmers' practice (5.88 Mg ha<sup>-1</sup> and 13.33 Mg ha<sup>-1</sup>). Similarly the protein content in grains was increase by ~10% in all the CSA based scenarios after 5 years of continuous cultivation. Results show that CSA based management systems are crucial for both food and nutritional security in the IGP.

**Key words:** climate smart agriculture, rice-wheat, maize-wheat, microbial diversity, diversity index





**Influence of Heat units and different pruning months on growth and flowering of *Jasminum grandiflorum*.**

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**ABSTRACT**

An investigation was carried out at the Department of Floriculture & Landscaping, TNAU, Coimbatore to study the effect of Heat units on pruning, growth and flowering of *Jasminum grandiflorum*. The level of pruning height was 30cm from the ground and pruning months (September-April) every month was done except in the peak season (May-August) of flowering. Pruning during the last week of October gave the highest plant height (65.18 cm), number of shoots (47.33) and maximum yield (64.24 g/plant) in *Jasminum grandiflorum* whereas, the lowest plant height (48.9 cm), number of shoots (27.00) was observed in November and yield (24.59g/plant) December pruning. The meteorological parameters viz., maximum temperature (2017-31.4 and 2018-30.4°C), minimum temperature (2017-22.9 and 2018-22.4°C), relative humidity (2017- 88 and 2018-87%), sunshine hours (2017-6.2 and 2018-8.2) day length (2017-12.08 and 2018-12.09), GDD (2017-0.30 and 2018-0.29), PTU (2017-3.62 and 2018-3.51), HTU (2017-1.86 and 2018-2.38) and HUE (2017-456.30 and 2018-362.70 kg ha<sup>-1</sup> day °C) were recorded under field conditions.

**Key words:** *Jasminum grandiflorum*, Heat units, pruning months, flowering, yield and pruning height



## Reduction in greenhouse gases

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### ABSTRACT

Climate change is a global phenomena of climate transformation characterised by changes in the planet's normal climate (temperature, precipitation, and wind) driven primarily by different human activities. Agriculture, forestry, and other land use account for over a quarter of all anthropogenic greenhouse gas (GHG) emissions. Both afforestation and Bio energy with carbon capture and storage (BECCS) are high-intensity negative-emission technologies that have an impact on agriculture via land markets. There is a negative impact on agriculture since cropland availability is decreasing due to averted deforestation or afforestation, as well as demand for bio energy. As a result, it highlights vulnerabilities in the global agricultural industry with changes in area, production, productivity and price implications as well as biotic and abiotic stress that may respond to climate change, ozone damage, or direct heat stress. The effects of climate change are expected to worsen in the second half of the twenty-first century. As a result of the increase in extreme weather occurrences, the negative effects of climate change have been deemed detrimental. A change in the climate is likely to have a negative effect on overall agricultural production. The two important strategies are mitigation and adaptation can help to minimize the negative effects of climate change. Mitigation options are helpful, but it is desirable to combine adaptation and mitigation strategies in order to best manage the impact of climate change. Policy support, research and socio-psychological empowerment of farmers are needed to implement the potential technologies.

**Keywords:** Climate change, Mitigation, Agriculture, Adaptation, Stress, Emission.



**Impact of rice (*O. sativa* L.) straw incorporation induced changes in soil physical and chemical properties on yield, water and nitrogen–balance and –use efficiency of wheat (*T. aestivum* L.) in rice–wheat cropping system: Field and simulation studies**

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**ABSTRACT**

Deterioration of soil physico–chemical properties as a result of puddling and burning of rice straw is one of the big challenges for the farmers in Indo Gangetic plains. The specific objectives were to study the impact of rice straw incorporation persuaded changes in soil properties on yield, water and nitrogen use efficiency of wheat in rice–wheat cropping system. A field experiment, with split plot design and replicated thrice, was conducted with treatment combinations of four rates of rice straw incorporation, Rsti (0, 5, 7.5, 10 t ha<sup>-1</sup>) as main plots and four rates of fertilizer nitrogen, N (0, 90, 120 and 150 kg ha<sup>-1</sup>) as sub plots for ten years. Simulations with same treatments of Rsti and N along with three irrigation regimes, IW (240, 320 and 400 mm) were carried out for 30 years with calibrated and validated DSSAT–CSM–CERES–Wheat v4.75 model. The results of field experimentation and model showed that the significant effect of Rsti on wheat yield was up to 7.5 t ha<sup>-1</sup> ; Comparable yield to recommended practices (without crop residue) was realized with Rsti in conjunction with less IW and N, ensuing saving of 80 mm IW plus 30 kg N ha<sup>-1</sup>. Rsti increased water use efficiency via reducing evapotranspiration; and increased nitrogen recovery efficiency by increasing N uptake, and decreasing N leaching and NH<sub>3</sub> losses. The model based simulations signifies that Rsti into surface soil is a viable option in India and IGP as it enhances yield, water and nitrogen use efficiencies in wheat of rice–wheat system.

**Keywords:** Rice straw incorporation, Physico-chemical properties, Simulation studies, Wheat productivity, Water & N use efficiency.



**Evaluation of growth traits in high resin-yielding half-sib families of *Pinus roxburghii* Sargent**

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**ABSTRACT**

In the years 2020–2021, a field experiment was carried out at Shilli Conservation Reserve in Solan, Himachal Pradesh to evaluate the growth traits of high resin yielding half sib families of *Pinus roxburghii* Sargent. Height, diameter at breast height, bark thickness, crown height and crown length were among the characteristics examined. According to the study, all of the traits varied significantly, with mean values for diameter at breast height (31.10 cm), height (17.79 m), bark thickness (2.81 cm), crown length (10.75 m) and crown height (6.95 m). High variability was seen in all of the half-sibling families according to variability estimates, genetic parameters, correlation studies, principal component analysis and divergence studies. It may be concluded that evaluation of the chir pine diversity can be highly beneficial for improving the quality and quantity of the many examined features.

**Key words:** Trait, Height, *Pinus roxburghii*, Length

***Ailanthus excelsa* and *Prosopis cineraria* based farming system - A climate change mitigation option for arid western Rajasthan**

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**ABSTRACT**

An experiment was conducted at CAZRI, Regional Research Station, Bikaner to find out the climate resilient tree based farming system. *Ailanthus excelsa* and *Prosopis cineraria* tree species were grown with rainfed clusterbean in *kharif* seasons at three spacing viz., 4m×4m, 6m×6m and 8m×8m. The trees were watered with drip irrigation system. At three years after planting, it was observed that *A. excelsa* performed better than *P. cineraria* with significantly higher mean basal diameter and height at all the three tree spacings. The mean basal diameter of *A. excelsa* at 8m×8m (154.4mm) and 6m×6m (147.5mm) spacing was on par with each other. *A. excelsa* had a higher mean tree height at 8m×8m spacing (407.1cm). Clusterbean gave significantly higher yield (21%) when grown with *A. excelsa* at 6m×6m spacing compared to 8m×8m spacing. No significant variation was observed between tree species for crop yields. *A. excelsa* recorded significantly higher above ground biomass of 2.75 t ha<sup>-1</sup> at 6m×6m spacing. Significantly higher total carbon stock of 1.56 t ha<sup>-1</sup> and carbon sequestration of 5.72 t ha<sup>-1</sup> was also recorded by *A. excelsa* at 6m×6m spacing. The results revealed that *A. excelsa* tree performed well in arid region and their growth is promising. It will provide additional income to farmers through sale of wood for plywood production and small branches for fuelwood use and can help to increase the tree cover outside the forest area. Also, it can sequester more carbon in the wood which will be stored as plywood for years and can provide carbon credit benefits to farmers. Hence, integration of *A. excelsa* in farmlands of arid region can play a vital role in climate change mitigation and environmental conservation, addition to solving the problem of fodder shortage in climate change vulnerable desert ecosystem.

**Keywords:** Climate change, Agroforestry, *Prosopis cineraria*, *Ailanthus excelsa*, arid region



## **Design and quantification of ecosystem services from multifunctional agroforestry established for family farming in India**

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### **Abstract**

Multifunctional agroforestry (MFA) have potential to meet 9 out of 17 sustainable development goals which aim to reduce poverty and food insecurity. In order to achieve this goal, a new and unique circular-shaped multifunctional agroforestry model was designed in 2018 comprising of 24 tree species and 8 intercrops. The trees are established in six concentric circles having separate importance viz., high-value timber, timber, plywood, medicinal, fruits and moringa circles. The total area is also divided into four equal quadrats and different intercrops are raised viz., quadrat I (Flowers), quadrat II (Vegetables), quadrat III (*Murraya koeingii*), and quadrat IV (Fodders). The border row consists of tree borne oil seeds.

Ecosystem services were quantified in MFA. 1. Provisioning services (food, fodder, fruits, timber, medicinal plants): Quantification was done in Kilograms and local market price was used for economic valuation. 2. Regulating services (Carbon sequestration): Non-destructive method was used. Supporting services (Butterflies): Diversity of butterflies was estimated using Pollard walk method. 4. Cultural services: Questionnaire method using Willingness to pay (WTP) was followed. Results revealed the total value of provisioning services from MFA was \$5285.60. The marketable carbon price of MFA was \$206.40. A total of 32 butterflies were recorded in supporting services and the value of cultural services estimated was \$ 0.44 per visit respectively. The study results can be used by policymakers taking into account smallholder farmers' interests and profitability, mainly to achieve the REDD+ initiative, especially in low-income and developing countries.

**Keywords:** Ecosystem services, Multifunctional agroforestry, Family farming, quantification

## Diversity and relative abundance of insect pests associated with rainfed, tubewell and canal irrigated chickpea crop in hot arid region of Rajasthan

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### ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the major pulse crops grown in Jaisalmer. This region is characterized by aridity, frequent drought, moisture stress poor soil, habitation of desert. Over the years, introduction of IGNP and other sources of irrigation have brought in immense ecological changes. The climatic changes like high temperature, relative humidity and rainfall patterns influence the population and diversity of pests. Knowledge of diversity, behavior and seasonal population dynamics are very crucial for development of integrated pest management. Information available on these aspects is very scanty from the hot arid region. Therefore a study was done in arid western part of Rajasthan; A total of 10 locations of chick pea selected from rainfed, tubewell and canal irrigated area in Jaisalmer district and surveys were made at fortnightly intervals during *Rabi* 2019-2020. Different insects *i.e.*, pod borer (*Helicoverpa armigera* Hubner), aphid (*Aphis craccivora* Koch), cutworm (*Agrotis ipsilon* Hufnagel) and termite (*Odontotermes obesus* Rambur) recorded on chickpea. Of these, *H. armigera* and *O. obesus* were recorded as the key pests; It is evident that *H. armigera* was first appeared in the First fortnight of November (45<sup>th</sup> - 46<sup>th</sup> SW) (0.49 larvae per plant) and peak attained in the First fortnight of February (6<sup>th</sup> - 7<sup>th</sup> SW) and density was maximum (1.90 larvae per plant) in rainfed as compared to canal (1.28 larvae per plant) and tubewell irrigated (1.50 larvae per plant) chickpea crop. In regard to aphid first appeared in the second fortnight (49<sup>th</sup> SW - 50<sup>th</sup> SW) of December (0.02 aphids per plant) and maximum numbers were recorded during first fortnight of February (6<sup>th</sup> - 7<sup>th</sup> SW) (2.18 aphids per plant) as compared to canal (0.50 aphids per plant) and tubewell irrigated (0.44), however in tubewell irrigated maximum population recorded in second fortnight of February (8<sup>th</sup>-9<sup>th</sup> SW). Infestation of cutworm recorded was in negligible numbers. Infestation of termite was maximum in rainfed grown chickpea as compared to tubewell irrigated and canal irrigated.

**Key words:** Arid Rajasthan, chick pea, insect-pests, *Helicoverpa armigera*.

**Technology for rapid whey removal for production of *chakka***A.D.Vairat<sup>1</sup>, P.S. Minz<sup>2</sup>, Chitranayak Sinha<sup>3</sup>, Khushbu Kumari<sup>4</sup><sup>1</sup>Dairy Engineering Section, ICAR-National Dairy Research Institute, SRS, Bengaluru, 560030<sup>2-4</sup>Dairy Engineering Division, ICAR-National Dairy Research Institute, Karnal, 132001

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**ABSTRACT**

*Chakka* is the semi-solid intermediate traditional Indian dairy product obtained by draining off the whey from the curd mass. Traditional gravity method of whey removal from curd mass is a time consuming process and during summer it sometimes results in quality deterioration. A rapid whey removal system was designed and fabricated for *chakka* production. Special curd holder partition with 120° angle was designed and integrated to ensure faster and uniform whey removal from the curd mass. The performance of the developed whey dewatering mechanism was evaluated with different process variables spin time (30 to 90 min), curd temperature (5 to 15°C) and quantity of curd (2- 6 kg). The measured responses were yield, moisture content, total solids and total solid loss. The numerical optimized process parameters were: quantity of milk: 2-6 kg, spin time: 60 min, curd temperature: 5°C. Whey draining time reduced from 600-720 min to 60 min (90-92 % time reduction) was observed in case of mechanized production of *chakka*. The developed equipment is suitable for small-entrepreneurs for the mechanized production of *chakka*.

**Keywords:** Chakka, Indian dairy product, rapid, whey removal, curd

**Potential of Agroforestry in Reclamation of Problematic Soils in India**Avinash Kumar Bhatia<sup>1\*</sup>, K S Pant<sup>1</sup>, Saakshi<sup>1</sup>, Harish Sharma<sup>1</sup><sup>1</sup>Department of Silviculture and Agroforestry, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) 173230**ABSTRACT**

According to FAO 2007, there are 340 million hectares to 1.2 billion ha of salt-affected soil worldwide. These salt-affected soils cover millions of hectares and are suitable for agricultural production, but are underutilized due to salinity/sodicity and other issues with the soil and water. If corrective measures are not done, salinization of arable land will cause a 30–50% loss in the next 25 years to year 2050. About 6.73 million hectares of salt-affected soils and 3.60 million hectares of sodic soils are present in India. It has long been advised to leach saline soils with high-quality water to make them viable for crop development. The effectiveness of these management techniques is constrained, though. Through the benefits of trees on the soil, agroforestry systems have the ability to utilize marginal and degraded lands. It conserves soil and improves soil fertility in addition to providing timber, feed, fuelwood, and medicines. By reducing soil erosion and runoff, preserving soil organic matter, enhancing the physical, chemical, and biological characteristics of the soil, increasing nitrogen intake through N-fixing plants and recycling through litter falling to the ground, soil fertility can be improved. Agroforestry has potential in the soil constraints because trees have the ability to flourish in challenging climatic and soil conditions and have the capability to conserve soil.

**Keywords:** Agroforestry, problematic soils, degraded lands, nitrogen fixation and soil





**Developing climate resilient chickpea cultivars through nature of gene action and combining ability analysis for heat stress**

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**ABSTRACT**

Chickpea suffers with heavy yield losses when exposed to heat stress ( $>35^{\circ}\text{C}$ ) particularly during reproductive (flowering and pod development) phase and the estimated yield losses were up to 39 per cent, together ensures a huge gap between potential and actual yield of chickpea. In order to develop heat tolerant lines, six genotypes representing diverse characters with heat tolerance were crossed in half-diallel (6 x 6) fashion excluding reciprocals. Consequently, fifteen  $F_1$ 's along with parents were evaluated under stressed and non-stressed conditions for heat tolerance during 2016-17 at BCKV, Mohanpur. Parents ICCV 10, JGG 1 and Annigeri 1 maintained overall high gca status, while crosses ICCV 10 x JG 14, Annigeri 1 x JG 14 and ICCV 10 x Annigeri 1 showed high sca status for biomass and harvest index coupled with high seed yield. Parents and the cross combinations have recorded maximum per cent pollen viability with a range from 99.52 to 64.05 per cent under normal to heat stressed conditions respectively. Biomass and harvest index were most contributing to seed yield when regressed ( $R^2=0.50$ ) under stressed conditions. Thus these cross combinations could be advanced for getting more transgressive segregants against heat tolerance in future breeding program of chickpea.

**Keywords:** Chickpea, heat stress, gene action,

## Characterization and identification of photo-thermo insensitive genotypes of cowpea for climate resilience under hot arid environment

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### ABSTRACT

The cowpea (*Vigna unguiculata* L.) is an important legume crop in the traditional mixed cropping system of arid region which is mainly grown for grain purpose, but its tender pods and seeds are also used as vegetable. High green pod yield, dual purpose (seed and vegetable type), earliness and photo-thermo insensitivity are the major breeding objectives of cowpea improvement programme. Photo-thermo sensitivity makes this crop vulnerable to photoperiod and temperature fluctuations particularly in hot arid regions, thereby affecting its yield potential drastically. Therefore, the present study was aimed to study diversity at morphological and molecular level among cowpea germplasm and identify elite genotypes with photo-thermo insensitivity, which can fit well across all seasons under hot arid environment. From the diversity study, a wide range of variability was observed with respect to various morphological traits. Further, molecular characterization of cowpea germplasm was done to confirm the morphological diversity at molecular level using 12 CAAT-box Derived Polymorphism (CBDP) and 10 Start Codon Targeted Polymorphism (ScoT) markers. The 12 CBDP and 10 ScoT markers produced 65 and 93 scorable alleles. The alleles ranged from 03 to 11 alleles with 5.42 alleles per marker in case of CBDP markers, whereas it ranged from 03 to 09 alleles with an average of 6 alleles per marker in case of ScoT marker. The PIC generated by both markers ranged from 0.35 to 0.76 and 0.37 to 0.63, respectively. The clustering analysis was done using UPGMA dendrogram in NTSys 2.0 software which grouped 24 genotypes into three major groups with each groups divided into sub-groups. Among the characterized germplasm, two lines, viz. AHCP-1-4-1 (IC-0625644) and AHCP-2-3 (IC-0628910) were found photo-thermo insensitive as these were able to flower and set pods at temperatures as high as 46°C during summer months (April-June). The line AHCP-1-4-1 is vegetable pod quality variety and suitable as irrigated crop. It has the yield potential of 132-174 q/ha. The line AHCP-2-3 is multiple use and tender pods as vegetable quality variety and suitable as rainfed crop. It has yield potential of 124-168 q/ha under rainfed conditions. Both are early maturing and took 46.5-58.2 and 40.5-48.7 days for first harvesting of tender pods, respectively. The identified genetic resources will contribute towards adaptation and resilience of farming system in changing climate scenario and will improve the productivity and extend the availability of cowpea with quality pod yield across all seasons and locations of stressed environment of hot arid regions.

**Keywords:** Climate resilience, hot arid region, diversity, photo-thermo insensitivity and *Vigna unguiculata* L.

## Climate change effect on phytochemistry of *Bt* cotton

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### ABSTRACT

A central issue in ecology is to determine how environmental variations associated with global climate change; especially changing atmospheric carbon dioxide (CO<sub>2</sub>) and temperatures affect trophic interactions in various ecosystems, more so on the physiology of the plant system. In this regard, an investigation on phytochemistry of *Bt* cotton under different climate change treatments *viz.*, elevated CO<sub>2</sub> (550 ± 25 ppm) and temperature (2 °C rise) was conducted and compared with ambient levels of CO<sub>2</sub> and temperature under open top chambers (OTC's) at University of Agricultural Sciences, Raichur. The results indicated that climate change in terms of eCO<sub>2</sub> and temperature has favored the growth and development of *Bt* cotton crop, as it was evidenced by the accelerated growth rates in the form of plant height, number of leaves, leaf area, leaf area index (LAI), leaf water content (LWC) and sympodia. The growth parameters showed positive trend along with the yield parameters and resulted in increased yield in the eCO<sub>2</sub> and temperature treatments. Likewise, biochemical analysis of the *Bt* cotton plant showed lot of changes wherein, the chlorophyll content, carbon and carbon-based compounds *viz.*, tannins, phenols and sugars significantly increased in the eCO<sub>2</sub> conditions (CO<sub>2</sub> alone and in combinations with temperature) as compared to aCO<sub>2</sub> treatments. On the contrary, nitrogen (N) and N-based compounds *viz.*, proteins and amino acids decreased in the eCO<sub>2</sub> conditions which resulted in change in carbon to nitrogen (C: N) ratio. Climate change typically affected carbon and nitrogen dynamics in *Bt* cotton, which being a transgenic plant invests some nutrients for the production of specific toxic proteins (*i.e.*, endotoxins). This was evidenced in the present investigations which clearly showed that eCO<sub>2</sub> and temperature treatments decreased *Bt* toxin production.

**Keywords:** Elevated CO<sub>2</sub>, Elevated temperature, phytochemistry, *Bt* cotton.



## Heritability estimates for seed yield of machine harvestable chickpea cultivars in different environments

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### ABSTRACT

Chickpea cultivation being increased linearly in central and southern India, which necessities mechanization of chickpea harvesting for saving cost and time. Ten genotypes comprises popular cultivars and crossed lines were subjected to assess their broad sense heritability for seed yield potential under five locations (L1, L2, L3, L4, L5). Seed yield per se performance (1852.08 kg/ha in L2,) and its wide range of variation (559.97 to 1852.08 kg/ha) under different locations indicates ample of variability present in the studied material, there is a scope for selection of suitable breeding line for improvement of desired trait. High heritability (73.90 and 66.83) assisted with high genetic advance as per cent of mean (GAM) (48.18 % and 25.10 %) for seed yield observed under L1 and L2, respectively. A simple selection based on phenotypic performance of seed yield would be more effective under such locations. Moderate heritability (44.62) with high GAM (20.07 %) for seed yield under L3 represents the influence of non-additive gene action and considerable influence of environment in trait expression. low heritability (44.62) with low genetic advance as per cent of mean (20.07 %) in L4 and L5 for seed yield indicates limited scope for improvement of trait through selection.

**Keywords:** Chickpea, heritability, GAM, seed yield.

## Mitigating methane emissions by intelligent management of crop residue, nutrients, and soil moisture in long-term conservation till soil

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### ABSTRACT

With increasing attention being placed on crop residue incorporation in the agricultural field for sustainable agricultural waste management, its effect on methane emissions is unclear. A mesocosm experiment was conducted to evaluate the impact of different crop residues (wheat, rice, soybean, and maize) on methane (CH<sub>4</sub>) emissions and the underlying mechanisms in response to two soil moisture {80% field capacity (FC) and 60% FC} and under seven nutrient levels: N0P0K0 (no nutrients), N0PK, N100PK, N150PK, N100PK+manure@ 5 Mg ha<sup>-1</sup>, N100PK + biochar@ 5 Mg ha<sup>-1</sup>, N150PK+ biochar@ 5 Mg ha<sup>-1</sup>. The results indicated a significant ( $p < 0.001$ ) interaction effect of residue type, nutrient, and soil moisture. Across crop residue and nutrient levels, reducing soil moisture from 80% FC to 60% FC increased methane consumption. The average methane fluxes at the two soil moistures were 2.72 and -6.97  $\mu\text{g-C kg}^{-1}$  soil, respectively. The incorporation of rice and maize straw increased methane consumption across all nutrient management compared with soybean and wheat at 80% and 60% FC. Nutrient application (inorganic and integrated) increased methane emission compared with minus nutrient in control and residue amended soil. The regression analysis showed that soil CO<sub>2</sub> emission and soil moisture levels were the key predictor variables and could explain 40% variability in the soil methane emission in the Vertisols of central India. Based on our results, the methane mitigation capacity of different residue amendments could be improved by adequate soil moisture management via changing plant residue species combined with improved nutrient management.

**Keywords:** Methane, Residue types, Fertilizer, Soil moisture, Carbon dioxide



**Application of randomized response technique in forestry – a case study to measure proportion of forest encroachment in Shimla district of Himachal Pradesh**

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**ABSTRACT**

Forest land is encroached quite often for illegal horticultural and agricultural practices by the peoples living in the vicinity of forest. This illegal logging of forests cause loss of biodiversity and disturbance in the ecological balance. As encroachment is causing a serious threat to the environment, a proper forest management strategy should be developed. However, a proper identification and mapping of forest encroachment is important for framing such strategies for forest management. In the backdrop of the above, a survey was undertaken to map the proportion of population that involved in forest encroachment in Himachal Pradesh. Information on encroachment is a sensitive issue and the direct question regarding encroachment may result in false information and refusal to respond. Consequently, the estimates from a direct survey would be highly biased. Warner (1965) proposed the randomized response technique for such sensitive survey that lessen potential bias due to non-response. A sample of 250 respondents was interviewed using Warner's randomized response device. The estimate of proportion of forest encroachers was 0.03 with a variance of 0.00687, which is a significant proportion and strategies may be framed to avoid encroachment. However, a proper mapping can be done through remote sensing techniques.

**Keywords:** Randomized response technique, forest encroachment, sensitive questions



## **Vulnerability of rural farming communities to climate change and natural disasters: An evidence from Kuttanad wetlands ecosystems of Southern India**

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### **ABSTRACT**

Wetlands are described as the kidneys of the landscape. Climate change can affect wetlands through direct and indirect effects of rising temperatures; erratic rainfall etc. Rural farming communities in wetlands may be more vulnerable to climate change because living in remote and ecologically fragile zones will directly impact their immediate environments. Vulnerability assessment is considered as the essential first step in addressing issues related to climate change. Vulnerability assessment helps to determine the most vulnerable communities and the factors contributing to their vulnerability. It is crucial to quantify the vulnerability of rural households affected by climate change at a regional/agro-ecological level, so that efficient and effective adaptation strategies/policies can be formulated. This study provides insight into the vulnerability of rural farming households affected by climate change in the Kuttanad wetland ecosystem of Kerala. We collected primary data from 1344 rural farming households and vulnerability was analysed using Climate Vulnerability Index. Our study concludes that non-climatic and climatic factors govern a household's vulnerability to climate change. High literacy rate and a low dependency ratio increase farmers' adaptation capacity, whereas access to social networks plays a significant role in uplifting rural farming households. The findings are useful for policymakers in identifying avenues to build wetland farming communities' resilience to climate change.

**Keywords:** Vulnerability, Adaptive capacity, Sensitivity, Exposure, Resilient

## Change detection of soil total Nitrogen in Bhoirymbong block, Meghalaya using Remote Sensing data

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### ABSTRACT

Recently, remote sensing has drawn interest for improving digital soil mapping since it constantly delivers reliable data over huge areas on a regular basis. Optical satellite imaging is the most commonly used type of remote sensing data for STN prediction. Temporal STN variations result from soil-vegetation interaction, crop biomass accumulation and breakdown, and spectral reflectance; topographic parameters (height, aspect, and slope) and land use all have an impact. We effectively identified the specific STN and AVL N characteristics using indices including NDVI, BSI, TVI, and SI. To do this the best model from 2019, which was selected in the part prior based on its performance throughout the validation stage, was extrapolated. Using multi-temporal Landsat TM-5, ETM-7, and OLI-8 data, our findings showed the potential for STN prediction. A correlation matrix was created using the Pearson's correlation coefficient ( $r$ ) for STN ( $r=0.72$ ) and Available N ( $r=0.81$ ) to investigate the relationship between STN and AVL N with SOC data. The finding has been validated using ordinary linear regression with STN value ( $R^2= 0.50$ , RMSE= 0.02) and the AVL N value ( $R^2= 0.80$ , RMSE=2.32). The STN and AVL N maps from 2004, 2009, and 2014 were constructed for their change analysis using the stepwise regression equation. Using the indices, it was discovered that multispectral images provide the best results for all features in 2019 with a value of 0.18, 2014 with a value of 0.19, 2004 with a value of 0.19, and 2009 with a value of 0.27. Changes result from runoff and rainfall, human migration, disturbance from natural disasters, and modifications to agricultural techniques.

**Keywords:** STN, Nitrogen Indices, Optical sensors, Soil mapping





**Drought risk and Agriculture – Economic Impact of Adoption of Climate Resilient Technologies in Semi-arid Region of Karnataka**

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**Abstract**

Drought is the major constraint affecting the semi-arid regions of India. Water shortages and droughts decrease crop and livestock production and thereby drastically affect the farm household income. The extreme events like drought are a serious and direct burden on the farmers especially the small and marginal farmers. During a drought the farmers not only lose their investments but also struggle to meet their basic needs. Adoption of Climate resilient Technologies (CRTs) are important in effectively managing drought at the farm household. Keeping these in view, the study attempts to quantify the impact of drought in Kalaburagi district in Karnataka state, its effect on the farm income, and analyses the effect of climate resilient technology adoption on farm income. The primary data on household characteristics and the farm income was collected from a sample of 60 farmers each from National Innovations in Climate Resilient Agriculture (NICRA) program adopted village and a comparable control village in the district. The impact was estimated following the difference-in-differences (DiD) model which helps in analyzing the data across time and regions. The study reveals that average income of a farm household in the NICRA village is more than 40 percent compared control village and during a drought situation the farmers under NICRA intervention were better off by 19.5 percent. The income from crops and livestock production in treated village was significantly higher than the control village. Adoption of better climate smart interventions improved the farm incomes. The estimate showed that the treated farm household had higher income of nearly Rs 50000/ Farm household /year than the control during a drought year and in normal year the double difference in farm income was Rs. 29062 / year. The climate resilient agriculture practices will address risk as well as enhance productivity and income of farmers.

**Key words:** Drought, Climate resilient Technologies, NICRA, Yield and farm income



## Adaptation Strategies in Changing Climate

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### ABSTRACT

Climate change threatens agriculture and farming-based livelihoods. Rising temperature, waterlogging/excess or insufficient soil moisture due to rainfall variability, the terminal heat effect, and food and water shortages are major climate change variables that impact agriculture. Adaptation measures are needed to maintain agricultural productivity, reduce vulnerability, and strengthen climate change resilience. Soil management, crop diversification in space and time, changing the cropping pattern, introducing new crops or replacing existing crops, or changing crop sequence have been proposed and tested for minimizing climate change's effects. Integrated water management promotes the use of waste and marginal water for agriculture, crop pest and disease management, and sustainable land management practices like agroforestry and conservation agriculture. Agroforestry may help diversify and sustain smallholder farming systems by increases the system's resilience to climate change impacts. Agroforestry act as the largest terrestrial carbon sinks, by sequestering carbon. Climate change risk can be buffered through risk sharing, risk transfer, improved forecasting, agro-advisory, and institutional measures.

Most agricultural adaptation options are location-specific, so farmers need location-specific early warning systems to choose crops and agronomic approaches ahead of climate unpredictability.

**Key words:** Climate, Agriculture, Adaption



**Title: Climate change and land degradation in the Sudanian climate domain in Benin**  
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**ABSTRACT**

The changing climate with its increasing temperatures and variability of precipitation has an impact on the environment. This study addresses the issue of climate variability and its impact on land degradation. The study aims to analyse the intensity and magnitude of the impact of climate change on surface conditions in the Sudanian domain of Benin. The methodological approach is based on the calculation of indices of climatic anomalies, monthly Angot rainfall, and climatic aggressiveness from data on rainfall, temperature, insolation and potential evapotranspiration (ETP) (1971-2020) collected at Météo-Bénin. Land use data (2000-2020) were used to determine the synthetic index of land degradation status based on the calculation of the average annual rates of spatial expansion and global change. The results were analysed using impact significance and vulnerability assessment matrices. Indeed, the period 1971-2020 is marked by a decrease in rainfall of 11.47% (Kandi) and 6.81% (Parakou). The rate of climate warming is +0.02 °C/year in both stations. This trend shows that in August (3.19 in Kandi) and September (2.31 in Parakou), soils are subject to intense erosive processes. The high frequency of surplus years (48% in Kandi and 56% in Parakou) reflects a high level of aggressiveness (between 106.91% and 141.11% in Kandi and 100.13% and 177.98% in Parakou). The analysis of land use units between 2000 and 2020 showed that natural formations regressed (23.12%) to the benefit of anthropogenic formations, which increased (76.87%). The rate of land degradation in the Sudanian domain is estimated at 77.14% in 2020 (6192197 ha). The planting of fast-growing, commercial species and organic farming are being developed to restore the land.

**Keywords:** Sudanese climate, land degradation, climatic aggressiveness, trends

## A study on rice (*oryza sativa L.*) germination under anaerobic conditions

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### ABSTRACT

The primary barriers to broad adoption of direct-seeded rice production in both rainfed and irrigated locations are poor germination and delayed seedling establishment due to waterlogging and unplanned flooding. In the study, the anaerobic germination potential of 60 rice genotypes gathered from the North Eastern Hill Region comprising of landraces, released varieties, and CAUS lines were screened. Seeds were sown in plug trays partially filled with sand and submerged in water at a depth of 8 cm. Simultaneously, a control for germination under normal aerobic conditions was established. The observations were taken on 21 days after sowing. There was a general trend in reduction of shoot length, thickness of stem and leaves for all the genotypes in anaerobic environment. However, four of the genotypes, Sahbhangi Dhan (a released variety), CAUS 107, CAUS 123 and Lakang Baso (a local cultivar) showed greater speed of germination, germination percentage and survival percentage in anoxic conditions as compared to the other genotypes. It was observed that the coleoptiles emerged from the water level at the 8<sup>th</sup> day of submergence, with Lakang Baso having the highest rate of emergence followed by Sahbhangi Dhan. The performance of the plants improved considerably when the coleoptiles emerged from the water level, compared to when they were submerged. The  $\alpha$ -amylase and peroxidase activity of these genotypes were also tested. The study discovered that the above mentioned genotypes showed promising behaviour under anoxic conditions.

**Keywords:** Anaerobic germination, Anoxia, Direct-seeded rice, Genotypes.

## **Scheduling and rate of nitrogen fertilisation impacted ammonia volatilization losses and yield in maize field**

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### **ABSTRACT**

Nitrogen is one of the most crucial nutrients for wheat development and yield. Nitrogen losses from the soil and plant system can have serious environmental repercussions in addition to reducing soil fertility and agricultural output. Ammonia volatilization is the most common cause of nitrogen losses in agroecosystems. Scheduling and rate of nitrogen (N) fertilizer application can influence maize (*Zea mays* L.) grain yield, N uptake, and ammonia volatilization losses. This study compared preplant (PP) and split (SP) applications of differing N rates for maize under irrigated conditions on loamy sand at ICAR-Indian Agriculture Research Institute. Preplant applications of N were applied at recommended and 125% of recommended N (RN) rates (PP 100- 100% RN and PP 100- 125% RN). Split application treatments included a two-way (75%, 100% and 125% of RN) and a three-way split (TSP) (75%, 100%, and 125% of RN), with the total N rate equally split among application times. Maize grain yield with TSP was 6.2 t ha<sup>-1</sup> among years and significantly greater than that with preplant treatments, whereas ammonia volatilization losses in TSP plot reduced significantly i.e. 1.1- 1.2 kg NH<sub>3</sub>-N t<sup>-1</sup> yield compare to PP and SP. These results suggest that split applications of N can increase maize grain yield and reduced ammonia volatilization losses in maize field and applying N fertilizer near planting or as a split application can improve N management in maize.

**Keywords:** preplant, split application, irrigated, management



## Identification of wheat amphidiploids derived from *Thinopyrum bessarabicum* for grain yield under drought and temperature stress

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### ABSTRACT

Wheat was domesticated 10000 years and since then its genetic base has narrowed down significantly due to domestication and directed selections. Global climate change and increase in temperature need the diversification of available genetic base and it can be performed through identifying novel source species like crop wild relatives and using them in wide hybridization. In the present research work *Thinopyrum bessarabicum* [(Savul. & Rayss) Á. Löve (Poaceae)] which is known as a source of rust resistance and tolerant to heat, was used in the crossing program. Seven different durum (AABB) and two bread (AABBDD) wheat cultivars were selected and were used as the recipient parents to improve them. The fixed lines were studied and evaluated for various agronomic and physiological traits at two locations Karnal and Hisar (rabi season 2019 & 2020) under irrigated timely sown (E1) and rainfed timely sown (E2) at Karnal; while irrigated timely sown (E3) and rainfed late sown conditions (E4) at Hisar. AMMI and GGE analysis of grain yield (tonnes/ha) under multiple environments showed that these amphidiploids performed better in E4>E3>E2>E1 revealing that their average performance was superior under heat and drought stress conditions. All the nine amphidiploids performed better at Hisar under drought and temperature stress. EC787014 (*T. aestivum* L. cv. Chinese Spring X *Th. bessarabicum*) was found the best performing genotype in both years for heat and drought stress environment (E4) with mean yield of 4.05 tonnes/ha in 2019 and 3.92 tonnes/ha in 2020. However, these were taller and late maturing genotypes as compared to the check varieties. The number of grains per spike, thousand kernel weight and number of grains per spikes were recorded higher than the local checks under stress environments. But these still needs to improve for grain colour and plumpness of grains.

**Keywords:** Wheat Wild relatives; wide hybridization; amphidiploids; temperature and drought stress

## Response of Chinese potato [*Plectranthus rotundifolius* (Poir.) Spreng.] to elevated carbon dioxide concentrations

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### ABSTRACT

The responses of plants to increased concentrations of CO<sub>2</sub> in the atmosphere vary. A study was conducted at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala during November 2019 to July 2020 to assess the response of Chinese potato [*Plectranthus rotundifolius* (Poir.) Spreng.] to elevated CO<sub>2</sub> levels. Elevated CO<sub>2</sub> was created by using different organic substrates as sources. The design used was completely randomized design with six treatments (s<sub>0</sub>: no substrate, s<sub>1</sub>: cow dung, s<sub>2</sub>: coir pith, s<sub>3</sub>: cow dung + coir pith (2:1), s<sub>4</sub>: s<sub>2</sub> + *Pleurotus* 1g kg<sup>-1</sup> + N + P (2% w/w) and s<sub>5</sub>: s<sub>3</sub> + *Pleurotus* 1g kg<sup>-1</sup> + N + P (2% w/w) and replicated thrice. Rectangular trenches of size 2m x 1m x 1m were taken and the organic substrates were spread at the trench base to a thickness of 5 cm as per treatment, taking precautions to avoid direct contact of the substrates with the cuttings planted directly in soil. The trenches were kept covered with a dome prepared of 200 μ uv stabilised polyethylene sheet fixed on a metal frame, daily from 4.00 pm to 10.30 am. CO<sub>2</sub> concentration was recorded at weekly intervals, the highest peak of CO<sub>2</sub> concentration (858 ppm) was observed in cow dung + coir pith (2:1) + *Pleurotus* 1g kg<sup>-1</sup> + N + P (2% w/w) followed by cow dung + coir pith (2:1) (752 ppm) at two weeks of application and thereafter it declined. The superiority of cow dung + coir pith (2:1) + *Pleurotus* 1g kg<sup>-1</sup> + N + P (2% w/w) on growth attributes were evident at 60 DAP and later stages of growth. The results of the study indicated that elevated CO<sub>2</sub> enhanced the vegetative growth in Chinese potato at the expense of tuber development.

**Key words:** Chinese potato, Elevated CO<sub>2</sub>, Substrates, Tuber development



## Assessing intercrop performance and soil health under different agri-horticultural systems in hot arid Western Rajasthan

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### ABSTRACT

Arid zones are characterized by low, erratic, and variable precipitation, low fertile soils that are vulnerable to wind erosion, a paucity of good quality groundwater, and frequent incidences of extreme events like droughts and heat waves, which all adversely affect crop production in the hot arid regions and result in relatively very low and markedly unpredictable yields of crops and livestock production. Under such conditions, intensifying agricultural systems through the integration of hardy fruit trees to maximize resource consumption is an important technique for increasing productivity and income per unit area, while reducing risks in crop production and improving soil quality. The experiment was conducted in a 15-year-old orchard of three fruit trees: kagzi lime (*Citrus aurantifolia* Swingle), bael (*Aegle marmelos* L.) and gonda (*Cordia myxa* L.) at Bikaner, Rajasthan during 2016 and 2017. Moth bean (*Vigna aconitifolia* L.) and cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] were grown as rainfed intercrops to evaluate their performances under different agri-horti systems. The highest yield of both the intercrops (moth bean and cluster bean) was recorded under intercropping with kagzi lime compared to that under other trees and sole cropping during both the years. Soil enzyme assays serve as a measure of soil fertility or productivity and can reveal information on biological metabolism and chemical transformations. The soil microbial activity in terms of dehydrogenase and acid phosphatase activity was analysed and the kagzi lime-based system gave higher values of dehydrogenase activity, compared to gonda and bael systems. The soils below the trees also had more dehydrogenase activity, which might be due to the continuous presence of crops and the addition of organic matter in the form of leaf litter. Soil phosphatase activity was seen to be generally higher in the tree lines and also in the crop plots. Thus, significantly higher enzyme activity was noted in the agri-horti system compared to activity from soil from an open uncultivated area. The study showed that the intercropping of rainfed arid legumes could successfully be done under 15-year-old plantations of fruit trees like citrus, bael, and gonda with proper management practices.

**Keywords:** Arid zone, Intercrops, Soil health, Agri-horti system



**Mining nutri-dense accessions from Assam rice collection.**

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**ABSTRACT**

Rice is a staple crop for more than half of the Indian population where North-East Indian states are primarily dependent on rice for their diets. Traditional rice germplasm (landraces) are highly diverse and good source of nutritional traits but still remain nutritionally uncharacterized. Nutritional profiling of 395 Assam landraces was done for starch, AC, TDF, TPC, oil, phenol and TPA using AOAC and standard methods and the mean content of the landraces was found to be 75.2 g/100g, 22.2 g/100g, 4.67 g/100g, 9.8 g/100g, 5.26%, 0.40 GAE g/100g and 0.34 g/100g respectively. GI was estimated in 24 selected accessions out of which 17 accessions were found to have low GI (<55). Multivariate analysis including PCA and HCA were applied to decipher the similarities/differences in the multiple nutritional attributes. PCA revealed that PC1, PC2, PC3 and PC4 contributed to 81.6% of variance where maximum loadings were from protein, oil, starch and phytic acid. HCA revealed 16 clusters and the trait specific accessions of these clusters could be identified for the novel cultivar development in breeding programs. Significant correlations were found among different traits which can facilitate in the direct and indirect selection of the evaluated accessions for quality improvement program.

**Keywords:** Landraces, nutritional composition, variability, multivariate analysis, PCA, HCA

**Environmental implications of farming systems in mid-hills of Himachal Pradesh**

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**ABSTRACT**

The field study was conducted to find out the most sustainable farming system in the mid-hills by selecting Traditional (control), Organic, Protective, Vegetable and Orchard practices in Himachal Pradesh. To meet the objectives physico-chemical properties of soil were assessed. The pH and salt concentrations of soils under different farming systems were in the normal range. Under all practices the soil available nitrogen ranged from 296.29 to 358.50 kg ha<sup>-1</sup>, phosphorus from 23.51 to 79.09 kg ha<sup>-1</sup> and potassium from 228.09 to 432.95 kg ha<sup>-1</sup>, respectively. The concentration of Fe (23.04 mg kg<sup>-1</sup>) and Pb (0.18 mg kg<sup>-1</sup>) in the orchard farming system was found to be above the permissible limits. The study revealed that high input based farming system like orchard farming has started affecting the quality of the soil adversely in mid-hills of Himachal Pradesh. Therefore, there is urgent need to promote judicious use of inputs to sustain soil health.

**Keywords:** Soil, traditional, organic, protective, vegetable, orchard



## Climate change favours flowering in *Vitis x champini* cv. Dogridge

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### ABSTRACT

Flowering in *Vitis x champini* cv. Dogridge is the challenging objective for the improvement of Dogridge to introgress sodicity genes. This was successfully achieved through standardizing pruning timings and severity. September II fortnight and October I fortnight pruning put forth highest percentage of flowering and fruit set which coincides with 27 to 30 °C of maximum temperature ( $T_{max}$ ) and 11 to 20 °C minimum temperature ( $T_{min}$ ) throughout the reproductive stage. However, the climate prevailed during backward pruning of April second fortnight of 2022 at Bangalore conditions favoured modification of vegetative shoot meristem to floral meristems. Meanwhile, the unpruned vines remained vegetative. The mean maximum temperature was 35.2 °C and minimum was 19.1 °C and rainfall was 54.7 mm during pruning to shoot/ flower bud initiation stage, meanwhile the mean values during the corresponding period for the previous 5 years was 34.5 °C ( $T_{max}$ ), 22.7 °C ( $T_{min}$ ) and 35.1 mm (rainfall). Flower bud initials to flower opening stage was coincided during May first fortnight with maximum temperature of 32.8 °C and minimum of 20.0 °C and rainfall of 96.0 mm, while the corresponding period for the previous 5 years was 33.9 °C ( $T_{max}$ ), 21.4 °C ( $T_{min}$ ) and 67.2 mm (rainfall). Critical minimum temperature during shoot initiation stage modified the vegetative bud to floral buds, which favoured flowering and fruit set in Dogridge.

**Keywords:** Dogridge, flower induction, climate change



## Climatic change and rainfall modelling - a case study of Alappuzha, kerala

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### ABSTRACT

A study was made in this paper to analyse climate change overtime occurring from 1997 to 2018 in Alappuzha district of Kerala. The major climatic parameter includes maximum and minimum temperature and rainfall over a period of 22 years. The average monthly maximum temperature over the years varied from 20.97° C in July to 33.72° C in March which indicated a variation in the maximum temperature from June to April in a year. For minimum temperature, the highest value was found during the month April, May and lowest in January. Highest rainfall of 10904 mm in June followed by 9620.02 mm rainfall in July and very poor in January (294.7 mm) was noticed. Trend analysis based on Mann-Kandall (MK) and Sen's slope estimation were performed to assess climate change overtime occurred. A slight decreasing trend was observed for annual and seasonal rainfall during the study period. But for maximum and minimum temperature a clear increase in trend was noticed except during summer and winter wherein a decline in trend was observed. Even though no significant trend was noticed in rainfall except for annual and north east monsoon and the slope estimator was negative indicating a decline in rainfall. The SARIMA model was fitted to monthly rainfall and the model parameters were obtained by using maximum likelihood method and the best model were selected using information criteria.  $ARIMA(2, 0, 2) \times (1, 1, 0)_{12}$  was found best fit for rainfall.

**Keywords :** Akaike Information Criteria (AIC), Bayesian Information Criteria (BIC) and Hannan-quinn coefficient

## Climate Resilient Practices Adopted in Flood and Drought Prone Areas of Siwan District, Bihar

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### ABSTRACT

Climate Resilient Agriculture (CRA) is need of hour in many parts of the World when the variability of climates is concerned. In this regard, the CRA project funded by Government of Bihar, India is a state wide project which addresses the climate change scenario further its influence on cropping pattern and promoting the strategies to be made to achieve sustainable production. Three seasons with different cropping system were entailed during the start of the project from Rabi 2020-21, Summer-2021 and Kharif-2021. The Rabi sown zero till wheat in CRA plots recorded higher yield of 32.80 q ha<sup>-1</sup> with increase of yield of 23.02 per cent over farmers' practise (Control). Similar trend of improvement in yield and net returns were observed in CRA experimental plots compared to control of respective climate resilient practises during *Rabi*-2021. Summer sown moong bean also followed similar trend of increase in yield of 11.00 q ha<sup>-1</sup> over the control (7.22 q ha<sup>-1</sup>) treatment. During Kharif-2021, Paddy sown with DSR practises recorded higher yield (41.00 q ha<sup>-1</sup>) compared to farmers' practise. Nutrient expert (LCC) based fertilizer application and Community irrigation plots recorded similar trend of increase in yield over the control. The results suggested that an adoption of CRA practises improved productivity and also saved time and expenditure towards crop production.

**Keywords:** Climate Resilient Agriculture, Zero-tillage, DSR, LCC, Raised bed Planting, Community Irrigation



**Adaptation to mitigate climate-induced crisis by pigeon pea growing framers in  
Karnataka: implications for climate services in India**

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**ABSTRACT**

Successful adaptation to change in climate requires long-term investments in strategic research and new policy initiatives into development planning. The practice of these adaptation strategies helps to reduce vulnerability to improve their 'socio-economic status' and the 'quality of life'. Therefore, farmer led adaptation strategies to confront with change in climate requires to be recorded. This study investigates how Pigeon Pea growing framers in Karnataka are coping with changing climatic scenario. The cross-sectional survey of 90 pigeon pea growing farmers was conducted with semi-structured interview schedule followed by Focus Group Discussions to find the indigenous adaptation strategies with respect to crop productions, soil and water conservations, livestock management, land and labour use, and family and financial management. More than half of the pigeon pea growers alters the date of sowing according to the onset of monsoon and adopt the several water saving techniques. However, considering all parameters, farmers' exhibit medium to low level of adaptive capacity in farming to overcome adverse effects of climate change. The farmers need to be capacitated through training that can help improve their adoption level, which is the major source to reduce vulnerability. Findings suggests that, providing training on off farm activities helps farmers to diversify the activities that can help them improve their livelihoods and minimize risk of having only one livelihood source. Further, information on climate and technologies to be availed to the farmers so they can quickly adopt changing climate.

**Keywords:** Climate Change, Climate Services, Mitigation, Adaptation strategies, Pigeon Pea

**Climate Change vis-à-vis Vegetable Production**  
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**ABSTRACT**

Vegetables are wholesome food that provides nutrition in a balanced form. As per ICMR, 300g of vegetable/day/capita is recommended for good health. But climate change is affecting the world's food supply. Already around 12% of the world's population is suffering from hunger and malnutrition. Climate change is causing natural disasters and affecting mankind. India is a diverse country that comprises of northern plains, deltas, mountainous, plateau, coastal regions, etc. and climate change will disturb the growing pattern of vegetables. Events like drought, flooding, land degradation, rise in sea level, heat waves, salinity etc. have affected the production of vegetables. Especially marginalized communities require alternatives that are simple, affordable and accessible which emphasize nutrition, health and economy as well as environmental sustainability. Various strategies like the development of resistant varieties, genetic engineering, integrated pest and nutrient management, organic farming, use of underexploited vegetable crops, conservation agriculture, protected cultivation and agronomic practices with government efforts can help in balancing the ecosystem.

**Keywords:** climate change, vegetables, sustainability and balanced nutrition.

**Scientific and managerial innovations for promoting climate smart agriculture**

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**ABSTRACT**

Climate Smart Agriculture (CSA) is an approach to help guide actions to transform and reorient agricultural systems. The challenge is intensified by agriculture's extreme vulnerability to climate change. Climate change's negative impacts are already being felt, in the form of increasing temperatures, weather variability, shifting agroecosystem boundaries, invasive crops and pests, and more frequent extreme weather events. On farms, climate change is reducing crop yields, the nutritional quality of major cereals and lowering livestock productivity. CSA is an approach that involves several aspects *i.e.* encouraging policy frameworks, enhancement of financing options, deploying practises on the ground *etc.* CSA encompasses on-farm and off-farm actions, as well as technologies, policy, institutions and investment. The World Bank Group (WBG) is currently scaling up climate-smart agriculture. In 2020, 52 percent of World Bank financing in agriculture also targeted climate adaption and mitigation. CSA is agriculture that increases productivity, improves resilience and mitigates climate change. Small holder adoption of farming technology is necessary to speed the transition to CSA. Managerial innovations involve micro farm-level approaches, farm system approaches and resilient supply chain management. Equally important are scientific innovations that address the limitations of the existing systems and barriers in the era of climate change. Adoption of CSA would impart sustainability and profitability to the existing farm systems, however there is an urgent need to conduct further research on this aspect so as to improve its adoption even by the smallest of the land holders.

**Keywords:** CAS, Micro Farm, Managerial innovations and Institutions innovations



**Assessing the recreational value of ecosystem services in perspectives of sustainable use of forests.**

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**ABSTRACT**

The existence of protected areas such as national parks is particularly important and provides many benefits both to the environmental factors and to human beings. These are recreational spaces and home to various flora and fauna which contributes to the improvement of microclimate, reduce atmospheric pollution and protect biodiversity. Due to the fragility of forest ecosystems, developing forest recreational resources must consider sustainable ecological, economic, and social development, and reduce impacts from recreational activities. This study assessed the amenity value of the Simbalbara National Park (SNP) by adopting the willingness to pay (WTP) by contingent valuation method via face-to-face survey of 150 randomly selected respondents. The prime variable for estimation of the WTP function is household income of the individual. The per capita mean willingness to pay was found by using mean and median WTP integration and Turnbull estimator and the study concluded that the individuals who had participated in environmental protection groups had higher WTP for the amenities of the SNP. In addition, the tourists who visited more frequently also tended to have higher WTP, who investigated the value of forest tracks. Finally, those who stayed for a longer period had higher WTP.

**Keywords:-** Willingness to pay, protected area, ecosystem services etc.



## **A quick method to identify salt tolerant genotypes at the seedling stage in wheat**

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### **ABSTRACT**

Salinity is one of the most important abiotic stresses affecting wheat crop yield. The experiment included evaluation of one hundred forty genotypes representing *Triticum aestivum*, *Triticum durum* and *Triticum dicoccum* under hydroponics at four salt levels (control, 75, 150, 225 mM NaCl) along with field condition (saline and control). Seedling parameters were affected by various salt levels. This work has established screening procedures with hydroponic culture that correlated well with grain yield at salt stress condition. This study also showed that the relative importance of seedling traits may differ with the severity of the salt stress. The association study revealed that salt tolerance at field level was manifested by early vigour such as higher shoot length and can differ with the severity of the salt stress. Among the species, *T. dicoccum* found to be more tolerant followed *T. aestivum* and *T. durum*. The findings suggested that assessing salinity tolerance at the seedling stage may predict salinity tolerance at the later stages. Thus, standardized protocol will help to verify genotypes for salt tolerance and further shows potential utility in crop-improvement programmes.

**Keywords:** Wheat, Salinity, Hydroponics, Seedling and Salt tolerance.





## Role of tree species in ecosystem sustainability and environmental conservation

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### ABSTRACT

Soil degradation now-a-days is major concern which is affecting the overall ecosystem sustainability. The adoption of practices like continuous use of chemicals, mono-cropping, conventional tillage practices by farmers to obtain more production being led to soil health deterioration. Also, the continuous use of poor-quality irrigation water in irrigated tracts of arid and semi-arid regions of Haryana, leads to salt build up in soil which in turn affect the soil quality and plant growth and results in poor crop production. The normal cultivation practices are not beneficial to maintain soil health as well as to obtain the higher returns. In view of this concern, the present study was conducted to conserve the ecosystem sustainability via tree plantations. Tree species viz. *Ailanthus excelsa* and *Prosopis cineraria* (which are most commonly found under arid and semi-arid conditions) were selected. The soil samples were collected from 0-15, 15-30, 30-60, 60-90, 90-120 and 120-180 cm soil depth. The soil was loamy sand. It was observed that these tree species helped in overall improvement of soil health. Addition of organic matter through leaf litter enhances the nutrient content in soil through decomposition of organic matter. The pH and electrical conductivity were reduced under tree plantations as compared to control. The deep rooting system of the tree species helped in amelioration of soil and reduced the salt build up. In general, tree species improved the overall soil health and conserves the soil fertility as compared to control.

**Keywords:** Soil health, Ecosystem, Degradation, Mono-cropping

## **Analysis of challenges and strategies in promoting climate change resilient agriculture in Northern Karnataka**

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### **ABSTRACT**

The study was conducted in the identified climate change prone areas of northern Karnataka during 2019-2021 to critically analyse farmers' adaptation strategies to climate change as part of National Agricultural Science Fund (NASF), ICAR New Delhi sponsored project 'developing climate resilient adaptive strategies for empowerment of farmers'. The results on farmers' perception of climate change on agriculture systems in the identified eight climate prone villages in Zone 3 and 10 highlighted that only 23.42 per cent of farmers had high perception of impact of climate change on soil, growing of crops, livestock, and socio-economic aspects of human beings but majority (56.75%) possessed medium perception. The detailed analysis of adaptive measures practiced in soil and water conservation in response to perceived climate change revealed that cent per cent of farmers in the study area were found to practice summer ploughing, but very less per cent found to practice laying trench cum bunds along field boundary (27.22%), and optimizing drainage channels (25.55%), followed by 25.00 per cent each were practicing laying bunds along field boundary and across slopes, opening of open trenches along field boundary, opening conservation furrows in sole and intercropping systems and vegetative soil coverage. The results on adoption of crop cultivation in response to perceived climate change pointed out that high per cent of farmers found to practice crop rotation (75.00%), repeated inter cultivation to remove weeds and create soil mulch to conserve soil moisture (70.55%), avoid top dressing of fertilizers till favourable soil moisture or until receipt of rains (68.89%) and intercropping system (52.22%).

The observation of adaptive measures in livestock management in response to perceived climate change revealed that major adaptation practices followed were decreasing herd size by selling some of the animals (73.58%), depending for fodder from elsewhere (70.75%), and supplementary feeds and concentrates (67.92%) followed by Sending some of livestock to goshala during drought/ flood year (62.26%), change in feeding pattern (57.55%) and using different and adapted forage crops (51.89%).

The participatory analysis highlighted the challenges of creating awareness and interest amongst the farmers and other stakeholders on the impact of climate change, sensitizing climate change and promote adoption of CRA practices, keep the research workers/ policy makers informed of the farmers' problems in adoption CRA practices from time to time, and strengthen linkage amongst farmers, extension officers, researchers and other stakeholders. Further, the study critically analysed the recommendations for strengthening research and extension system and government policies for promoting increased adoption of climate resilient agriculture practices.

**Keywords:** Climate resilient agriculture, Challenges, Strategies

## ROLE OF TREE SPECIES IN ECOSYSTEM SUSTAINABILITY AND ENVIRONMENTAL CONSERVATION

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### ABSTRACT

Soil degradation now-a-days is major concern which is affecting the overall ecosystem sustainability. The adoption of practices like continuous use of chemicals, mono-cropping, conventional tillage practices by farmers to obtain more production being led to soil health deterioration. Also, the continuous use of poor-quality irrigation water in irrigated tracts of arid and semi-arid regions of Haryana, leads to salt build up in soil which in turn affect the soil quality and plant growth and results in poor crop production. The normal cultivation practices are not beneficial to maintain soil health as well as to obtain the higher returns. In view of this concern, the present study was conducted to conserve the ecosystem sustainability via tree plantations. Tree species viz. *Ailanthus excelsa* and *Prosopis cineraria* (which are most commonly found under arid and semi-arid conditions) were selected. The soil samples were collected from 0-15, 15-30, 30-60, 60-90, 90-120 and 120-180 cm soil depth. The soil was loamy sand. It was observed that these tree species helped in overall improvement of soil health. Addition of organic matter through leaf litter enhances the nutrient content in soil through decomposition of organic matter. The pH and electrical conductivity were reduced under tree plantations as compared to control. The deep rooting system of the tree species helped in amelioration of soil and reduced the salt build up. In general, tree species improved the overall soil health and conserves the soil fertility as compared to control.

**Keywords:** Soil health, Ecosystem, Degradation, Mono-cropping

## Utilization of Identified Local Genetic Resources in *Cassia auriculata* for adaptation and resilience farming in degraded land management

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### ABSTRACT

*Cassia auriculata* is a time-honoured medicinal plant which is used since from centuries in India, China, Srilanka and other South Asian countries. It is a hardy drought tolerant leguminous woody shrub belongs to *Caesalpinaceae* family. The *Cassia auriculata* flower (fresh petals /dried form) was traditionally used by anti-diabetic purposes. Dry flower powder is also having high market value as an important ingredient in many pharmaceutical and cosmetic preparations. While *Cassia auriculata* is one of the important woody leguminous shrub and this high valued medicinal as well as dye yielding multi-utility plant yet not been utilized effectively so far. In this research study, local genetic resources of 30 different genotypes of *Cassia auriculata* were assembled from different semi-arid regions Rajasthan (India). The main objective of the project is to identify potential *Cassia auriculata* genotype for high density cultivation and resource conservation in non-arable land/degraded land management under harsh environment and stress ecosystems. The 30 genotypes were raised and evaluated through progeny evaluation trial under nursery and field condition using morphometric traits to find the genetic divergence, variability, heritability and genetic advance at ICAR-Indian Institute of Soil & Water Conservation, Research Centre, Kota, Rajasthan, India during 2016-2021. Though there is distinct morphological variability among the selected genotypes of the species, this type of morphometric analysis would help to understand the differences at the phenotypic level. Such genetic variability studies would go a long way in understanding the potential of the species. The progenies of assembled genotypes were showing considerable variation in plant growth and yield performance viz., plant height (avg. mean range varies from 1.16 m to 2.15 m), collar diameter (avg. mean range varies from 18.15 mm to 28.25 mm), no. of stems /plant (avg. mean range varies from 5 to 12) and Avg. flower yield/plant (range varies from 368 g to 740 g) under evaluation trial. Based on over all genotype performance evaluation using various biometrical and biochemical attributes in *Cassia auriculata*. The following genotype viz., CA-4, CA-3 and CA-1 were selected as superior genotypes in terms growth and yield. The CA-4 recorded significantly maximum value for important plant growth, yield and plant physiological and biochemical observations viz., plant height, collar diameter, no. of stems, flower yield, pod yield compare to other genotypes. The identified genotype and their popularization among the commercial growers are highly benefited to farming community to meet the demand of flower production. The existing substantial amount of variability and diversity in identified genotypes can be utilized for commercial cultivation, hybridization, genetic resource conservation and further genetic improvement programme of this species. High levels of morphometric and genetic variation found in the present work could also pave the way for detailed research on legume plant for diversifying utility. This multi-utility plant has high market values in terms fresh and value added products. It can also easy fit into afforestation, agro-forestry and soil reclamation programmes as a legume plant with desirable traits for adaptation and resilience farming system to contribute SDGs from semi-arid regions.

**Keywords:** Genetic resource, superior genotypes, *Cassia auriculata*, legume shrub, medicinal plant, drought tolerant, resource conservation, resilience farming, land Improvement



## Evaluation of Himalayan landraces of black gram (*Vigna mungo* (L.) for yield and its component traits

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### ABSTRACT

Black gram is not only a rich source of protein, vitamins, and minerals especially in the vegetarian diet but is also utilized as fodder. In any breeding and varietal development programme variability is the prime requirement to acquire favorable gene combinations in segregating generations. With this view, in the present investigation 23 black gram landraces were evaluated during *Kharif* 2021 at two distinct locations viz., KVK Berthin (Location-1) and Palampur (Location-2) using Randomized Block Design (RBD) in two replications to determine the extent of genetic variability. The data was recorded for 11 polygenic characters viz., days to 50% flowering, days to 75% maturity, plant height, branches per plant, biological yield per plant, harvest index, seeds per pod, pods per plant, pod length, 100-seed weight and yield per plant. On the basis of DUS characterization, these genotypes were classified into distinct groups for nine traits and may be used as reference genotypes and grouping in hybridization programs for the production of improved varieties. The analysis of variance revealed significant variations for all yield and its component traits evaluated in each environment as well as the pooled environment. In the current investigation, the values of PCV were observed to be higher than GCV for all of the traits under consideration, albeit with a very minor difference, demonstrating that GCV and PCV have a tight correlation and less influence of environment on the traits under investigation. As a conclusion attributes with a great degree of variability; a meaningful selection based on phenotype would not be misleading. High heritability was found to be associated with higher genetic advance for biological yield per plant and harvest index, demonstrating the dominance of additive gene action, thus, referring advantages selection of these traits.

**Key words:** Black gram, Genetic variability, GCV, PCV, Heritability, Genetic advance



## Gene expression programming for forest fire risk modeling in Western Himalayas

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### ABSTRACT

Western Himalayas are largely prone to chir pine forest fires, which are predominantly governed by climatic factors. Therefore, the present investigation aimed to develop forest fire risk models based on climatic parameters using gene expression programming for Solan district of Himachal Pradesh. Climatic parameters *viz.*, maximum temperature, minimum temperature, mean temperature, soil temperature, maximum relative humidity, minimum relative humidity, mean relative humidity, rainfall, sunshine hours and wind speed, for the past fifteen years was randomly divided into training set (75%) and validation set (25%). Training data was used to construct eight models which were having different combinations of ten weather parameters and the models were validated using validation data. Several statistical criteria *viz.*, coefficient of determination, Pearson's correlation coefficient and statistical errors, were used for evaluation of performance of Models. Model 2, Model 5 and Model 8 showed better performance in both training and validation stage, however among these models, Model 2 ( $R^2 = 1.00\%$ ;  $r = 1.00$ ) was selected and described. Model 2 was generated using temperature, relative humidity and rainfall as input data. This model can be exploited for prediction and prevention of forest fire hazards in the study area.

**Keywords:** forest fire, gene expression programming, logistic regression, modeling

***In vitro* propagation and slow growth conservation of *Hedychium coronarium* J. Koenig - a vulnerable medicinal and aromatic plant at *In Vitro* Genebank, ICAR-NBPGR, New Delhi**

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**ABSTRACT**

*Hedychium coronarium* J. Koenig (Zingiberaceae), commonly known as butterfly ginger is a high value medicinal and aromatic perennial rhizomatous herb. The plant has been widely used in traditional medicines for treatment of several ailments and also used in food and cosmetic industry for fragrance. Due to diverse use and high demand for essential oil led to the overexploitation of species from their natural habitat and put the species as one of the conservation concern medicinal plant species. In general, conventional vegetative propagation *via* rhizomes is very slow. Thus, the species needs immediate attention with regard to rapid propagation using *in vitro* techniques. Keeping aforementioned in view, experiments were conducted to induce multiple shoots in one accession (IC628130) on MS medium with different concentrations of NAA, BAP and Kn (0 - 10 mg/l) alone or in combination. Of the 25 media tested, multiple shoot formation (4-5 shoots/explant) occurred on MS with BAP (4.0 mg/l) and NAA (0.4 mg/l). *In vitro* established cultures were subjected to various slow growth conservation strategies and subculture duration was extended up to 3 years on MS medium supplemented with low concentration of BAP alone (0.5 to 1.0 mg/l) (50%), on MS basal media (45%) and on MS basal media under dark incubation (38%) at standard culture room conditions. Upon shifting to fresh multiplication medium, 100% regrowth was observed from the 3 years conserved plants. Thus, the standardized slow growth conservation protocol has been applied for safe and medium-term conservation of *Hedychium coronarium* at *In Vitro* Genebank of ICAR-NBPGR, New Delhi, India

**Key words:** *Hedychium coronarium*, Micropopagation, Slow growth conservation



## **Vegetable Grafting: An innovative approach for abiotic stress resistance**

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### **ABSTRACT**

Vegetables are susceptible to various environmental stresses both biotic and abiotic factors due to the changing environment. Vegetables are the most essential source of nutrients in our diet, and their importance to our health cannot be overstated. Numerous environmental factors, including salinity, drought, alkalinity, and heavy metals, adversely affect the establishment and development of vegetable crops, resulting in substantial production losses. Raising the yield potential of horticultural crops by breeding has several constraints, as it increases for high-input sustainable production systems and inevitably widens the yield gap under suboptimal conditions. To prevent production losses caused by severe climate change grafting could be used to graft vegetables onto rootstocks that are able to mitigate the impact of various stresses on shoots. Grafting in vegetables is a comparatively recent and popularised approach among vegetable growers throughout the world. Grafting is the plant-surgical technique that is the most eco-friendly also rapid and efficient. It is an integrable reciprocal process and thus, both scion and rootstock can affect the tolerance of grafted plants to unfavourable climatic conditions. Through grafting techniques, the negative effects of abiotic stresses on the growth and yield of horticultural crops can be mitigated.

**Keywords:** Abiotic stress, biotic stress, environment and grafting.



## Characterization of drain discharge from subsurface drainage system at 40 m lateral spacing in saline vertisols of Tungabhadra command area

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### ABSTRACT

The characterization of drain water for irrigation over the cropping season was assessed from February 2021 to March 2021 at ARS Gangavati in the TBP command area. Fifteen times of water samples collected from three different sampling man holes revealed that, the pH and EC values of drain water varied from 7.33 to 7.00 with a mean of 7.16 and EC values varied from 6.64 to 5.94 dS m<sup>-1</sup> with a mean of 6.22 dS m<sup>-1</sup>. The SAR values in drain discharge varied from 21.80 to 14.60 (mmol/L)<sup>1/2</sup> with a mean value of 17.20 (mmol/L)<sup>1/2</sup> and RSC values varied from 13.20 to 0.00 me L<sup>-1</sup> with a mean value of 2.69 me L<sup>-1</sup>. The DCR in drain discharge varied from 0.28 to 0.17 with a mean value of 0.23 and SSP concentrations in drain discharge varied from 83.3 to 71.8 with a mean value of 76.5. The Mg/Ca ratio in drain discharge varied from 12.70 to 0.29 with a mean value of 1.92 and the Cl/SO<sub>4</sub> ratio in drain discharge varied from 0.63 to 0.31 with a mean value of 0.49. In general, the maximum variations in EC, the SAR, and RSC values of drain water among the sampling stations were observed, particularly in the months of February and March. Drain discharge varied from 1.72 to 0.75 mm day<sup>-1</sup>. While salt output ranged between 88.1 and 39.6 kg ha<sup>-1</sup>, NO<sub>3</sub>-N loss was 6.96 kg h<sup>-1</sup>. The EC, Cl/SO<sub>4</sub> ratio, and SSP values are the major constraints on the majority of drain water samples as far as their irrigation feasibility is concerned. As a result, based on the salinity of the drain water, it is possible to conclude that these waters are unsuitable for irrigation.

**Keywords:** Subsurface drainage system, Drain discharge, Drainage water quality, Irrigation water quality, Irrigation water shortage



## **Adaptations and Mechanisms of Plants For Heat Stress Tolerance**

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### **ABSTRACT**

We all are aware of the tremendous temperature hike on earth which affecting the human life as well the plants in many ways. The drastic climate change in environment is now the most unpredictable threat to our agriculturally important plants. In general heat stress is term as the rise in temperature beyond a threshold level for a period of time sufficient to cause havoc damage to plant health. Constantly or transitory high temperature cause several physiological, anatomical and biochemical changes in plants, which invade the plant growth and development and it may lead to severe reduction in economical yield. It is estimated that about 30%-40% yield loss will be occur by 2080 due to high temperature. Plants show a variety of responses to high temperature. Heat-stress proteins help in folding and unfolding of essential proteins under heat stress to sustain cellular functions. Depending on the condition of the plant health, attempts have been made to induce heat tolerance in a range of plant species using different approaches. Molecular knowledge of response and tolerance mechanisms will pave the way for engineering plants that can tolerate heat stress and help in crop production which can produce economic yield under heat-stress condition.

**Key words:** Heat Stress, Plant health, Stress proteins, Tolerance Mechanism



## Climate Change Resilient Agriculture

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### ABSTRACT

The unbridled increase of greenhouse gas emissions is causing global warming. Melting glaciers, more precipitation, more and more extreme weather events, and shifting seasons are some of the consequences. Climate change is speeding up, and this, combined with global population and wealth growth, poses a danger to food security around the world. Climate change has a significant impact on agriculture. Higher temperatures eventually reduce desirable crop yields while encouraging the spread of weeds and pests. Short-term crops failures and long-term production patterns change. Countries like India where majority of population dependent on agriculture faces a great threat to these ups and down in climate. "Climate change may reduce yearly farm income in the range of 15% to 18% for irrigated areas and up to 20% to 25% for unirrigated areas," according to a 2017-18 economic survey. This results in food shortages, as well as nutrient deficiencies in humans as a result of insufficient intake of good foods, making them vulnerable to health problems.

"Climate-resilient agriculture (CRA) is a method of achieving long-term greater productivity and farm revenue through the sustainable use of existing natural resources in crop and livestock production systems." In the face of climate change, this strategy decreases hunger and poverty for future generations. CRA methods have the potential to change the current situation and sustain agricultural output on a local, regional, and global scale, particularly in a sustainable manner. Climate-resilient practices result in enhanced access to and use of technology, transparent trade regimes, higher use of resource conservation methods, and increased agricultural and livestock tolerance to climatic stress. We have developed various strategies and technologies for adapting these changes in climate like tolerant crops, tolerant breeds in livestock and poultry, reduced tillage, crop rotations, and cover crops, etc.

**Key words:** Greenhouse gases, Climate-resilient agriculture (CRA), tolerant crops, tolerant breeds in livestock and poultry, reduced tillage, crop rotations, and cover crops,

**Impact of climate change on agriculture pea crop production/ yields**Ashish Kumar Nagar<sup>1</sup>, Ashutosh Singh Rajpoot<sup>2</sup>, Siddharth Namdeo<sup>3</sup> and Badal Verma<sup>4</sup><sup>1,2</sup>*Department of Extension Education, College of Agriculture, JNKVV, Jabalpur (MP) 482004*<sup>3</sup>*Department of Extension Education, College of Agriculture, RVSKVV, Gwalior (MP) 474002*<sup>4</sup>*Department of Agronomy, College of Agriculture, JNKVV, Jabalpur (MP) 482004***ABSTRACT**

Higher temperatures often lead to lower agricultural yields and an increase in the growth of weeds and pests. Increase in temperature and changes in water supply, climate change can have a detrimental impact on the yields of irrigated crops in all agro-ecological zones. The increase of the temperatures will have at first an effect on development stages and the sensitive period will be moved. The reproductive stage of the crop cycle, Pea may sometimes avoid drought, extreme temperatures, and root disease. Available cultivars, however, are not sufficiently resistant to frost and are susceptible to aerial diseases like ascochyta blight and bacterial blight which results in yield losses when winters are mild and without progressive negative temperatures, which provide frost acclimation. Ascochyta blight can be prevented from spreading to winter pea crops by improving lodging resistance, limiting sowing density, and better adjusting sowing dates. Increasing use of Aphanomyces soil testing for spring pea might prevent planting the crop in contaminated fields. The creation of a pea crop model that simulates the impact of various stresses encountered on winter and spring pea crops can help to better define the regions best suited for the cultivation of these two types of cultivars.

**Keywords:** Climate change, Temperature, sowing, disease, pea crop.

## Regulation of physiological and biochemical mechanism in wheat under combined drought and heat stress

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### ABSTRACT

The growth and productivity of wheat crop is predominantly affected by heat and less water availability. Due to its cultivation in rainfed areas, wheat faces high temperature stress combined with irregular water supply during the reproductive stage which results in severe yield loss. The present study was conducted to identify the negative effects of drought (D, 50% field capacity), heat (H, 35-36 °C/30 °C, with normal irrigation), and combined heat and drought (HD, with 35-36 °C/30 °C day/night temperature and moisture content was maintained at 50% field capacity) stresses on physiological and biochemical traits of wheat during reproductive stage which were strongly associated with improved heat and drought tolerance under diverse conditions. Four wheat genotypes (C306, HD2967, Raj3765 & WL711) were evaluated under (H), (D), and (HD) stress from heading till maturity and sampling was done at the anthesis (A), 10 days after anthesis (A+10) and 20 days after anthesis (A+20). These stresses caused oxidative stress by enhancing the production of reactive radicals (H<sub>2</sub>O<sub>2</sub>), malondialdehyde contents (MDA), abscisic acid (ABA), and increased transpiration rate (Tr), which resulted in reduced total chlorophyll content (TCC), photosynthetic rate (Pn), stomatal conductance (gs), Fv/Fm ratio and SPAD value in all four wheat genotypes across the ages. Independent and combined drought and heat stresses significantly altered relative water content, membrane stability, proline content, soluble sugars and proteins along with antioxidative defence system in terms of catalase (CAT), peroxidase (POX) and glutathione reductase (GR). However, (H), (D), and (HD) stresses induced the accumulation of proline, and enzymatic antioxidants to prevent the damage caused by active oxygen species (ROS). We also studied pollen biology in all these four wheat genotypes. Hence, we concluded that out of four genotypes, Raj3765 was a better performer followed by C306, HD2967, and WL711 (most sensitive) under combined stresses. Moreover, the combination of stresses was more detrimental as compared to the independent stress treatment.

**Keywords:** Oxidative damage, free radicals, antioxidative enzymes, combined stress, osmolyte, heat stress



### **Effects of climate change on vegetable cultivation**

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### **ABSTRACT**

By 2050, the global population is expected to reach 6 billion. Rising hunger and malnutrition have become an issue for all countries, especially developing countries with limited resources. Hunger in the world requires both quantity and quality of food. Vegetables are protective foods abundant in vitamins, minerals, medicinal and nutraceutical compounds. Additionally, vegetable gardening produces work. The complex growth and development process is influenced by agro-climatic factors. Consequently, any environmental deviation caused by climate change may result in crop failure in a farmer's field. High temperatures, limited soil moisture, decreased irrigation water, increased acidity or salinity, soil erosion, high wind speed, severe hail, thunderstorms and frost damage limit productivity. The effects of climate variation on soil fertility, soil microorganisms, diseases and pests, host-pathogen interactions and pollinator behaviour are significant. In the future, climate change may lead to a food shortage as a result of reduced production and productivity. All of these factors have an impact on the worldwide vegetable growing system and economic yield, both of which are crucial to growers. To prevent the negative consequences of climate change on vegetable growing, it is necessary to comprehend its effects and ramifications.

**Keywords:** Hunger, protective, malnutrition and salinity,



## **Climate change and its impact on agriculture**

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### **ABSTRACT**

Shifts in agriculture owing to climate change has been seen recently. Major adverse impacts of climate change on agriculture are owing to increase in temperature; change in rainfall pattern; weather hazards, decline in soil and water quality; shifting dynamics of insects, diseases, soil flora and fauna; intrusion of sea water on land and biotic and abiotic stresses arising due to climatic extremes. There could be a few positive impacts of climate change on agriculture in some locations because of change in temperature and moisture regimes. To address the consequences of climate change we need to develop strategies that could main high productivity levels under changing climate. More than 80% of Indian farmers are marginal farmers, having cultivable land of less than one hectare or small farmers with cultivable land area of one to two hectares, with poor coping capacity. Climate change and its variability are likely to aggravate the problem of future food security by putting pressure on agriculture affecting its sustainability. The strategies have to be built upon the current knowledge about climatic, ecological and economic systems' dynamics. To face the challenges of food security and climate change, the country needs to reorient its land use and agriculture with the state-of-the-art technologies and policy initiatives.

**Keywords:** Climate change, food security, ecological and economic systems dynamics.

## Modern practices and technology for climate resilient agriculture

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### ABSTRACT

The National Initiative on Climate Resilient Agriculture (NICRA) is a multi-institutional, multi-disciplinary network project launched by ICAR in 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate variability through strategic research and technology demonstrations. Technology Demonstration Component (TDC) of NICRA offers a great opportunity to work with farmers to address current climate variability with matching responses. On-farm participatory demonstrations of available technologies are being implemented in 100 most vulnerable districts. Climatic vulnerabilities addressed are drought, flood, cyclone, heat wave, cold wave etc. Interventions include resource conservation practices and technologies for natural resource management, and efficient use of resources and inputs for improved crop, livestock and fisheries production. Realizing the need for support in the form of better access to farm machinery and implements for wider adoption of resilient practices and technologies by farmers, custom hiring centres (CHCs) were established in the NICRA villages. Enhancing resilience is the key to achieve sustainability in agriculture especially in the context of climate vulnerability. Thus the focus is on adaptation to climate variability and entails appropriate responses to contingency situations. This publication attempts to capture and highlight some of the key interventions that were successful in participatory demonstrations and have the potential for further up-scaling through various missions under the National Action Plan for Climate Change (NAPCC), especially under the National Mission on Sustainable Agriculture. Technology demonstrations will be expanded to cover more climatically vulnerable districts in the XII plan and we believe that many more resilient practices.

**Keywords:** Climate change, resilience, sustainability



**Role of muconic acid production from paddy straw using indigenous fungus *Aspergillus clavatus* isolated from rice field of IARI, Pusa, New Delhi in climate change resilient Agriculture**

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**ABSTRACT**

Adipic acid is a crucial organic diacid intermediary in the production of nylon. It is manufactured mostly through an industrial process that produces nitrous oxide as a by-product, which is neither ecologically favourable nor eco-friendly, valorization of muconic acid (precursors of adipic acid) from paddy straw will develop a new bio-based platform technology that will replace petroleum-based products in diverse markets like nylon 6,6, plasticizers, chemical fibres, lubricants, and polyesters using solid state fermentation of paddy straw by the lignocellulolytic fungus *Aspergillus clavatus*. Commercially available muconic acid is expensive and not environmentally friendly, and burning of paddy straw leads to the loss of beneficial microflora and fauna as well as nutrients in the soil. The indigenous fungus *Aspergillus clavatus* was isolated from the rice stubble of IARI Pusa, New Delhi using RMM media supplemented with lignocellulosic substances. Production of muconic acid was done by solid state fermentation using 3% of *Aspergillus clavatus* ( $9.6 \times 10^8$  cfu/ml) along with .1% catechol and 5% paddy straw, and the yield was 18.99g/l on the 9<sup>th</sup> day of SSF. Hence, this lignocellulolytic fungus can be used for the valorization of paddy straw into muconic acid, and later this muconic acid can be valorised into adipic acid via catalytic process.

**Keywords:** Solid state Fermentation; Valorization; Muconic Acid; Adipic acid; Paddy straw; lignocellulolytic

## Multipurpose Windbreaks: Balancing Ecosystem services and Crop Yields in Arid Western Rajasthan

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### ABSTRACT

Western Rajasthan accounts for 61 per cent of the arid zone of the country. This amounts to over 20 million hectares, which is subjected to extremes of temperature, high wind velocities leading to soil erosion, higher evapotranspiration and low humidity, and scarce rainfall, in addition to high population pressure. Windbreaks are an important technology that can reduce the effects of the prevailing harsh climate. A study was undertaken in the Bikaner district of Rajasthan, with the objective of quantifying the role of such existing tree windbreaks in farmers' fields and their effect on crops. Trees as windbreaks provide multiple benefits in terms of ecosystem services, which can be a boon to resource poor areas of arid western Rajasthan. Depending on the tree species selected, the provisioning services may range from the supply of fruit to wood to timber, and other services like regulation of wind velocities, nutrient cycling, addition of organic matter, increased fertility of soils, providing shade to livestock/people, sustaining other biodiversity, etc., and also increasing the aesthetic beauty of the farm. Crop data were also collected from different distances from the tree line, in order to understand the effect of the tree species on the crop growth. Crop yield was observed to be adversely affected by different tree stands, mainly up to the average tree height. In most cases, crop stand and growth were meagre for 1-2 m from tree line, irrespective of tree species in the *kharif* season. This yield reduction might be due to shading and competition for moisture by trees, as well as the damage by birds which are harboured by the trees during germination. In the case of single-row windbreaks constituted by ber (*Zizyphus* sp.) and gonda (*Cordia myxa* L.), the crop yields were noted to increase with increasing distance from the tree line, up to ten times the average windbreak height (10h). After this distance, the yield measured beyond 20h was seen to be similar to that at 10h. Gonda was observed to have a less negative effect on the crop growth and yield compared to ber. However, with proper management and design, a balance can be maintained between losses due to the tree windbreak and benefits received from it, which can be an important factor in arid parts of the country.

**Keywords:** arid zone, ber, crops, gonda, windbreak, ecosystem services



## **Carbon farming: an viable option for food, soil security and climate change**

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### **ABSTRACT**

Carbon farming involves increasing the soil organic carbon stored in the different pools as in the form of organic matter, and often increasing the carbon that is present in perennial biomass above and below ground as well. Different carbon farming enriching practices such as usage of soil amendments i.e., manures, compost, biochar, conservation tillage, Agro-forestry, cover cropping, cultivation of c4 plants, millets and underutilized crops etc. IPCC 2018 report clearly indicated that transition is required to limit the impact of climate change to 1.5<sup>0</sup> C increase in global temperature. So, this need 570 Gt of CO<sub>2</sub> to remain within the accumulated carbon budget, to generate the business of carbon trading globally around 2050. Carbon farming reverses the climate change by curtailing the emissions of potential GHG's by sequestering the carbon into soil. Soil organic carbon is the greatest asset for future generation to make it itself as triple duty to generate resources and also in ensuring favourable climatic change adaptations and to give nutritional and soil security. Community of progressive farmers should know and aware of the carbon farming and the pools of carbon in different soil layers that can make the crop and soil more productive as well as fertile which include soil structure to reduce the erosions. Because of its, immense potential in day-by-day life, carbon farming is becoming emergent and massive frontier in current sustainable agriculture to store the soil organic carbon pools and to play key role in supplying security to food, resilience to soil and able to create congenial conditions in disturbed climatic changing situations.

**Key words:** Carbon farming, Carbon trading, Climate change and Food security.

## Species Distribution Models : Multiple Uses and Methods

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### ABSTRACT

Species Distribution models involve a heterogeneous group of techniques to model geographic ranges of species by relating their known occurrences with the environmental conditions, typically climatic conditions. The relationship between species range and environmental predictors are well described in a Species Distribution Model, simply SDM. The detailing in such descriptions can be further streamlined by inclusion of interaction within the species, some non climatic predictors or spatial incorporation that depicts seasonal and temporal variability.

To predict how species will respond to climate change, we need to first understand their climatic tolerances. Toward this aim, a common practice is to use a species' observed occurrences to estimate its physiological tolerances for various environmental and climatic variables and then to map the species' potential geographic range as the full extents of "suitable" areas (Feeley, K. J. (2015) Species distribution modeling (SDM) is an important tool to assess the impact of global environmental change. Many species exhibit ecologically relevant intraspecific variation, and few studies have analyzed its relevance for SDM (Oney, B, et al, 2013). Species Distribution Models are utilised for purposes as common as getting knowledge about species ranges to policy decisions involving countries and boundaries.

Multiple methods and algorithms ranging from complex statistical computations and machine learning channels to open source engines like Google Earth Engine (GEE) can be used to generate an SDM. Validating predicted species distribution is necessary, when broad-scale models (continental or oceanic scale) are generated based on limited and spatially aggregated presence-only records.

**Keywords:** Species Distribution models, Conservation, translocation, Maxent, occurrence data



## **Precision farming:- demand of current as well as future agriculture**

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### **ABSTRACT:-**

As we all know that precision farming is the demand of current agriculture system. Day by day population is increasing tremendously and land area is decreasing fastly. So we have to adopt the precision farming system and sustainable production of food grains for future needs. It is information and technology based farming system. It is precise way of farm management practices. By the help of precision farming systems we understand the strategy of reducing incidence of pest and disease management practices. It gives the idea of using fertilizer in a right place, right amount, right time and in a right way. Precision farming systems is best for optimum productivity, profitability, sustainability and protection of land resources by minimising the production costs. Increasing environmental conciousness of the final public is necessitating us to modify agriculture management practices for conservation of natural resources such as( soil, water quality, air) and balancing the ecology. The most components of this farming system using recent smart technology like GPS,GIS, remote sensing SSNM, VRT and plenty of more smart technology. It's the smart practices by which we offer a controlled and ambient environment for the agriculture food production. It provides the joint development of management skills and pertinent information databases. A farmer must have skilled knowledge of aim of precision farming and crucial information necessary to create decisions effectively. Effective information management requires more than simply keeping analysis tools. It requires an entrepreneurial attitude toward education and experimentation for better understanding. It's a holistic approach to manage spatial and temporal variability in agricultural lands at micro level supported integrated soil, plant, information, and engineering management technologies as well as economics. Precision farming gives the benefit of overall yield increase, efficiency improvements, reduced production costs, better higher cognitive process in agriculture management, reduced environmental impact and accumulation of farmers knowledge for better management with time. It's the appliance of principles and technologies to manage spatial and temporal variability related to all aspects of agricultural production for the aim of improving crop production and environmental quality.

**Keywords:** Precision Farming, GPS, GIS, SSNM.VRT

## Effect of elevated CO<sub>2</sub> and temperature on rice and wheat cropping system in *Vertisol* of Central India

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### ABSTRACT

The rice-wheat cropping system is mostly adopted cropping system in India predominantly in Central India. The current study was undertaken to evaluate the effect of elevated CO<sub>2</sub> and temperature on plant growth and yield of rice-wheat cropping system in *Vertisol* of Central India. A field experiment was conducted under Free Air CO<sub>2</sub> Enrichment (FACE) system with 6 treatments: T1 (Control (Ambient CO<sub>2</sub> and Temperature)); T2 (Ambient temperature + Elevated CO<sub>2</sub> (600ppm)); T3 (Ambient CO<sub>2</sub> +Elevated temperature (2°C)); T4 (Ambient CO<sub>2</sub> + Elevated temperature (3°C)); T5 (Elevated CO<sub>2</sub> (600ppm) +Elevated temperature (2°C)) and T6 (Elevated CO<sub>2</sub>(600ppm) + Elevated temperature (3°C) along with 4 replication. The plots are arranged in randomized block design. The plant height at fully vegetative stage of rice was not significantly difference among the treatments while in wheat T2 was significantly higher than the other treatments. In both rice and wheat crop, the highest value was accorded in T2 (Ambient temperature + Elevated CO<sub>2</sub> (600ppm)) in terms of shoot and root biomass, yield and no. of grain/panicle. The yield increased over control was highest in T2 (16.24%) in rice and (17.40%) in wheat. Study suggests that climate change factors would affect the productivity of rice-wheat cropping system significantly.

**Keywords:** Elevated CO<sub>2</sub>, temperature, rice, wheat, productivity





## DMS Cloud for Global Warming Mitigation

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### ABSTRACT

Climate change represents an urgent and potentially irreversible threat to human societies and the planet. Human influence on climate has been the dominant cause of observed warming since the mid-20th century. Anthropogenic activities have caused about 1.0°C of global warming above the pre-industrial level, which is likely to reach 1.5°C if the current emission rates persist. The spread of fossil-fuel-based material consumption and changing lifestyles is a significant driver of global resource use and the main contributor to rising greenhouse gas (GHG) emissions. Global warming is the unusually rapid increase in Earth's average surface temperature over the past century primarily due to the greenhouse gases released as people burn fossil fuels. In 1987, The CLAW hypothesis proposed a negative feedback loop that operates between ocean ecosystems and the Earth's climate. CLAW describes a feedback system whereby dimethyl sulphide (DMS) produced by marine phytoplankton is oxidized in the atmosphere to form sulphate aerosols, thus acting as a precursor to cloud condensation nuclei (CCN). It affect the cloud's albedo and hence increases the amount of backscattering of incoming sunlight back to space, thus keeping global temperatures stable and sea surface temperatures cool. Because cloud albedo, and therefore Earth's radiation budget, is sensitive to CCN density, it was suggested that the production of DMS could have a role in climate regulation.

**Keywords:** Climate change; Global warming; Greenhouse gases; Mitigation; CLAW; DMS



## Molecular identification of fungal endophytes and their ability to confer drought tolerance in sorghum

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### ABSTRACT

Endophytic fungi have gained importance in agriculture because of their ability to confer resistance to different biotic and abiotic stress. In this study, a total of 46 endophytic fungal isolates were obtained from leaf and stem tissues of drought adapted *Prosopis* spp. (*P. juliflora* and *P. cineraria*). These samples were collected from semi-arid habitats of Vijayapur and Bagalkot districts of Karnataka. All the 46 isolates were screened for drought tolerance using PEG8000 MW. Four endophytic isolates viz., PJB-1, PJB-9, PCV-6 and PJV-6 were selected for further studies based on their *in vitro* tolerance against drought stress. These potent fungal endophytes were tested for their pathogenicity in sorghum seedlings. The three isolates viz., PJB-1, PCV-6 and PJV-6 which did not develop disease symptoms were used for further studies. Fungal endophyte PJV-6 was found to be a promising isolate which showed significant improvement in shoot and root growth of sorghum seedlings under PEG 8000 induced drought stress. Based on molecular characterization, fungal endophytes PJB-1, PCV-6 and PJV-6 were identified as *Fusarium sulawense*, *Botryosphaeria dothidea* and *Penicillium brevicompactum*, further, whose sequences were submitted to NCBI and the accession numbers MW308555, MW308558 and MW308528 were obtained respectively.

**Keywords:** Drought stress, Fungal endophytes, Molecular Characterization, Sorghum

## **Drought Severity and Water Management Strategies in North Eastern Transition Zone of Karnataka**

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### **ABSTRACT**

Rainfall data from 1979-2019 was analysed across the ten agro climatic zones in Karnataka. Rainfall Anomaly Index and Mean deviation methods are used to identify drought years and wet years over both spatial and temporal on time scale. The North Eastern Transition Zone is recorded as most drought effected zone as it about 24 dry years (<3 RAI) which indicates existence of water stress in this zone. Farmers adopt various water management strategies during rainfall off season and dry spell days. Through Garatte Ranking techniques it is observed that, Rain water harvesting (rank I) was majorly practiced by semi-arid farmers. Farmers use water source from groundwater (rank II) through bore-well for irrigating crop in the fields. They try to have irrigation through pumps from rivers (rank III). Farmers gave last preference for drip irrigation due to its high cost of investment. Krishi Bhagya Scheme provided water harvesting structure for efficient use of water through adoption of farm pond technology. Majority of farmers prefer farm ponds 30 m × 30 m × 3 m as the water stored in the farm pond during Kharif with storage capacity of 2700 cubic metric, which can approximately irrigate 1.5 ha. About 240 sample farmers, i.e. 180 adopters and 60 non adopters of farm pond technology were drawn from Bidar and Gulbarga district of Karnataka and observed a positive impact on beneficiary farmer's annual income when compared to non-beneficiaries.

**Key words;** Drought, Water stress zone, Farm pond technology, Farmers, Income



## **Impact of Dominant Land Uses on Soil Quality in Mid hills and High hills of Himachal Pradesh**

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### **ABSTRACT**

The field investigation was conducted during 2018–2020 in the Mandi district of Himachal Pradesh at two elevation ranges *viz.* 651-1800m (mid-hill zone) and 1801-2200m (high hill zone). To assess the impacts of land use on soil quality, the dominant land use systems *i.e.*, Forest, Cultivated land, Pasture land and Scrubland were selected. Representative soil samples from each selected land use were collected and analysed for various physical, chemical and biological characteristics. The Soil Quality Index (SQI) was worked out by considering 23 soil parameters into account. Land use-wise SQI ranged from low (0.39) to medium category (0.65). The highest SQI value was found in the Forests, followed by Grasslands, Cultivated lands and Scrublands. The study indicated that the inferior soil characteristics were recorded under Scrublands, which was followed by the Cultivated land use system. Hence there is an urgent need to manage the Cultivated and Scrubland by following conservation practices so that they can perform their functions within natural or managed ecosystem boundaries on a sustainable basis.

**Keywords:** Forest, Cultivated land, Pasture land, Scrubland

## Estimation of crop water requirement and irrigation scheduling of rice in Shivamogga district of Karnataka using FAO CROPWAT

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### ABSTRACT

Climate change is expected to have a significant impact on the water needs of rice crop worldwide in the upcoming decades. Proper water management is essential to enhance crop yield as well as maximising the region's water use efficiency. The purpose of this study was to estimate the crop water requirement (CWR) and irrigation scheduling of rice in Shivamogga district of Karnataka using FAO CROPWAT model for a time span of 20 years (2001 to 2020). It was estimated that the crop water requirement of rice was 565.50 mm (average of 20 years) with the highest and lowest CWR (606.1 and 527.9 mm) in 2011 and 2001, respectively. Crop water requirement value showed a slight increasing trend ( $R^2 = 0.0544$ ) throughout the years from 2001 to 2020. Total gross irrigation (TGI) and total net irrigation (TNI) for rice was 491.61 and 344.12 mm, respectively during the study period. The present study is useful for effective planning and management of irrigation water needs of rice in Shivamogga district of Karnataka.

**Keywords:** Climate change, Crop water requirement (CWR), FAO CROPWAT model, Irrigation scheduling, Rice, Total gross irrigation

### Rancidity: A limiting factor in the adoption of pearl millet as climate-resilient crop

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### ABSTRACT

Pearl millet is a coarse cereal also called as nutri-cereal. It is generally grown in drier and destitute regions of the world mainly for subsistence or at a small commercial level. It is a rich source of vitamins such as riboflavin, niacin, and thiamine and minerals and offers numerous health benefits in comparison to other cereals. Despite having high nutritional richness, its cultivation and consumption are limited. Rancidity may be the sole factor responsible for it. Rancidity is a very complex phenomenon that involves both oxidative and enzymatic activity, which is an interplay of various enzymes. Enzymes start degrading pearl millet the moment we grind the grain and make a floor out of it. Lipase is the first enzyme that triggers the phenomenon of rancidity in pearl millet which acts upon the pearl millet floor followed by lipoxygenase, peroxidase and than polyphenol oxidase. In the abruptly changing climatic conditions, pearl millet is a good option as a climate-resilient crop. Pearl millet has high photosynthetic efficiency with excellent productivity and growth even in poor soil conditions, along with it can withstand high temperatures from germination to physiological maturity. So for making pearl millet a climate-resilient crop the problem of rancidity must be checked

**Keywords:** Pearl millet, Rancidity, Climate Resilient Agriculture, Lipase

## **Rhizobacteria mediated drought stress alleviation for Sustainable agriculture in climate change era**

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### **ABSTRACT**

Climate change will certainly intensify the prevalence of drought stress as a single most stressful environmental factor that put down the Agri-industry, as it affects the water relations of a plant at the cellular and whole plant level, decreasing productivity and causing economic losses in agriculture. Furthermore, the frequency of drought occurrence increases every year eroding more and more agricultural land throughout the world resulting in a 9-10 percent reduction in crop production which threatens world food security. Generally, drought stress can be addressed by breeding drought-resistant cultivars, adjusting crop calendars, strategic planning, conventional breeding, and genetically engineered drought-resistant plants. However, the technical, economic, and ecological limitations of these strategies have sparked interest in the exploration of alternative low-cost, natural, and ecologically friendly approaches *i.e.*, the use of plant-growth-promoting beneficial rhizobacterial biomes. Co-inoculation of plants with beneficial bacterial biomes which are adapted to moisture stress conditions may promote plant growth and protects the crops plants from the deleterious effects of extreme drought stress. These bacteria are known to remain associated with plant roots and act in the soil for growth promotion, either directly, or indirectly, through several mechanisms. In the present chapter, we attempt an overview of current knowledge on how plant-rhizobacteria interactions help in alleviating drought stress naturally and their usage for sustainable crop production.

**Keywords:** climate change, drought stress, rhizobacteria, sustainable agriculture

## SEED TECHNOLOGICAL APPROACHES TO MITIGATE PRE-HARVEST SPROUTING IN SOYBEAN (*Glycine max* (L.) Merrill)

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Soybean (*Glycine max* (L.) Merrill) seed yield and qualities are affected by biotic and abiotic stresses. Among them, fungal diseases and pre-harvest sprouting are the major biotic and abiotic stresses affecting seed yield and quality. Thus, it is very pertinent to consider the improvement of soybean with resistance to biotic and abiotic stresses, along with yield which could be achieved through proper and adequate seed technological investigations. One of the major constraint in soybean seed production is precocious germination at the time of physiological maturity or harvesting stage due to untimely rains leading to sudden moisture increase in the seeds there by occurrence of pre-harvest sprouting in pods is more. Therefore, identifying the ways to mitigate pre-harvest sprouting in soybean will be of much helpful to the seed industry in general and farming community in particular. The present investigation was carried out with the objective to study the effect of chemicals spray in mitigating pre-harvest sprouting. The pot experiment was conducted at glass house of College of Agriculture, University of Agricultural Sciences, Raichur during two consecutive *Kharif* seasons of 2017 and 2018, the foliar spray of sodium chloride (NaCl) @ 2000 ppm at physiological maturity helps in mitigating pre-harvest sprouting effectively. Minimum germination standard (70 %) was maintained up to 50 mm rainfall, although 10-15 per cent of pre-harvest sprouting was noticed. However, when it was above 50 mm and continuous, it affect seeds more at harvesting stage and increases pre-harvest sprouting in pods. To mitigate this problem, foliar spray of NaCl @ 2000 ppm which is comparable to Abscisic acid @ 100 ppm maintains seed germination up to 70 %, even the plants are exposed to 75 mm rainfall.



## Effect of spacing on the coppice growth performance of Willow clones

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### ABSTRACT

The present study aimed at determining the effect of spacing (1m × 1m, 2m × 2m, 3m × 3 m) on the growth characters viz., height (m), basal diameter (cm), DBH (cm), volume (m<sup>3</sup>), volume per hectare (m<sup>3</sup>/ha), number of branches and branch angle (°) of *Salix* clones (J799, Kashmiri and J194). The parameters for one year coppice and two-year coppice were recorded. The results revealed that among the clones J799 (basal diameter, DBH, volume, volume per hectare) and Kashmiri (height, number of branches, branch angle) found superior. Among different spacing, 1m×1m demonstrated better height and volume per hectare, whereas 3m × 3m spacing showed high basal diameter, DBH, volume, number of branches and branch angle at one year age. For two year old coppice, clone J799 (height, basal diameter, DBH, volume, volume per hectare, number of branches) and Kashmiri (branch angle) found superior, whereas in 1m × 1m, 2m × 2m and 3m × 3m performed better for height; basal diameter, number of branches and branch angle and DBH, volume and volume per hectare, respectively. Similarly, maximum increment was recorded for clone J799 (height, basal diameter, DBH, volume, volume per hectare, no. of branches, and branch angle). In conclusion, different spacing has impact on growth parameters and selection may be made accordingly with respect to traits of interest.

**Key words:** Spacing, *Salix* clones, Growth characters, Increment, High-density plantation

**Performance of Pumpkin (*Cucurbita moschata L.*) and Cluster bean (*Cyamopsis tetragonoloba L.*) genotypes under sodic soil**

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**ABSTRACT**

Sodicity is a major abiotic stress reducing the yield of a wide variety of crops. Research was taken up at Horticultural College and Research Institute for Women, Tiruchirappalli with 17 pumpkin and 33 cluster bean genotypes. They are assessed for its antioxidant enzymes activity related to sodicity tolerance. The antioxidant enzyme system of plants plays an important role in scavenging the Reactive Oxygen Species (ROS) that accumulate during stress and is the first line of defense to counter the deleterious stress effects. Proline, catalase and peroxidase plays a significant role in abiotic stress that significantly increased in tolerant genotypes and decreased in sensitive genotypes. CM -11 (Madurai), the salt tolerant genotype maintained higher levels of chlorophyll (3.7  $\mu\text{g/g}$ ) and proline content (428  $\text{mg/g}$ ) as well as catalase (278  $\mu\text{g of H}_2\text{O}_2\text{g}^{-1}\text{hr}^{-1}$ ) and peroxidase activities (272  $\mu\text{g of H}_2\text{O}_2\text{g}^{-1}\text{hr}^{-1}$ ) under sodic soil condition followed by CM -12 (Sedapatti) and CM-1 (Old Ayakkudi). In cluster bean genotypes, significant variations were recorded among genotypes in growth, yield and quality parameters. Among the 33 genotypes screened, high protein content (25.84 %) was recorded in IC-116737, high catalase activity (2.57  $\mu\text{g of H}_2\text{O}_2\text{ g/min}$ ) was observed in IC-415161 and peroxidase activity (0.40 activity /min/ g sample) was observed in IC-116525 which might be the primary mechanism for sodicity tolerance. The tolerant accessions can be used in further breeding programme.

**Key words:** Cluster bean, Pumpkin, abiotic stress, sodicity tolerance

**Tuber crops – climate resilient crops for fostering food security**

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**ABSTRACT**

Food security in the context of climate change is among the major global issues of the 21<sup>st</sup> century. Our staple food crops like rice and wheat have very sensitive nature towards climate change. Tuber crops can substitute cereals owing to their higher dry matter production and heavy calorie yield. Tuber crops especially cassava is likely to outperform other crops amid rising temperature and could even become more productive offering farmers away to cope with climate change. In tuber crops, there is no separate period of development of economic part. Tuber and shoot grow simultaneously during normal or favorable condition. Tuber crops cease tuber development as well as vegetative growth and become dormant during unfavorable conditions. They resume growth and tuber development during favorable condition and so there is a less chance of crop failure. Tuber crops are the energy reservoirs of nature. Due to high starch content and calorie value, these crops have a major role in meeting the food security of our ever increasing population. They are known as crops for adversity since they have resilience to adverse weather conditions. The ability to yield reasonably well under changing climatic conditions makes them the future crops.

**Keywords :** Tuber crops, Food security, Climate resilience, Climate change, Future crops





## Potato late blight disease prediction using meteorological parameters in Northern Himalayas of India

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### ABSTRACT

Weather parameters play an important role in the spread of potato late blight of caused by *Phytophthora infestans* (Mont.) de Bary has historically been serious disease of potatoes through worldwide, including India. Due to spatial variation in prevailing weather conditions, its severity varies from region to region. Disease development process and the weather parameters are well understood and have been utilized for disease developing forecasting models and decision support system. Therefore, an experiment was conducted for two consecutive cropping seasons (2017 & 2018) to develop a forecasting model against late blight of potato using stepwise regression analysis for Northern Himalayas in India. Maximum and minimum temperature, relative humidity, rainfall and wind speed appeared to be most significant factors in the potato late blight disease development. The meteorological conditions conducive for the development of potato late blight disease were characterized. Maximum and minimum temperatures in the range of 15.0 – 28.0°C and 2.0 – 12.0°C were found favorable for potato blight disease. Similarly, relative humidity, rainfall and wind speed in the range of 85 - 95 per cent, 15.5 - 20.75 mm and 1.0 - 5.5 Km h<sup>-1</sup>, respectively, were conducive for potato late blight disease which are helpful in disease development.

**Key words:** Environmental factors; potato late blight; *Phytophthora infestans*



### **Efficient water use for sustainable dairy production**

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#### **ABSTRACT**

Water is an essential component that is required in largest quantity by livestock. Drinking water provides 60 to 80 % of dry and lactating cows' water needs and feed provides the rest of the water needed. Water availability and quality has a direct impact on health and production performance in dairy cattle. Shrinking water resources warrants judicious use of water since low water availability will lead to adverse effect as animal growth and production. In its broadest sense, water use efficiency is the net return for a unit of water used. There is considerable scope for improving water use efficiency of crop, livestock and fisheries at field through to basin scale. Practices used to achieve this include water harvesting, supplemental irrigation, deficit irrigation, precision irrigation techniques and soil-water conservation practices. Practices not directly related to water management impact water productivity because of interactive effects such as those derived from improvements in soil fertility, pest and disease control, crop selection or access to better markets. However, there are several reasons to be cautious about the scope and ease of achieving water use efficiency gains. Crop water use efficiency is already quite high in highly productive regions, and gains in yield (per unit of land area) do not necessarily translate into gains in water use efficiency. Reuse of water that takes place within an irrigated area or a basin can compensate for the perceived losses at the field-scale in terms of water quantity, though the water quality is likely to be affected. While crop breeding has played an important role in increasing water use efficiency in the past, especially by improving the harvest index, such large gains are not easily foreseen in the future. More importantly, enabling conditions for farmers and water managers are not in place to enhance water use efficiency. Improving water use efficiency will thus require an understanding the biophysical as well as the socioeconomic environments crossing scales between field, farm and basin. An effort has been made to analyze LWUE in smallholder and commercial production and to formulate for strategies for improving LWUE. Primary data was collected from 75 small and medium sized dairy farms in Kolar and Shimoga district. The water intake by animals through forage and other feed ingredients are more as compared to water intake through drinking water and that used for on farm servicing operations such as cleaning etc. The average direct consumptive water use by small holder system was found to be 97 litres per day and 127 litres per day for commercial dairies. The calculated water use efficiency for small holder system was 0.85 and for commercial dairying it was 1.62. This indicates that the small holder system was more efficient in water use. To improve LWUE, we need to increase the quality of locally available feed and the way we feed the animal. Such activities may involve selection, intercropping, urea treatment, chopping of coarse residues and other plant-animal management practices.

**Key words:** LWUE, Dairy, Forage, Quality

## Growth performance of *Brassica* cultivars under elevated temperature gradients under present climate change scenario in Gwalior, Madhya Pradesh

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### ABSTRACT

In the research work carried out at the climate change project unit, department of environmental science, College of agriculture, Gwalior, RVSKVV during 2021 -22 to study the growth performance of *Brassica* cultivars under elevated temperature gradients under present climate change scenario in Gwalior, Madhya Pradesh. The experiment was carried out in open top chambers (OTC) unit with four different levels of temperatures (ambient in OTC, ambient + 1 °C, ambient + 1.5°C and ambient + 2 °C) and a control plot. Two *Brassica* cultivars (RVM -2 and Giriraj) were selected and Randomized Block Design (RBD) with two way analysis was applied for analysis. Growth, yield and qualitative parameters were compared at different levels of temperature.

The study revealed that with an elevation of 1.5 °C in the atmosphere, the growth, yield and quality of mustard cultivars was better as compared to other temperature levels in addition to ambient temperature in OTC unit & open field. Growth parameters viz., plant height, LAI, root length, shoot length was 197.3 cm, 2.6, 11.9 cm, 175 cm at 120 DAS in RVM -2 and no. of leaves/plant 30.6 in Giriraj were observed with more values at elevated temperature of 1.5 °C. Likewise, the yield contributing parameters like dry weight of root and shoot (5.3 gm & 53.9 gm), total biomass (599.6 gm), number of pods/plant (205.6), number of seeds/pod (10.9), number of seeds/plant (2,274.8), seed weight/plant (11.36 gm) was towards higher values at ambient + 1.5 °C. Consequently, the yield was maximum (25.24 q/ha) in Giriraj at ambient + 1.5°C. Similarly, it was found that the quality parameters sulfur (1.12%), oil content (39.7%) and chlorophyll (38.6) was more at ambient + 1.5°C. Among the cultivars, Giriraj showed better results in yield and quality parameters while RVM-2 performed better in regard to growth parameters. Correlation coefficient analysis of temperature and growth, quality parameters were positively significant in most of the cases and a few were negatively significant (table no.4.6). Thus, it can be concluded that increase in mean temperature of the earth by 1 or 1.5°C in upcoming years will not affect the growth performance of cultivars (RVM -2 and Giriraj) negatively. However, it was observed in the experiment that if temperature goes higher than 1.5 °C then the growth and yield may not be the same and decline.

**Key words:** Elevated temperature, growth performance, climate change scenario, *Brassica* cultivars (RVM-2 and Giriraj), OTC.

## Assessment of elevated CO<sub>2</sub> levels on yield and nutrient status and uptake in pigeon pea and black gram

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### ABSTRACT

An experiment was conducted during *kharif* 2019 in an open top chamber (OTC) to study the impact of different elevated carbon dioxide levels (500, 450 and ambient 395 ppm) on the growth and yield of pigeon pea and black gram and nutrient status and uptake of crop at College of Agriculture, Gwalior (M.P.). The experiment was in Randomize block design (RBD) with eight treatments; having 4 levels of CO<sub>2</sub> (395ppm CO<sub>2</sub> (C<sub>1</sub>), 450ppm CO<sub>2</sub> (C<sub>2</sub>), 500ppm CO<sub>2</sub> (C<sub>3</sub>) and Natural CO<sub>2</sub> (C<sub>4</sub>)) in combination with pigeon pea (p<sub>1</sub>) and black gram (p<sub>2</sub>), repli cate three times. The significant positive response were recorded for plant height, number of branches and pods per plant; pod length, number of grains per pod and plant biomass at elevated CO<sub>2</sub> levels. Maximum values were recorded under C<sub>3</sub> over remaining levels of CO<sub>2</sub>; whereas maximum nutrient content in seed and straw were recorded in ambient (C<sub>1</sub>) condition compared to rest of CO<sub>2</sub> levels. The yield attributes differed significantly in both pigeon pea and black gram and highest grain (121g plant<sup>-1</sup>; 12 g plant<sup>-1</sup>) and straw yield (318 g plant<sup>-1</sup>; 37 g plant<sup>-1</sup>) were recorded under C<sub>3</sub> followed by C<sub>2</sub>, C<sub>4</sub> and C<sub>1</sub>. The increasing the levels of elevated CO<sub>2</sub> reduces the N, P and K content in grain and straw and maximum content recorded in C<sub>1</sub>; whereas the highest nutri ent uptake was found in C<sub>3</sub> and available N, P & K were recorded with C<sub>1</sub> for both crops. The pH, EC not showed much changes but organic carbon showed identical changes with elevated levels of CO<sub>2</sub> in both crops. Thus, the findings emphasize for sustained food with nutritional security under climate change scenario and may be beneficial in terms of increasing the productivity and soil fertility by pulse crops in semi -arid regions of Gwalior district of Madhya Pradesh.

**Keywords:** Elevated CO<sub>2</sub>, nutrient status, pegoypea, black gram, Open Top Chamber

## INTEGRATED FARMING SYSTEMS IN BRINGING RESILIENCE TO CHANGING CLIMATES THROUGH MICROCLIMATE MODIFICATION AND ENHANCED PRODUCTIVITY

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### ABSTRACT

Field experiments were conducted for six years during 2016-2022 at ICAR-Indian Institute of Horticultural Research, Bengaluru including various intercrops in rainfed mango, to find out the effect of intercropping on microclimate modification and earning higher income. The results of the study revealed that the intercropping with protective irrigation modifies microclimate. Closely grown protective irrigated crops like brinjal found to reduce temperature both at canopy level and at ground level as compared to no intercropping control. The relative humidity is significantly reduced when short stature crops like dolichos and field bean cultivated. Less canopy coverage leading to open light penetration increased temperature while decreasing the relative humidity. On the contrary, growing crops like brinjal intensively with protective irrigation significantly enhanced the humidity. Among different intercropping systems tried, mango + brinjal system gave significantly higher system productivity of 22,468 kg/ha followed by mango + sweetcorn 10,864 kg/ha and mango + pigeonpea 7,068 kg/ha. High yielding nature of hybrid brinjal, high yielding potential of the short duration C<sub>4</sub> sweet corn as intercrop in mango resulted in higher productivity and net returns. On an average, the net returns from a hectare of rainfed monocropped mango garden were Rs.99,000/ha while that of growing an intercrop in rainfed mango was around Rs. 2,72,000/ha. Further, maintenance of a unit of two milch cows on the farm using the fodder grown on the bunds and the crop by products, recycling the FYM produced from the dairy back to the mango garden and maintaining a vermicompost unit, a mean gross return of Rs.4,24,000 was obtained per hectare.

**Keywords:** Climate Resilience, Mango, Microclimate modification,

**Microbial biofilms: An eco-friendly agri-input to enhance soil and cotton productivity**

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**ABSTRACT**

Field trials were conducted to study the effects of microbial biofilm-based formulation (MBF) as seed treatment, soil application, foliar spray, and seed + soil + foliar application (SSF) on cotton growth and soil health at ICAR-CICR, Nagpur, and Coimbatore. Overall, the inoculation of MBF as SSF significantly enhanced the cotton growth, root attributes, yield, plant defense enzyme activities, and soil nutrient availability. Yield enhancement of 16% was observed in SSF compared with 100% RDF without MBF. Further, MBF inoculation as SSF has enhanced root length by 11%, root density by 15%, root girth by 17%, secondary root number by 24%, and root surface area by 30% compared with RDF without MBF. Inoculation of MBF as SSF significantly enhanced the availability of organic carbon, N, P, K by 26%, 12%, 34%, and 7%, respectively, compared with RDF without MBF, and saved 25% cost on chemical fertilizer. SSF significantly enhanced the activities of peroxidase, polyphenol oxidase, catalase, phenyl ammonia lyase, and phenols by several folds. From our study, it is evident that the use of MBF provides greater beneficial effects on plant and soil health. Therefore, MBF can be recommended as a promising ecofriendly input to improve cotton productivity and soil fertility.

**Keywords:** Cotton, microbial biofilms, seed cotton yield, soil nutrients, plant defense enzymes



## **Agricultural insurance: A mitigation strategy to climate vulnerable risk**

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### **ABSTRACT**

Farmer's income depends upon the returns from agriculture and allied activities: which is not steady on account of the risk conquered by climate change and other factors. Hence, agricultural credit must play a vital role in meeting the needs for farm sector development and adoption of new technologies. In a view of alleviating the risks faced by the farmers, crop insurance scheme was introduced by the Government of India (GOI) in 1947. The Pradhan Mantri Fasal Bima Yojana (PMFBY, 2016), is a new crop insurance scheme that improved upon its predecessors making it easier for the farmers to avail crop insurance and enhance coverage. In Tamil Nadu, crop insurance coverage and claim settlements for paddy crop is highest in Tiruvarur district. Successively, the sample size of 60 respondents each from insurers and non-insurers category were selected. The average rainfall of Tiruvarur district is around 1129 mm. The variation of rainfall throughout the year plays a key factor for the adoption of crop insurance. Hence, a study to identify the factors influencing the adoption of crop insurance was carried out and the results inferred that mitigation of risks and direct payment to farmers bank account were the major factors in adopting of crop insurance. Furthermore, the delay in claim settlements and lack of knowledge in online registration were the major factors for not adopting the scheme. The claim disbursement may be settled at the earliest, so that the spike in insurers rate can be realised. In addition, the awareness must be created about the guidelines of the crop insurance scheme to the farmers.

**Keywords:** Agricultural insurance, climate change, risk mitigation, farm income.



**Screening and molecular characterization of bacterial endophytes from *Digitaria sanguinalis* and *Parthenium hysterophorus* for drought stress tolerance in chilli (*Capsicum annum L.*)**

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**ABSTRACT**

Abiotic stress like rising temperature due to global warming has wreaked havoc on farmers all across the world. Bacterial endophytes counter drought stress and stimulate plant growth in an ecologically sound manner through varied mechanisms like antioxidant generation, phytohormone production and others. Initially the polyethylene glycol (PEG) of molecular weight 8000 was standardized (-0.66 MPa) for the pre-germinated chilli seedlings (Arka Meghana) as per the obtained LC<sub>50</sub> value. The bacterial endophytes, viz., DSR2A (12.38 cm) and PHR2C (12.25 cm) from *Digitaria sanguinalis* and *Parthenium hysterophorus*, respectively enhanced the growth of chilli seedlings significantly by exhibiting a minimum of 70 % growth in chilli seedlings under the stressed condition of -0.66 MPa compared to the control (sterile water without stress) and the reference strain *Bacillus cereus* isolate GE 16 (KY312802.1) along with other PGPR activities. Isolate DSR2A and PHR2C were subjected to molecular characterization through 16S rRNA sequencing and were identified as *Enterobacter cloacae* (MZ976774) and *Acinetobacter pittii* (MZ976775). Under greenhouse studies, inoculation with *Enterobacter cloacae* significantly increased the plant growth attributes at 80 % and 60 % field capacity, followed by in the consortium (*Enterobacter cloacae* + *Acinetobacter pittii*) and *Acinetobacter pittii* alone in comparison to control plants.

**Keywords:** Bacterial endophyte, chilli, drought stress, PGPR



## Changes in soil phosphorus fractions due to varied residues retention and phosphate fertilizer rates under conservation agriculture

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### ABSTRACT

Phosphorus (P) is the second most essential plant nutrient and plays a vital role in plant growth and development. Significant amounts of P can be present in crop residues and its potential contribution to P nutrition of crops could be significant. Presently, there is no distinct and clear fertilizer guidelines for conservation agriculture (CA) that retains a large amount of crop residues. The present investigation focuses on quantification of the P accumulation from residues and fertilizers and their impact on different P fractions for predicting and optimizing the P fertilizer application rate. A field experiment on CA was started during *khariif* 2013 in the research farm of ICAR-IARI, New Delhi. The experimental field was laid out as a split-plot design with four residue retention rates (No CR or no crop residue), 2 t ha<sup>-1</sup> CR, 4 t ha<sup>-1</sup> CR and 6 t ha<sup>-1</sup>) as main-plots and five combinations of P fertilizer application (No P fertilizer, 50% RDP, 100% RDP, 150% RDP and 50% RDP + AM + PSB) as sub-plots. After five cropping cycles, representative soil and plant samples were collected to perform various chemical analysis. The result showed that residue retention as well as P fertilization significantly affected different P fractions in soil depths of 0-5 and 5-15 cm. The distribution of soil P fractions in decreasing trend was: residual-P > HCl-P > NaOH-P<sub>o</sub> > NaHCO<sub>3</sub>-P<sub>o</sub> > NaOH-P<sub>i</sub> > NaHCO<sub>3</sub>-P<sub>i</sub> > WSP. Similar trend was observed for 5-15 cm soil depth having comparatively lower concentration than surface soil showing stratification of P in soil under CA. The 6 t ha<sup>-1</sup> CR treatment showed highest significant P content for all the P fractions compared to the other treatments, except for the residual P contents in both the soil depths. Among varying phosphatic fertilizer application, 150% RDP improved the P content in all the fractions, except residual-P in both the soil depths. The correlation study among different P pools with wheat grain yield showed higher correlation coefficient with

WSP ( $r^2 \sim 0.80$ ), suggesting the importance of relatively labile form of P for the growing

crop. This study helped in understanding P transformations in soil and hence could prove useful in rationalizing P management practices under CA based cropping systems.

**Keywords:** P fractions, Conservation agriculture, Crop residue retention, P fertilization

## **Influence of training systems on fruit quality properties of apple**

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### **ABSTRACT**

Training systems besides the changes in the quantity and quality of intercepted light, the partitioning of assimilates between vegetative and reproductive shoots may be responsible for the fruit quality. Optimum light interception with grater angled canopy improves the fruit physiochemical properties. The present investigation titled “Influence of training systems on fruit quality properties of Apple under Western Himalayan Region” was carried out during the year 2018 and 2019 at Fruit Research Farm of Department of Fruit Science, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) India. The experiment consisted of four training systems viz., Tall Spindle, Slender Spindle, Vertical Axis and Mini Centre training systems. Apple Cv. Jeromine trees are grafted on M9 rootstock and 4000 trees planted under high density with a spacing of 2.5 m × 1 m. Results concluded that fruits harvested from Tall Spindle and Vertical Axis trained trees were superior in fruit quality attributes viz., fruit size, weight, volume, total soluble solids, sugar contents, ascorbic acid and anthocyanin content of the apple fruits.

**Keywords:** Training systems, Apple, TSS, Ascorbic acid, and Fruit quality.

## **Impact of climate change on Indian agriculture**

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### **ABSTRACT**

The agriculture industry is crucial to a nation's economy and, incidentally, it is also the sector most susceptible to climate change. The world's population expected to reach 10 billion by 2050. As the world population increases, so does food consumption, necessitating the need for increased food production. Climatic change would result in new spatial and temporal environmental conditions, as well as changes in the severity and frequency of weather and climate events. The average temperature in India increased by around 0.7°C between 1901 and 2018. By the end of the twenty-first century, the average temperature over India is anticipated to rise by 4.4°C. As a result, climate change has the potential to have a considerable impact on agricultural productivity. Because agriculture is India's primary source of income, climate change could result in increasing crop failure and pest outbreaks. Future difficulties will be more complicated and demanding as a result. The reasons of increased greenhouse gas emissions and degradation of soil and water ecosystems must be recognized and addressed. Adaptation to the current agricultural environment must be undertaken immediately in order to prevent hazards and address challenges caused by global climate change.

**Keywords:** Climate change, global warming, agriculture, temperature, environment



**Productivity, resource-use efficiency, and greenhouse gases emission in wheat under a conservation agriculture-based pigeon pea-wheat system**

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**ABSTRACT**

Climate change is an emerging issue threatening food and nutritional security of burgeoning population. In order to make the agricultural system climate resilient, various adaptation and mitigation technologies have been developed and adopted worldwide. Adopting Conservation Agriculture (CA) with three principles (i.e. minimum mechanical soil disturbance, permanent soil cover with crop residue or cover crops, and diversified crop rotations) offers a sustainable option through improving crop productivity and profitability, carbon sequestration, soil nutrients status, nutrient and water-use efficiency, and climate change adaptation and mitigation. Therefore, the impact of a long-term (12-year old) conservation agriculture-based pigeon pea-wheat system was studied during *rabi* (winter) 2021-22. Results showed that the CA-based practices reduced irrigation water use and enhanced water use-efficiency (14.1-44.5%) compared to conventional tillage. CA-based treatments with residue retention improved soil organic carbon significantly at 0-5, 5-15, 15-30 cm depths as well as soil physical, chemical and biological properties. CA based treatments with reduced nitrogen dose (75%N) also reduced environmental footprints of wheat production. Therefore, it may be concluded that CA-based pigeon pea-wheat system can be a viable option for enhancing food and nutritional security amidst changing climate, which would be an adaptation-led mitigation strategy.

**Keywords:** Carbon sequestration, Conservation agriculture, Climate change mitigation

## Performance evaluation of cocoa genotypes for water deficit condition

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### ABSTRACT

The root morphology and root characters of different cocoa types are observed at 100 and 50 percent field capacity under water deficit condition at seedling stage. A survey was conducted at Idukki region of Kerala, India and twenty seven plus trees were identified. These twenty seven plus trees were screened for water stress tolerance under glasshouse condition by gravimetric method. With respect to the performance of plus trees, root length under 50% field capacity got increased to 21.15 cm as against 20.51 cm in 100 per cent field capacity. Fresh root weight and dry root weight substantially got increased under water stress. The average root girth of 27 plus trees got increased in stressed condition from 3.70 cm to 3.88 cm. The root volume also followed the same trend (47.28 as against 45.96). The percent of nitrogen is 1.37 in 50 per cent field capacity as against 1.63 in 100 per cent field capacity. The percentage of phosphorous decreased to 0.16 under 50 per cent field capacity as against 0.37 in 100 per cent field capacity. Similarly the percentage of potassium also showed a decreasing trend (1.27 % under 100 % field capacity to 1.06 % under 50 % field capacity). In the present investigation, underwater stress condition the root length, number of roots, fresh weight of root and dry weight of root tends to increase compared to the 100 per cent field capacity, indicating the morphological adaptations of roots to survive under water stress condition. Furthermore, under water stress condition, root nutrients tend to get depleted.

**Key words:** Cocoa, genotypes, water deficit, root characters

### Assessment of women farmers' perspective on impact of climate change on dairy farming

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### ABSTRACT

Impact of climate change on various sectors across the globe is quite evident and dairy sector is no exemption to the threats of changing climate. Most of the activities in dairy farming are performed by women and spend most of their time and dairy farming is a source of sustainable income for the women in rural areas. Women are more vulnerable to the adverse effects of climate change due to their socio-economic position in the society. So, an attempt was made to capture the impacts of climate change on dairy farming from women farmers' perspective. A total of 360 women farmers were approached for the study. Analytical hierarchy process was used to identify which of the four components and 16 sub components of dairy farming that are most affected due to changing climate. Analysis of farmers' responses revealed that productive performance was perceived to be the most affected component and average daily milk yield was perceived to be greatly affected due changes in climate.

**Key words:** Climate change, Women farmers, Dairy farming, AHP

**Punjab: Policy options for agricultural sustainability nexus**Sangeet Ranguwal<sup>1\*</sup>, Baljinder Kaur Sidana<sup>2</sup> and Sunny Kumar<sup>3</sup><sup>1</sup> Department of Economics and Sociology, Punjab Agricultural University, Ludhiana, Punjab\*e-mail: [sangeet@pau.edu](mailto:sangeet@pau.edu)**ABSTRACT**

Carbon footprint (CF) can be a powerful tool to guide sustainable food production systems. The present study quantified the CF and analyzed the variability in CF across farm categories along with share of different contributing inputs for rice and wheat production in the Punjab state. The carbon footprint of rice was found to be much higher (6.34 tons CO<sub>2</sub>e/ha<sup>-1</sup> and 0.91 tons CO<sub>2</sub>e/ton<sup>-1</sup>) than wheat (1.41 tons CO<sub>2</sub>e/ha<sup>-1</sup> and 0.28 tons CO<sub>2</sub>e/ton<sup>-1</sup>). Methane emissions contributed about 60 per cent to the emissions followed by free electricity for irrigation (17.9%), N<sub>2</sub>O (10.8%), plant protection chemicals (7.5%), diesel (6.1%) and fertilizers (3%) for rice while for wheat the major share of emissions were from N<sub>2</sub>O (41.3%) followed by diesel fuel (28.1%), fertilizers (11.8%), electricity (10.6%) and chemicals (5.1%). Across farm categories, the share of fertilizers (in terms of on-farm (11.2%) and off emissions (3.1)) remained the maximum for marginal farmers while large farmers contributed the most to the GHG emissions (18.5%) by using free electricity. The share of on-farm emissions was higher for rice (95.5%) than for wheat (80.1%) because of cultivation of rice under flooded conditions leading to methane emissions. The major contributors to the higher off-farm wheat emissions were fertilizers especially P<sub>2</sub>O<sub>5</sub>, followed by the use of diesel fuel and chemicals. The study stresses the need for sustainable management of agro-inputs which will not only offset the associated GHG emissions but also will improve the soil health. In addition, awareness of climate-smart agricultural practices and access to technologies like DSR, laser leveling, and Happy seeder are key factors in determining the utilization of farm and land management practices that may simultaneously decrease these emissions and increase the adaptive capacity of farmers, and thus improve food security.

**Keywords:** Carbon footprint, Methane, Fertilizers, Farm category



**COMPARATIVE ANALYSIS OF BACKCROSS AND SELFED PROGENIES IN  
SUNFLOWER (*Helianthus annuus* L.)”**

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**ABSTRACT**

Sunflower (*Helianthus annuus* L.) is one of the important oilseed crop, with comparatively narrow genetic base. To broaden the genetic base wild species have been used through wide hybridization. Generally wide hybridization between wild and cultivated sunflower (*Helianthus annuus*) comes with linkage drags which contribute several undesirable traits to cultivated species. In the present study, comparative analysis of backcross (BC<sub>2</sub>F<sub>3</sub>) and selfed (BC<sub>1</sub>F<sub>4</sub>) progenies was carried out to know the extent of variability in desirable direction created in both the generation derived from wide hybridization. Results revealed that traits such as days to 50 per cent flowering, days to maturity, head diameter, test weight, seed yield per plant exhibited more variability in backcross progenies as indicated by higher mean values of these values as compared to selfed progenies. Hence backcrossing is an effective tool in early generation to derive stable inbred lines rather than selfing alone. The study also gave a clear demarcation between backcross and selfed progenies derived from wide hybridization indicating the possibility to develop more stable and promising lines through one or more of progenies of backcrossing rather than selfing for progenies advancement.

**Key words:** Sunflower, Wide hybridization, Backcrossing, Selfing.

## **Biochar Synthesis from Agro Waste to Produce Novel Product for Sustainable Environment**

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### **ABSTRACT**

The agricultural sector generates a lot of trash, which is mostly wasted, and this is becoming a threat to world health and food security. The use of agricultural waste to produce value-added products has helped in managing waste management difficulties while also addressing cost-effectiveness concerns. The synthesis of these biomaterials has been widely researched in recent years due to the promising applicability of agro-residues in diverse industries such as chemical, agricultural, food processing, and medicinal for the development of unique solutions for society. The surface area, porosity, and functional groups of biochar vary depending on the type of biomass used and process parameters adopted during pyrolysis. The returning of biochar obtained from agricultural waste to the agricultural field is a new technique for increasing crop production while mitigating environmental difficulties associated with conventional sources. Furthermore, it aids in soil improvement by regulating soil organic carbon, pH, water holding capacity, and soil ion exchange potential with reducing greenhouse gas (GHG) emission and carbon sequestration. The current review article focuses on the development and use of biocomposite materials made from biochar produced from diverse crop wastes. FTIR, SEM, BET, TGA, XRD, mechanical characterization, proximate and ultimate analysis by standard procedures are some of the characterization techniques of biochar and biocomposites described by the various authors covered in this article. This review article found that biocomposites are environmentally safe materials that can be used in sustainable agriculture.

**Keywords:** Agricultural waste, Biochar, Bio-composite, Pyrolysis, Greenhouse gases



## CLIMATE CHANGE IMPACT ON SOILS

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### ABSTRACT

Climate change influences composite set of measurable soil quality attributes which relate to functional soil processes. Climate change impacts soil chemical, physical and biological functions through a range of predicted global change drivers such as rising atmospheric carbon dioxide (CO<sub>2</sub>) levels, elevated temperature, altered precipitation (rainfall) and atmospheric nitrogen (N) deposition. The exact direction and magnitude of these impacts will be dependent on the amount of change in atmospheric gases, temperature, and precipitation amounts and patterns. Many studies have progressed our understanding of relationships between particular soil properties and climate change drivers, e.g. responses to temperature, CO<sub>2</sub> or rainfall. The complexity and interdependence of many of the climate change drivers influence soil microbial properties like microbial biomass and biomass diversity, rate of organic matter decomposition, C and N cycles, physical chemical parameters of soil like pH, EC, nutrient availability and physical parameters like porosity, aggregate stability, soil erosion, etc.

**Key words:** *Climate; impact; soil quality indicators; microbial biomass; nutrient availability.*



## Assessment of irrigation water quality and soil fertility using GIS mapping in Coastal area of Ramanathapuram block Ramanathapuram district Tamil Nadu, India

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### ABSTRACT

The irrigation water quality and soil fertility is gaining importance day by day due to the changes in the urbanisation and industrialisation which over utilize the under ground water. The ground water samples were collected from 21 revenue villages of Kadaladi block, Ramanathapuram district, Tamil Nadu during the July, 2019 at variegated intervals, processed and analysed for the irrigation water samples viz., physico – chemical, anionic and cationic parameters to find out their quality by arriving calculated parameters viz., SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate), TDS (Total Dissolved Salts), SSP (Soluble Sodium Percentage) and soil samples viz., physico - chemical, available N P K , OC, and DTPA extract micronutrient viz., Fe, Zn, Mn, Cu, and though the overall values lies well within the safe limit of water quality, the 14 percent water samples found to be non- saline, 53 percent found to slightly saline and 33 percent found to saline levels. The highest value of 8.66, 43.63dSm<sup>-1</sup>, 8.00, 136.14, 27923.20, and 95.61 of pH, EC, RSC, SAR, TDS and SSP were observed in the irrigation water samples have been recorded as per CSSRI, Karnal water quality classification, and soil samples were analyzed for 10 chemical parameters and the data along with GPS readings were used for the preparation of soil fertility maps using GIS. The soil fertility maps clearly revealed that a major area of the blocks was alkaline, non-saline, low in OC, low, high and medium in available N, P and K, respectively; with regard to available micronutrients, Zn was predominantly deficient and Cu was deficient while Fe, was moderate and Mn were in sufficient status. As a whole, OC, available N, Zn and Cu are the major nutrient constraints in Kadaladi block, Ramanathapuram district.

**Key words:** water quality, anions, cations, derived parameters, soil fertility, GPS and GIS techniques



## ANALYSIS OF CHANGING PATTERN OF INDIAN COFFEE SECTOR

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### ABSTRACT

India one of the fastest growing economies in the world is a major producer of vegetables and fruits in the world. With regard to coffee, India is the seventh largest producer in the world. India occupies fifth position in the area under coffee in the world (459730 ha in 2020). India being a major producer and exporter of coffee a study was conducted to analyze the patterns in area and production and assess the trade competitiveness of Indian coffee in the world. The growth rate in area (0.0000048) and production (0.0000046) showed a positive significant growth at one and five per cent level of significance from 1961 to 2020. To assess the variations in coffee area and production the instability index was calculated. The results showed that Indian coffee sector was highly instable. Regarding exports of coffee, India is the eighth largest exporter of coffee in the world. Even though it is one of the top ten exporters in the world the Indian coffee market is not competitive in the international market. This was depicted in the results of Herfindahl Hirschman Index. The results showed that Indian coffee market was highly concentrated in the international market.

**Keywords:** area, coffee, production, productivity, trade

## Analysis of impact of climate change and its hydrological impacts for climate resilient agriculture

Shivam

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### ABSTRACT

Temperature and precipitation are the main components of the hydrologic cycle which is affected by the climate change phenomena. Rising temperature and changing rainfall pattern affects the several hydrological processes such as evapotranspiration, infiltration and surface runoff etc. This study was conducted to find the hydrological in a river basin in Eastern India. Trends in temperature and precipitation data for baseline period were analyzed for assessment of the changes in magnitude of these climatic variables. Further, hydrological modeling approach was used for assessment of changes in water availability in river basin. Correlation coefficient for model calibration at monthly scale was found 0.89 whereas for the validation period it was found to be 0.78. Hydrological model was further used for the water balance changes analysis for RCP2.6 climate change scenarios. Projection for the climate change scenarios, suggests seasonal changes in evapotranspiration process which can be attributed to the change in agricultural water availability. These changes in water availability suggest to adapt more climate resilient agriculture practices for sustainable agriculture under the threat of climate change.

**Keywords:** Climate change, Hydrological Model, Trend Analysis.

### Meta-QTL analysis and identification of candidate genes for abiotic stresses in maize (*Zea mays* L.) and their implications in breeding programmes

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### ABSTRACT

Due to climate change, abiotic stresses including drought, heat, salt, water logging, and low temperatures severely influence maize production, globally. A number of QTLs have been identified in maize to acquire abiotic stress tolerance, but only a small number of them have been successfully used in breeding programmes. Hence, meta-QTL analysis enable detection of robust QTL to be use in marker-assisted breeding. In the current study, meta-QTL analysis was carried out using BiomecatorV4.2.3 software. A total of 542 QTLs were compiled from 33 published studies for maize's tolerance to various abiotic stimuli. Out of those, only 244 significant QTLs were used for analysis, with more than 10% phenotypic variance. A total of 32 meta-QTLs were found for diverse abiotic stresses across varied genetic and environmental backgrounds. The identified MQTLs contained 1907 candidate genes for various stress responses. For combined abiotic stress, the MQTL2 1, MQTL5 1, MQTL5 2, MQTL5 6, MQTL7 1, MQTL9 1, and MQTL9 2 were detected governing many stress-related features. The candidate genes for significant transcription factor families have also been found. These identified meta-QTLs are valuable for future climate-resilient maize breeding programs and functional validation of candidate genes for these abiotic stresses.

**Keywords:** abiotic stress; candidate gene; maize; meta-QTL analysis



### Carbon Fixation Efficiency of Trees

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#### ABSTRACT

Carbon fixation is the process by which autotrophs, bacteria, algae and plants fix atmospheric carbon to form organic compounds. All the autotrophs, bacteria, algae and plants fix atmospheric carbon dioxide by the process of photosynthesis or chemosynthesis. The process of carbon fixation divided in C<sub>3</sub>, C<sub>4</sub>, and CAM cycles. C<sub>4</sub> plants show a high rate of photosynthesis as compared to C<sub>3</sub> plants because photorespiration does not occur in C<sub>4</sub> plants. Carbon fixation effected by light, temperature and enzyme activity. Amount of carbon fixed per unit leaf area per unit time ( $\text{g C/m}^{-2} \cdot \text{s}^{-1}$ ) is called as carbon fixation efficiency. Forest vegetation and forest soils constitute a major terrestrial carbon pool. The CO<sub>2</sub> source and sink dynamics are subjected to disturbance as trees grow, die, and decay. United Nations Framework Convention on Climate Change (UNFCCC) has recognized the importance of plantation forestry as a greenhouse gas mitigation option and it is need to monitor, preserve and enhance terrestrial carbon stocks (Updegraff *et al.* 2004). Increasing levels of atmospheric carbon dioxide affect climate, increasing global temperatures and changing rainfall patterns. Such changes also affect photosynthesis rates. So carbon fixation is important for mitigate green house effect on climate change. The tree species with the highest CO<sub>2</sub> sequestration capability are *Delonix regia*, *Tamarindus indica*, *Ficus religiosa*, *Albizia lebbek*, *Pongamia pinnata*, *Terminalia catappa*, *Ficus benghalensis*, *Butea monosperma*, *Samanea saman*, and *Azadirachta indica* for roadside plantation (Ragula and Chandra, 2020). In addition, carbon estimates will help to improve understanding of the role of trees in the global carbon cycle and mitigation strategies for climate change (Khanal *et al* 1970).

**Key Words :** Tree , carbon mitigation, greenhouse gas, Carbon stock.

## **Impact of Climate Change on Agriculture Production and Crop Stability**

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### **ABSTRACT**

The climate has a major impact on agriculture and its allied sectors. Crop production and livestock are the world's two major food industry, and they are extremely sensitive to climate change. Food production is usually affected by rising temperature, shifts in precipitation patterns, and variations in storm frequency and intensity. Though the effects vary by region, climate change causes challenges and uncertainty in countries all across the world. Climate experts believe that short-term increases in agricultural output will result from climate change in some high-income, high-latitude countries, but they believe that the effects will be disastrous in equatorial countries. Climate change is anticipated to have an impact on agricultural production and growth through four key, interconnected mechanisms: rising temperature, more frequent extreme weather events, changes in arable land distribution, and rising carbon dioxide levels. The effects of each mechanism differ according to their severity, region, and crop adaptations. The development and preservation of agricultural crops are significantly affected by temperature. Temperature has a major effect on plant physiology, with high temperatures affecting plant cells and decreasing agricultural production. Seasonal variations and temperature extremes cause risk to crop production because temperature affects plant growth cycles. This is because plant composition is actually affected by temperature and heat stress. Similarly, temperature fluctuations affect seasonal biomass increase by blocking or delaying critical windows in crop development, such as pollination. Temperature increases also accelerate crop maturation, reducing the time between planting and harvesting. As a result, the rate of senescence, or crop ageing and deterioration, increases. Climate change is anticipated to increase the frequency of severe crop yields, mainly droughts and floods. Even for farmers who irrigate their land, a drought can completely destroy or drastically decrease yields. The severity of the damage is determined by various factors, including the crop, its growth stage, the duration of the flooding and the temperature during the flooding. Crops are more sensitive to flooding during the reproductive stages, such as pollination, than they are during the vegetative and flowering stages.

**Keywords:** Carbon dioxide, climate change, crop production, drought, flooding.

**Seed Priming and Stress Memory- A Promising Pair for Drought Stress Mitigation**Kangkan Pandit<sup>1</sup>, Mahesh Kumar Samota<sup>1,2</sup>, Monika Awana<sup>1,3</sup>, Suresh Kumar<sup>1</sup>, Veda Krishnan<sup>1</sup>, Archana Singh<sup>1</sup><sup>1</sup>Division of Biochemistry, ICAR- Indian Agricultural Research Institute, New Delhi, 110012<sup>2</sup>ICAR-Central Institute of Post-Harvest Engineering & Technology, Punjab Agricultural University, Ludhiana, 141004<sup>3</sup>Division of Plant Physiology, ICAR- Indian Agricultural Research Institute, New Delhi, 110012**ABSTRACT**

Drought being a major abiotic stress, affects the growth and productivity of plants and limits the production of crops. Along with different conventional and molecular breeding approaches for developing drought resistant crops, seed priming is found to be a promising gateway to impart drought resistance in crop plants. The recovery from drought stress attributed to seed priming is aided by the accumulation of osmolytes, improved antioxidant activity, enhanced photosynthetic activity, and elevated expression of stress-responsive genes that undergo during the drought stress, impart a “stress memory” in the crop. Changes of gene expression patterns which are related to stress memory are often correlated with changes of the chromatin status. Epigenetic mechanisms like DNA methylations, histone modifications and chromatin structure alterations play a vital role in the regulation of gene expression that are mediators of epigenetic inheritance in plants. So far studies in this direction are limiting, so we are aiming to study the seed priming induced physio-biochemical, molecular and epigenetic alterations using bioformulation of methyl jasmonate, Fe and Zn to mitigate the drought stress in rice and to decipher the transgenerational efficacy of seed priming to bring interesting and novel information on priming induced stress imprints to mitigate drought stress.

**Keywords:** Drought, Epigenetics, Methyl jasmonate, Stress memory, Seed priming**Nakshtrawise rainfall pattern for agro-climatic zones of Karnataka state.**

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Email: [dmc.kar@gmail.com](mailto:dmc.kar@gmail.com), [dmc.keerthyng@gmail.com](mailto:dmc.keerthyng@gmail.com)**ABSTRACT**

Agriculture in Karnataka state mainly depends on summer monsoon and northeast monsoon rainfall. The temporal and spatial variability in the rainfall is very high in the State. In recent years the unseasonal heavy rainfall events, floods and frequent drought years have become a challenge to the agriculture sector. This paper presents a Nakshtrawise rainfall pattern as per the agro-climatic zones that will help in agriculture planning. This paper helps appreciate temporal and spatially rainfall variability over a smaller period of Nakshtrawise and spatially Agro-climatic zones that have been considered for the study. The objective of the paper is to analyse and see the Nakshtrawise rainfall pattern, trend and variability for agro-climatic zones of Karnataka. Mean rainfall, rainy days, coefficient of variation and rainfall trends are computed for agro-climatic zones by considering a long period rainfall data of 51 years from 1971 to 2021. Results show that most zones' highest mean rainfall and rainy days occur during Punurvasu and Pushya Nakshatra. And rainfall trend shows that all the agro-climatic zones are either increasing or significantly increasing in Hubba Nakshatra. And the majority of zones i.e., Eastern dry, Central dry, Southern dry, South transition and Northern transition zones, show a significant decreasing rainfall trend over the years in Uttara Nakshatra.

**Keywords:** Rainfall-Nakshatra, Rainfall Variability, Trend, Rainy days and Agro–Climatic Zones.

**Role of direct seeded rice in reduction of greenhouse gases**Ritika Joshi<sup>1</sup> and Ashish Khandelwal<sup>2</sup>  
NAHEP, ICAR, New Delhi-110012**ABSTRACT**

Worldwide, net emissions of greenhouse gases from human activities increased by 43 percent from 1990 to 2015. Emissions of carbon dioxide, which account for about three-fourths of total emissions, increased by 51 percent over this period. Paddy crop have been a major concern to scientific community, because they produce the threatening and long-lasting GHGs mainly CH<sub>4</sub> and N<sub>2</sub>O. Around 30% and 11% of global agricultural CH<sub>4</sub> and N<sub>2</sub>O, respectively, emitted from paddy fields. Water stagnant condition in paddy field leads to more emission of greenhouse gases. Therefore, there is a need to shift from traditional rice cultivation methods to alternate methods. Making changes to conventional crop management regimes could have a significant impact on reducing GHG emissions from rice field. Direct seeded rice (DSR) is one of the options to reduce CH<sub>4</sub> emission because it uses less water. There are two categories of direct seeded rice 1) Wet seeds rice and 2) dry seeded rice. In wet seeded rice seeds are sown in puddled field and in dry seeded rice condition, seeds are directly sown to un-puddled field conditions. In the Indian state of Punjab, the government has already proposed to reduce rice production area by 40 percent due to water shortages. Savings of 10–40 percent of irrigation water are significant, although it is important to determine if such field-level savings translate into water savings in the broader area. Researchers reported that direct seeded reduced GHG emission approximately around 46.4% and without any yield loss compared to transplanted rice. The direct seeded could be a feasible option to transplanted rice for mitigating and adapting to climate change.

**Keywords:** Direct seeded rice, Greenhouse gas emission, water saving

**Phenotyping to dissect genotypic differences and identify source for moisture stress tolerance in *Capsicum* species**Usha Rani E.,<sup>1\*</sup> Laxman R. H.<sup>1</sup>, Madhavi Reddy K<sup>2</sup>., Naresh P<sup>2</sup>., Kannan S.<sup>1</sup>  
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Climate change has emerged as the world's major concern today. It affects crop cultivation mainly due to high temperature and extreme rainfall events leading to deficit and excess moisture conditions under situations. The *Capsicum* sp. is the most widely consumed economically important horticultural crop, owing to its colour, pungency flavour as well as its high nutritional content. To identify the tolerance source, phenotyping of 23 *Capsicum* genotypes for deficit moisture stress tolerance was attempted. The genotypes were evaluated under two water regimes (100% FC and deficit water-50% FC) through gravimetric method in rain out shelter. The genotypes were assessed for root characteristics (root length, root volume, root fresh and dry weight), water relations (leaf relative water content, water potential), net photosynthetic rate and canopy temperature. Based on the membership function values for the above set of parameters, the genotypes, IHR- 4517, IHR-4597, IHR-4615, IHR-3448, IHR-4550, IHR-3014 were found tolerant and IHR-3476, IHR-4634, IHR-4635, IHR-4600 were found susceptible. Thus, the better root characteristics, water relations, higher net photosynthetic rate and lower canopy temperature are determining the tolerance to deficit water stress.

**Keywords:** Moisture stress, genotypic, *Capsicum*, root characteristics

**Theme - 5**  
**Post-Harvest Technology:**  
**Agri-Value & Supply Chain for**  
**Sustainable Production**



**Biochemistry, fatty acid profiling and value addition of cashew sprout**P. Preethi<sup>1</sup>, S. Mangalassery<sup>2</sup>, S.V.R. Reddy<sup>1</sup>, S.V. Ramesh<sup>3</sup>, S. Kumari<sup>4</sup> and S.S. Shetty<sup>4</sup><sup>1</sup>ICAR- Indian Institute of Horticultural Research, Bengaluru, India<sup>2</sup>ICAR- Directorate of Cashew Research, Puttur, Dakshina Kannada, Karnataka-574202<sup>3</sup>ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala<sup>4</sup>NITTE- K.S. Hegde Medical Academy, Mangalore, Karnataka**ABSTRACT**

Cashew kernel is a cholesterol-free, good fat (38-44%) and protein rich (18-20%) nut consumed by people of all ages, right from children to elderly, either in raw or roasted forms due to its delicious taste. Despite its taste and impeccable health benefits, cashew kernels have been identified as a second most allergic edible nut in United States due to the presence of 2S albumin allergen designated as *Ana-o-3*. Also, phytic acid - an anti-nutritional factor in the cashew kernel (190-4980 mg/100 g DW) restricts mineral absorption and has been reported as a cause for indigestion. Hence, elimination or reduction of anti-nutrients was attempted following germination in cashew and its biochemistry and fatty acids profile were investigated. Germination significantly reduces the contents of fat (from 45 to 20%), protein (from 22 to 16.5%), total sugars (from 7.53 to 2.17%), and calorific value (from 6870 to 5306 cal/g), however retains potassium (0.85%), and enhances fibre (from 1.25 to 4.3%) contents and other proximate characters and minerals. Absence of phytic acid content was evidenced in cashew sprout analysed through biochemical and HPLC methods. Among the saturated fatty acids, cashew sprouts are characterised with stearic acid at higher rate than myristic acid and myristoleic acid. The mono unsaturated fatty acids are less in cashew sprout than cashew kernel. Since, cashew sprout is a mineral rich, nutritive and does not warrant elaborate equipments, huge labour or complex processing steps, this can be potentially used for developing processed products such as extrudates, energy drink, and ice-cream.

**Keywords:** Cashew, kernel, sprout, biochemical properties, phytic and fatty acids



**Physical and functional properties of extruded snack products prepared by blending of defatted peanut flour with corn flour**

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**ABSTRACT**

Extruded snack products were prepared by blending of corn flour and defatted peanut flour using twin screw extruder. The flours were mixed and added with water put for conditioning prior to the extrusion cooking. The combined effects of feed moisture content, defatted peanut flour content, die head temperature and screw speed on the important physical (expansion ratio) and functional (water absorption index, water holding capacity and water solubility index) properties of extrudates were studied. The Response Surface Methodology (RSM) was used in designing the experiment. Since, the defatted peanut flour is poor in starch content, the flour content restricted the gelatinization and limited the expansion of the product. Defatted peanut flour was found to be suitable for the preparation of extruded snacks with the appropriate blending corn flour as a base material. The optimum treatment condition was found as 13% feed moisture content, 26% defatted peanut flour, 135 °C die head temperature and 250 rpm screw speed for the production of extruded product by blending of defatted peanut flour with corn flour.

**Keywords:** Extruded product, defatted peanut flour, extrusion cooking, functional properties

## A study on marketing channels and marketing efficiency of vegetables in mid-hills of Himachal Pradesh

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### ABSTRACT

The present study is to identify different marketing channels and marketing efficiency of vegetable in Mid-hills of Himachal Pradesh. Himachal Pradesh provides opportunity for production of different vegetables for sustainable income to farmers. Marketing of horticultural crops is complex especially because of perishability, seasonality and bulkiness. Two blocks (Balh and Kangra) were selected purposively from Mid-hill zone of Himachal Pradesh. A sample of 100 farmer's cultivating different vegetables and 30 market intermediaries (15 retailers; 8 wholesalers; 5 Local traders) has been selected on simple random sampling technique. Four major marketing channels identified in the study were channel-A: (*Producer-Consumer*), Channel-B: (*producer-wholesaler-retailer-consumer*), Channel-C: (*Producer-Local Trader-Wholesaler-Retailer-Consumer*) and Channel-D: (*Producer-Retailer-Consumer*). The most important marketing channel is use in the study area is that of Channel-B (*Producer-Wholesalers-Retailer-Consumer*). The price spread was low in channel-A as the produce was sold to the consumer directly by the producer. Comparison between different channels revealed the highest share in consumer's rupee in Channel A (*Producer--consumer*) and marketing efficiency has been also highest in channel A. As a result, there is a need for providing regulated and subsidized transportation facilities to the farmers in order to reduce marketing costs and thereby increase their share of the consumer's rupee.

**Keywords:** Marketing channels, price spread, marketing efficiency and vegetables

### Effect of blanching on the quality of green peas during freezing

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### ABSTRACT

Green peas are a very good source of protein, dietary fibre, vitamin K, vitamin B<sub>1</sub>, vitamin C, vitamin B<sub>2</sub>, vitamin B<sub>6</sub>, folate, manganese, phosphorus, copper, niacin, molybdenum, zinc, magnesium, iron and potassium. Freezing is one of the oldest and most widely used methods of food preservation, which allows preservation of taste, texture and nutritional value in foods better than other methods. Blanching is a thermal process designed to inactivate the enzymes responsible for generating the off-flavours and off-colours. Fresh green peas were blanched for various temperature (70, 80, 90 and 100 °C) and time (1, 2 and 3 min) in 4% maltose solution and stored in plastic zip lock bag (50 micron) at -18 °C for 6 months of storage. At 45 days intervals frozen peas were analyzed for biochemical and sensory parameters. Treatment 80 °C temperature and 2 min blanched in 4% maltose solution was observed to be best treatment amongst all treatments considering firmness, protein, carbohydrate, ascorbic acid, chlorophyll content and overall acceptability of frozen green peas at the end of storage period.

**Keywords:** Peas, blanching, freezing, firmness, biochemical properties



## **Biodegradable and antimicrobial nanofilm from rice starch (*kanjivellam*) for food packaging and preservation**

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Dr. Megha Shejy<sup>7</sup>

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### **ABSTRACT**

Due to the negative environmental impacts of synthetic plastics, the development of biodegradable plastics for both industrial and commercial applications is essential today. The present work investigates the rice starch-based biofilms for packaging applications. Various samples of biofilms are produced, with different compositions of rice starch, glycerol, sorbitol and gelatin. The tensile properties were improved after adding plasticizers and found that the biofilm was able to hold a maximum of 300gm for a length of 10x3 cm and above that the film breaks. Therefore, the maximum stress attained will be at this point. Further, water absorption and water solubility were reduced. On the basis of these results, the best sample was analyzed for thickness testing, biodegradability properties and sealing properties of biofilms. The average thickness of the bio plastic is found to be 0.7 mm (700 microns). Migration rate of the bio plastic monitored was found to be 0.92 mg/dm<sup>2</sup>, which is considerably less compared to normal plastic. Biodegradability of the film was also carried out and visually monitored. The moisture content was estimated by measuring the weight loss of bio film. It was found to be 6%. The temperature resistant of the

biofilm was tested at varying temperature (4,37 and 100? ). It could withstand extreme temperature

ranging from boiling point to freezing point. The food wrapped in biofilm was fresh when compared to uncovered one and hence enhances the shelf life of the food material. A greater attention has been paid to antimicrobial activity screening and evaluating methods.

Keywords: Rice starch, nanofilm, antimicrobial, food packaging

**Marketing strategies adopted by Self Help Groups in Navsari district**Priyanka Maity<sup>1</sup> and Ruchira Shukla<sup>2</sup><sup>1,2</sup>ASPEE Agribusiness Management Institute, Navsari Agricultural University, Navsari**ABSTRACT**

India being an agrarian country consists majority of the population living in rural areas and is largely dependent on agriculture. Unemployment and poverty are the few of the major problems faced in rural India. For the social and economic development and to eradicate the poverty among the rural people National Bank for Agriculture and Rural Development (NABARD) initiated a Bank linkage programme for self-help groups in 1992. Self-help group are the small women groups with 10 or more members coming together with the same goal of generating income among themselves and improve their living conditions. The present study was conducted in the Navsari district of Gujarat with a sample of 30 SHGs consisting 90 women members with one leader and two members from each SHG were selected as respondents. For the data collection multistage sampling method was used. The collection of data was done with the help of structured interview schedules keeping in the view the objective of the study. The study shows that SHGs are playing a crucial role in employment generation in rural areas by providing opportunity to involve in various economic activities and opportunities for skill development of women. The paper discusses various economic activities undertaken by the women SHGs and the marketing strategies adopted by Women SHG's. Furthermore, the study suggests that SHG can be a successful and important tool for generating employment in rural areas and women empowerment.

**Keywords:** Self-help groups, employment generation, marketing strategies  
**Future of warehousing technologies (Global vs Indian Scenario)**

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*Agricultural College and Research Institute, Kudumiyamalai- 622014***ABSTRACT**

With astronomically increasing domestic and international trade, warehousing and logistics go hand in hand. Digitalization of manual processes, designing sensor integrated autonomous vehicles, inclusion of robotic technology and adopting large scale mechanization is able to quench the arising demands in warehousing appealing to producers/ sellers worldwide especially in the global market. The feasibility of modern technologies is mostly hindered hugely by their huge installation and maintenance costs. Regardless, these can be compensated by the additional gains and reduction in manual errors. Such innovative technologies in vogue are inventory drone, multi-client shuttle technology, Cobots, IoT, Automated guided Vehicles (AGVs) etc., Agricultural produce storage is the foreground of Indian warehousing and not many technological advancements have been made with the latest ones being custom bonded warehouses and Air cargo complex. However, various policies and programs have been implemented to encourage warehousing activities among the general public, best examples are the rebates on published tariffs provided to various institutions. Other noteworthy service offered by the CWC of India is the Pest Control Services. With right medium of dissemination of information and execution, Indian warehousing industry has an enormous scope for advancement.

**Keywords:** CWC, warehouse technologies, Cobots, AGVs, future of warehouse, Indian warehouses

**Agricultural waste: Innovative techniques, challenges and future goals**Saroj Bala<sup>1</sup> and Urmila Gupta<sup>2</sup><sup>1</sup>*Department of microbiology, Punjab Agricultural University, Ludhiana, Punjab-141001*<sup>2</sup>*Department of Renewable Energy and Engineering, Punjab Agricultural University, Ludhiana, Punjab-141001***ABSTRACT**

Farming is defined as the production of organic substances in the soil of the earth as a result of the cyclical changes in the seasons. Those who consume these substances, both animals and humans, rely on these natural substances to ensure their survival. These substances are abundant on the planet and have the potential to be used to generate energy or manufacture useful products. There is significant potential for crop waste to be converted into energy in the broader energy sector as well. Biomass has physicochemical properties and is interdependent with the ecosystem from the time it is produced until it is disposed of. It also has an interdependent relationship with the ecosystem from the time it is produced until it is disposed of. Previous studies on biomass and agricultural waste conversion have been the subject of this paper's discussion, which includes a review of those studies. The purpose of this manuscript is to discuss the use of agricultural waste, as well as challenges and future goals.

**Keywords:** Agricultural waste utilization, anerobic digestion, biomass, industrial applications

**Consumer preferences for the products of minor millets in Tumakuru district of Karnataka**  
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**ABSTRACT**

The study was carried out in Tumakuru District of Karnataka state during 2021-22 to examine the consumer preferences for the products of Minor millets. Sample consumers are categorized into urban and rural consumer and data was enumerated from a total sample of 40 consumers comprising of 20 urban and 20 rural consumers. Finger millet was the most consumed among the urban consumers with 3.5 kg per month followed by foxtail millet 2.5 kg per month and little millet 2.0 kg per month, while other millets are equally being consumed by the urban consumers. The monthly household food expenditure among urban consumers, expenses made on groceries (38.03 percentage), vegetables (13.75 percentage) and millets (13.65 percentage). The total food expenses made by urban consumers were Rs.5404 of which 13.65 per cent was made on millets which amounted to Rs. 745. In case of rural consumers was Rs. 3906 which was less than the urban consumers (Rs.5404). For each respondent, part-worth were estimated using OLS regression analysis, rural consumers also found price to be the most significant attributes accounting 40.74 percent of relative importance, gaining awareness among consumers in consumption of millets for nutritional value and health benefits is improving progressively.

**Keywords:** Minor millets, consumer preferences, conjoint analysis

**Study on zeolite filler polyethylene composite film containing silver and chlorine to extend the shelf life and maintain nutritional quality of acid lime fruits stored at ambient and refrigerated condition**

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**ABSTRACT**

The present investigation consisting of different treatments viz T<sub>1</sub>-Zeolite-LDPE composite bag, T<sub>2</sub>- Silver-zeolite-LDPE composite bag, T<sub>3</sub>-Chlorine-zeolite-LDPE composite bag, T<sub>4</sub>- Zeolite-LDPE composite bag + CFB, T<sub>5</sub>- Silver-zeolite-LDPE composite bag + CFB, T<sub>6</sub>-Chlorine-zeolite-LDPE composite bag + CFB, T<sub>7</sub>-Only CFB, T<sub>8</sub> – Common poly bag and T<sub>9</sub>- Control (without any package) was carried out in Department of Post-Harvest Technology, College of Horticulture, Bagalkot during the year 2018-19. The experiment was laid out in a completely randomized design with three replications. The main objective was to find out the effective packaging material to extend the shelf life of acid lime fruits in both ambient storage (AS) and refrigerated storage (RS) conditions. In lime under both ambient storage (AS) and refrigerated storage (RS), fruits packed in T<sub>6</sub> showed maximum titratable acidity (AS- 7.33 %, RS- 7.01 %), juice percentage (AS- 50.01 %, RS- 51.24 %), respiration rate (AS- 11.16 ml CO<sub>2</sub>/kg/hr, RS- 7.02 ml CO<sub>2</sub>/kg/hr), texture (AS- 35.27 N, RS- 44.15 N), colour values (AS- *L*\*-41.80, *b*\*-39.12, RS- *L*\*-44.22, *b*\*-40.46), shelf life (AS- 11.55 days, RS- 76.44 days) and minimum TSS (AS- 7.20 °B, RS- 6.47 °B), TSS/acid ratio (AS- 0.98, RS- 0.94), PLW (AS- 17.04 %, RS- 14.21 %), *a*\* values (AS- 4.07, RS- 3.33), fruit decay (AS- 20.74 %, RS- 24.11 %) and highest sensory scores among the treatments during storage of 12 days in AS and 80 days in RS conditions. From this investigation, it can be concluded that chlorine-zeolite-LDPE composite bags with CFB boxes are found to be economically viable to extended shelf-life for additional 7 days in AS and 40 days more in RS compared to control (AS- 5 days, RS- 36 days) which is an intervention in farmers practice of packing of lime fruits in gunny bags.

**Key words:** Zeolite, composite film, acidity, PLW, silver, chlorine



### Studies on development and storage of kiwifruit based probiotic beverage

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#### ABSTRACT

Non-dairy probiotic beverages are gaining importance in functional food industry. Development of fruit juice probiotic drinks pose challenge due to sensory changes, and poor survival of probiotic strain in fruit- based matrices. The present study describes development of a kiwifruit based probiotic beverage with forty-five days shelf life during storage at 5 °C. Seven *Lactobacillus spp.* probiotic strains were screened for their suitability in making probiotic kiwifruit beverage, and all of them showed their ability to establish a population level  $1 \times 10^{12}$  to  $1 \times 10^{13}$  CFU/mL. Out of these strains, *Lactobacillus helveticus*, and *L. rhamnosus* ranked first and second respectively in sensory properties when evaluated using nine-point Hedonic scale. Further storage studies were conducted on kiwifruit beverage developed using *L. helveticus*. This beverage possessed a total sugar level of 15 gm/100mL and a population of  $12 \times 10^{12}$  CFU/mL in the within 24 hrs of inoculation. The acidity increased steadily during storage, which limited the shelf life to forty-five days. The acidity during storage ranged from 0.10 to 0.35 gm citric acid /100mL during storage. The population was maintained at  $1 \times 10^{11}$  CFU/mL by the end of forty-five storage. It was found that the beverage retained high antioxidant properties and vitamin C during storage. The probiotic cells from 45 days stored kiwi fruit beverage possessed high bile salt tolerance, indicating their capacity to survive in small intestine.

**Keywords:** Kiwifruit beverage, probiotic beverage, *Lactobacillus*, antioxidant capacity



**Influence of ozone treatment on carbohydrate content of wheat (*Triticum aestivum*) during bulk storage**

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**ABSTRACT**

The present study aimed to understand gaseous ozone exposure time and frequency of ozone cycle effect on carbohydrate content of wheat variety- GW 496 during storage, this experiment was conducted. The bulk storage of wheat grain in metal silo have major issue of insects and pests which is controlled by gaseous ozone treatment. Ozone gas is the acceptable and economically viable technique for treating grains during storage for its residue-free and environment-friendly nature. In this research article, the ozone gas treatment given to the wheat grain during bulk storage and evaluated its influence on wheat carbohydrate content. A pilot-scale ozone disinfestation system for wheat grains was developed. The two-factorial experimental design on the influence of the parameters of the technological process of ozone treatment on the physicochemical qualities of wheat seeds was carried out. Wheat grains were treated by gaseous ozone with various time durations (0 min, 30 min, 60 min, 90 min and 120 min) and at various frequency cycles (7, 14 and 21 days). Based on the experimental data, the effect of ozone treatment time and the ozone frequency cycle on the carbohydrate percentage of wheat grain was observed. There is negligible effect of normal doze of ozone on carbohydrate content of wheat grain during storage. On the other hand, excess ozone can also cause some negative effects on carbohydrate. This study provided new insights into how stored wheat grain responds to ozone treatment and highlighted the role of treatment time durations and frequency of cycle for wheat physicochemical property.

**Keywords:** Ozone, wheat, carbohydrate, bulk storage, ozone exposure time, ozone cycle



**Optimization of wall materials for spray-dried shrimp shell (*Metapenaeus dobsoni*) protein powder and its impact on instant soup mix**

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**ABSTRACT**

Shrimp is considered as one of the most export commodity from India. During the year 2020-21 around 5,90,275 MT was exported (MPEDA, 2021). As a result of high demand, around 55-66% shrimp waste is generated during processing. Currently shrimp shell waste are used for chitin production. However, protein recovery from shrimp shell is limited. The present study is focused to recover the protein from shrimp shell and to improve its stability using different wall materials such as Maltodextrin, Gum Arabic and Carboxymethyl cellulose on spray-drying process. Further its impact on instant soup mix was also evaluated. Shrimp shell protein was recovered by mechanical process and spray dried along with wall materials for developing instant soup mix. Response surface methodology was used to optimize the addition of wall materials. Shell protein incorporated soup mix was constituted and its physical, functional and organoleptic properties were evaluated. Based on the desirability function score, the optimum combination of wall materials was 28.53% Maltodextrin, 29.39% Gum Arabic, and 42.08% Carboxymethyl cellulose showed an improved viscosity ( $176.25 \pm 4.39$ ) Colour ( $L^* 64.27 \pm 0.10$ ) and overall sensory acceptability ( $8.53 \pm 0.24$ ). Results suggested that incorporation of shrimp shell protein powder could improve the nutritional, functional and sensory characteristics of develop instant soup mix.

**Keywords:** Shrimp shell protein, spray-drying, wall materials, soup mix, RSM

### Study on drying characteristics of *Simarouba glauca* leaves

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#### ABSTRACT

*Simarouba glauca* (Family: Simaroubaceae) leaves possesses analgesic, antibacterial, anticancer, antifungal, antimicrobial, antioxidant, antiviral, tonic and vermifuge properties. Solar and biomass drying in a closed system could be an alternative to overcome the disadvantages of conventional methods viz. sun, shade and tray drying. Hybrid drying using solar and biomass energy has advantages over efficiency, losses, quality control and time. *Simarouba glauca* leaves were dried with two different renewable energies i.e. solar, biomass and combination of both. Drying rate along with moisture content and properties of drying, ambient and exhaust air were recorded at definite time intervals for *Simarouba* leaves. Total drying time of 34 h, 18 h and 20 h and average drying air temperature of 34.8°C, 45.8°C and 43.1°C was observed for solar, biomass and hybrid drying, respectively. The reduction in time of hybrid drying was observed 41 % as compared to solar drying. About 33 % less fuel (Briquettes) requirement resulted for hybrid drying than biomass drying. Colour values were retained well with low-temperature drying. Total phenols and Total flavonoids were affected by drying air temperature, time of solar radiation exposure. Hybrid drying would be more effective than solar and biomass for drying of *Simarouba* leaves.

**Keywords:** *Simarouba glauca*, solar drying, biomass drying, hybrid drying, drying characteristic

#### Development of *simarouba glauca* leaf extract enriched edible food wraps

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#### ABSTRACT

Gelatin-polyphenol composite food wrap manufacturing is an environmentally friendly modern food packaging method. In a variety of food applications, edible food wrappers provide solutions to a wide range of needs and product challenges. It could lower environmental pollution and packaging waste. Gelatin and *Simarouba glauca* (paradise tree) leaf extract are used in edible food packaging to increase the antioxidant and antibacterial qualities of the food system. More research is being done on *Simarouba glauca* leaf as a cancer treatment. *Simarouba glauca* leaves were extracted in different ethanol concentrations for this study (80 percent ,60 percent ,40 percent ,20 percent). Extract's antibacterial qualities as determined by the disc diffusion method. Food-borne bacteria including *Pseudomonas*, *Shewanella*, *Aeromonas V.parahaemolyticus*, *V.cholerae*, and *S. aureus*, among others, exhibit a medium zone of inhibition. There is no zone of inhibition for yeast or mould. DPPH and ABTS assay used to investigate antioxidant activity. The sample includes 60% ethanol showing highest antioxidant activities. The main objective of this study is use of *Simarouba glauca* leaves extract in edible packaging films.

**Keywords :** *Simarouba glauca*, edible film, antimicrobial properties



**Information sources used by the farmers in agricultural inputs purchase: A case study of high hills temperate wet zone of Himachal Pradesh**

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**ABSTRACT**

Farmers' buying process is dependent on the information they receive from various sources. Moreover, to communicate adequately with the customers, suppliers of farm inputs should understand where farmers search for information related to agricultural inputs. The present study was conducted in the high hills temperate wet zone of Himachal Pradesh to understand the farmers' information sources for frequently and infrequently purchased agricultural inputs. Multi-stage random sampling technique was used for the selection of a sample size of 448 respondents. The result showed that the average number of information sources used by farmers for frequently purchased inputs was two to three; with the minimum being for seed (2.03) and the maximum being for agrochemicals (3.33). However, the number of sources used to obtain information for infrequently purchased inputs was significantly greater than frequently purchased inputs *i.e.* 3.20 for power sprayers and 4.09 for power tillers in the study area. The findings of the study also put forth that the number of information sources used for the purchase of seeds and agrochemicals significantly varied with their education level, farming experience, landholding and quality consciousness except for fertilizer where landholding was found insignificant. Whereas, farmers' decisions to purchase power sprayers using a variety of information sources differ significantly with their education level and farming experience. Fellow/progressive farmers (76.30%), were the main source on which farmers relied for information related to the seeds and fertilizers in the study area, whereas, in the case of agrochemicals they highly relied on private input dealers (72.00%). Further, private inputs dealers and state agriculture/horticulture departments were the main source of information related to the purchase of power sprayers and power tillers in the study area. Hence study suggested that providing information on varied inputs, best practices in farming, and timely access to the market helps farmers to make the right decisions about the production processes.

**Keywords:** Agri-input, buying behaviour, buying process



### **Recent trends in pectin extraction from apple pomace**

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#### **ABSTRACT**

Valorization of fruit processing by-products covers the most recent advances in the field of fruit processing following sustainability principles. Huge amount of apple pomace is being produced globally by the industries involved in manufacturing and consumption of apple-related products. However, apple pomace is a potential undervalued bio-resource for value addition of food products and natural health products. Pectin is one of the most important constituent of apple pomace. The most commonly used method for pectin production is the acid extraction method by using different acids viz., sulfuric, phosphoric, acetic or hydrochloric acid. Although acid extraction is economical, but can damage the pectin structure and cause environmental problems. For this reason, different extraction methods are investigated to isolate the pectin with higher yield at low temperatures and in short time with less or no acidic solvent use. Enzymatic extraction, ultrasound-assisted extraction, sub-critical water extraction, microwave-assisted extraction and radio frequency assisted extraction are the recently used ecofriendly techniques which are being used to extract pectin from apple pomace. These techniques offer several advantages, including shorter extraction time, increased yield, reduction or suppression of solvents, and minimization of the environmental impact. Apple pomace derived pectin has diverse food applications such as that of a gelling agent, stabilizer, fat replacer, etc. In the nutraceuticals arena, apple pectin exhibits a number of functions, from decreasing blood fat to combating various types of cancers and also acts as a delivery vehicle for pro-biotics and possesses potential pre-biotic nature which can enable its phenomenal utilization in promoting health.

**Keywords:** Pectin, nutraceuticals, pro-biotics, prebiotics, ecofriendly techniques

## Post-harvest technology and food processing

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### ABSTRACT

India has huge diversity in its agroclimatic conditions, which enables the growth and cultivation of wide range of fruit and vegetables. While, with the advancements in the technology, the area and production under fruits and vegetables has increased manifold but still there is a considerable gap between production and net availability due to heavy post-harvest losses. Postharvest technology and food processing have been identified to play a key role in maintaining as well as extending the shelf-life of perishables agricultural commodities and thereby reduces the food losses. It also helps to avoid the glut in the market hence ensures good return to the farmers. Globally, in the production of fruits and vegetables India ranks second next to China but huge number of agricultural products nearly around 30 to 40 percentage is lost annually which is sometimes as high as 50% due to poor post-harvest handling and improper infrastructure. Food processing is not new, in fact from the beginning of the human civilization, we have processed foods in order to improve its digestibility or palatability and cooking has been recognized as the earliest form of food processing. In spite of the huge production, Indian food industry is still incapable to fulfill the basic requirements of the customers. The importance of post-harvest handling, processing and value addition lies in the fact that the processing rate is only 2 to 3% of the total production that is quite less as compared to other dominant players of the world.

**Keywords:** Food processing, post-harvest handling, shelf life, post-harvest losses, agroclimatic zones

### Physicochemical characteristics, antioxidant properties and glycemic index of different types of basmati rice

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### ABSTRACT

Basmati, the long grain rice variety with minimum kernel dimension, is known for its pleasant aroma, digestibility and palatability. This study evaluates the physicochemical characteristics, antioxidant properties and glycemic index (GI) of three rice samples (basmati rice, aged basmati rice and brown basmati rice). The aged basmati rice was subjected to aging process (~1year). The brown basmati rice had the longest kernel length (0.8mm). All samples contained carbohydrate content more than 75%. The antioxidant properties (ABTS free radical scavenging activity and FRAP) were high for aged basmati rice (84.5±0.9 % and 0.7±0.01 mg ACE/g, respectively). Nevertheless, the DPPH assay showed white basmati rice has higher radical scavenging activity (56.2±0.5 %). The white basmati rice has low GI (53) it could be correlated negatively to the high amylose content (27.3±0.4%). The results indicate that white basmati rice with its low glycemic effect is suitable for diabetic population; however, the aged basmati possess high antioxidant properties, which can be harnessed to develop functional foods with health benefits.

**Keywords:** Basmati rice, glycemic index, antioxidant, DPPH

## UV irradiated mushrooms as a source of Vitamin D<sub>2</sub>

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### ABSTRACT

Vitamin D also called as calciferol, which is a fat-soluble vitamin, plays an important role in several human metabolic processes such as calcium and phosphorus metabolism, and skeletal and neuromuscular homeostasis. Nowadays studies on vitamin D have received considerable attention over the years supported by the increasing number of reports of vitamin D deficiency. Symptoms of vitamin D deficiency includes rickets and osteomalacia arising from poor calcium and phosphorus mineralization; but other diseases such as cardiovascular disease, cancer, hypertension, stroke, diabetes rheumatoid arthritis, inflammatory bowel disease, liver diseases, and mental illness have been also reported to be associated. The word mushroom is derived from Latin and Greek words “*Fungus*” and “*Mykes*”. Mushroom is a fruiting body of micro-organisms called fungi. They lack chlorophyll, absorbs nutrients from soil and decaying matter for their growth. Mushrooms are valuable nutritional foods with recognized bioactive properties, such as, antioxidant (ergothionine), bone growth and mineralization (Vitamin D), anti-cancer (lectins) and immunity boosting effect. The fruiting body of mushrooms, either in their fresh or processed forms, is rich in sterols, mainly ergosterol, form that can be converted into vitamin D<sub>2</sub> by UV-radiation. The amount of vitamin D varies among mushroom species, and also within the same species. Among them, mushrooms belonging to the genera *Agaricus*, *Lentula* and *Pleurotus* have been reported to contain interesting amounts of vitamin D after exposure to UV. However, there is still gap considering the knowledge of the most appropriate irradiation procedures (dose, intensity, distance between source and sample, exposure time) in order to maximize the content of vitamin D<sub>2</sub> in the mushrooms. This strategy will enable vitamin D<sub>2</sub>- enhanced mushrooms to be commercially available at affordable costs.

**Keywords:** Vitamin D<sub>2</sub> (ergocalciferol), mushroom, ultraviolet irradiation, ergosterol

## Implications for Agriculture waste management

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### ABSTRACT

India is an agricultural-based country. Farmers are the backbone of our nation. Agriculture wastes are produced from different sources including crop residues, agricultural industries, livestock, and aquaculture. In the early days farmers used natural resources such as waste after harvest, weeds, cow dung etc. Later they started using chemical fertilizers due to their rapid growth and good yield. Although they get good results in the early days, after 10-15 years of continuous use of agricultural land becomes barren, crops are declining to withstand environmental conditions. Disposal of agricultural waste they begin to burn and digest an aerobically in the land itself, leading to air pollution, emissions of greenhouse gases. The use of chemicals as fertilizers is not only expensive but also continues to accumulate in soil, plants, surpassing bio-magnification leading to health problems. Chemical fertilizers are not feasible from an economic, health, environmental point of view and in this case Indian farmers are committing suicide, instead they can use traditional technology and develop agricultural land. Because of this it was a lesson is done to control agricultural waste through vermi composting. However, this waste can be a major threat to human health from pollution and its handling can result in significant economic losses. Unfortunately, in many developing countries where large quantities of waste are produced, they are not properly managed because little is known about the potential dangers and benefits if properly managed.

**Keywords:** Agricultural waste, chemical fertilizer, composting, environmental management

### Use of post-harvest technology in adding value to flower crops

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### ABSTRACT

Value addition is a process in which economic value is added to a product by means of processing, packaging, drying etc. It mostly refers to post harvest processes that increase the value of raw commodities. In the modern era, flowers have become an integral part of human life. Postharvest products of floriculture have become a part of profitable industry. India is a religious country so in the peak festival season there is a great demand of flowers and farmers get good price. Also, there is an increasing demand all over the world for the decoration of living and working places with eco-friendly things like fresh foliage and flowers. Flowers are perishable and delicate in nature and cannot retain their beauty and fresh look for a long time in spite of using best chemicals for enhancing vase life. Moreover, there is a non-availability of fresh flowers and foliage all-round the year. In this context post-harvest technology offer a wide range of products with better qualities like novelty, longevity, aesthetic properties, flexibility and year-round availability. It can reduce the postharvest losses of flowers. Different kind of value added products are dry flowers, essential oils, flower arrangements, paper and candle making etc.

**Keywords:** Value addition, flower arrangement, dry flowers, packaging





## **Amelioration of pomegranate syrup and RTS with the fusion of chia seeds and sensorial attributes**

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### **ABSTRACT**

Pomegranate is a commercially/economically extensive fruit crop grown all around the world. Pomegranate juice is delectable one which is immensely invigorating and recommended for patients suffering from gastrointestinal inconvenience due to its medicinal value. Chia seeds are known as super food as it contains high potent of essential fatty acids, dietary fibers, vitamins and antioxidants. From the health point of view, omega-3 fatty acids are of thoughtfulness because they are influential element in the membranes of brain cells, cardiomyocytes and the rods and cones of the retina. Enrichment of the product not solely boost the attribute and nutrition but also leads to the emergence of new product advancement. In this investigate, nutritious pomegranate juice and immersed chia seeds were exploit at various combinations (100 : 0, 90 :10, 85 : 15 and 80 : 20) using both sucrose and fructose for preparation of pomegranate syrup and RTS by incorporation of chia seeds. Among the treatments, T<sub>5</sub> (100 per cent Pomegranate juice + Fructose 45° Brix : Control II) obtained maximum score for colour and appearance (8.37). The highest organoleptic score for taste (7.80) was in T<sub>7</sub> (85% Pomegranate juice + Fructose 45° Brix + 15% chia seeds), flavour (7.93) and overall acceptability (7.87) was maximum in T<sub>6</sub> (90% Pomegranate juice + Fructose 45° Brix + 10 % chia seeds).

**Keywords:** Pomegranate juice, chia seeds, fructose, sucrose, sensory characteristics

**Groundnut shell: Waste to beneficial products a review**  
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**ABSTRACT**

Groundnut shells accounts for approximately 20% of dried peanut pod by weight, as a result there is significant amount of shell residual left after groundnut processing, which is rich in many functional compounds and composed of hemicelluloses, cellulose and lignin. However, a large amount residue is turned out to be at agriculture field or dumping pit as waste. The present review highlights the technologies and processes used for utilization of the groundnut shell by products like feedstock for bio-ethanol production, for waste water treatment, development of plastic and also used as insulation board, in metal casting and a medium for pesticides as well as activated carbon. In order to make rational use of this valuable resource and protect the environment, the present study aimed to comprehensive utilization of the groundnut shell. A bio-nano composite film was prepared from groundnut shell as a result to convert petroleum based synthetic products into ecofriendly material, especially in food industries. Biodegradable packaging material has major advantages like increasing shelf life of product, increasing the nutrient value of food, preserving its quality and preventing microbial contamination. Several other features including low cost, easy availability, functional attributes, good mechanical and physical properties, opacity and resistance to water concluded that biopolymer can be used as a versatile material for food packaging application. It can lead to development of better technologies at industrial level for better use of groundnut shell.

**Keywords:** Groundnut shell, feedstock, bio-ethanol, paper, plastic, packaging material

**Moisture dependent physical properties of psyllium seeds for different varieties**Nirav U. Joshi<sup>1</sup> and Mukesh N. Dabhi<sup>2</sup><sup>1,2</sup>*Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh, Gujarat-362001***ABSTRACT**

The three varieties of psyllium seeds (VI-1, GI-3 and HI-5) were analysed for the effect of varying moisture content (6%, 12% and 18% w.b.) on the various physical properties. The physical properties are useful for the designing the cleaning, grading, conveying and size reduction equipment and storage structures. The dimensional properties like size and sphericity of psyllium seeds were ranged from 1.33 to 1.47 mm and 0.513 to 0.533. The gravimetric properties like, bulk density (550.07 to 585.54 kg/m<sup>3</sup>), true density (1206.78 to 1316.84 kg/m<sup>3</sup>) and porosity (54.06 to 56.75) were reduced as a function of moisture content except the thousand seed weight (1.52 to 1.82 g) which was found to be increased as the moisture increased. The frictional properties like static angle of repose (28.07 to 35.99°), coefficient of friction of glass (0.42 to 0.51), plywood (0.47 to 0.52) and galvanized iron (0.48 to 0.55) was also increased. The terminal velocity was also increased from 2.57 to 4.17 m/s as the moisture content was increased from 6% (w.b.) to 18% (w.b.). The individual effect of moisture content was found to be extremely significant ( $p < 0.001$ ) on all physical properties apart from non-significant effect on sphericity and porosity ( $p > 0.05$ ). Similarly, individual effect of variety was extremely significant on all physical properties ( $p < 0.001$ ). However, the interaction effect of moisture content and variety was only significant on the coefficient of static friction and terminal velocity.

**Keywords:** Psyllium, seeds, physical properties, moisture content, variety Isabgol, Isabgul

**Development of protein and mineral enriched gluten free cookies from quinoa and millet flour blends to combat malnutrition**Monika Mahajan<sup>1</sup>, Prabhjot Singla<sup>2</sup> and Sucheta Sharma<sup>2</sup><sup>1</sup>*Punjab Agricultural University-Regional Research Station, Bathinda-151005*<sup>2</sup>*Department of Biochemistry, Punjab Agricultural University, Ludhiana-141004***ABSTRACT**

Most of the gluten free products available in the market for celiac disease patients are lacked in essential nutrients. So, it is important to increase the nutritional potential of such products by supplementation with nutritive enriched flours. Quinoa is popularized as 'Superfood' due to its nutrient density. It is gluten free and is a source of micronutrients and high-quality protein with all essential amino acids. Pearl millet and foxtail millet have a great potential as food because of higher amount of dietary fiber, essential amino acids and minerals. Present study was undertaken for development of gluten free cookies by incorporation of foxtail millet, pearl millet, Quinoa and rice flour in different proportions. The quinoa flour was used to substitute rice in cookie dough at 10%, 20%, 30%, 40% and 50% by keeping pearl and foxtail millet flour percentage constant. Cookies formulated were evaluated for its physiochemical, nutritional and sensory aspects. Significant ( $p < 0.05$ ) increase in protein, minerals (K, Ca, P, Mg) and fiber was observed with higher quinoa supplementation. Organoleptic evaluation has indicated that quinoa supplementation up to 20% was acceptable by consumers. Therefore, supplementation of quinoa with rice and millets flour could be a decent alternative for making healthy gluten-free cookies.

**Keywords:** Quinoa, foxtail millet, pearl millet, gluten, cookies, minerals



## Effect of different moisture content on the physical characteristics of dill seeds

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### ABSTRACT

Physical and chemical analysis of dill seed (*Anethum graveolens* L.) varies with variety, the region where it is grown and the stage of harvest. Determination of physical properties of seeds and agricultural products is important in the design of harvesting, handling, and processing equipment. Physical properties of dill seeds were determined at three levels of moisture content. All dimensions of seeds increased with increasing moisture content from 8.26% to 22.93%. The geometric mean diameter along with the coefficient of friction, angle of repose, volume and terminal velocity increased with the different level of moisture content. Bulk density, true density and porosity of the seeds exhibited a declining trend with an increase in moisture content while sphericity and surface area remained unchanged. The isolation of essential oil was conducted by hydro distillation with a yield of 1.42% per 50gm of sample. Proximate analysis showed that dill seeds are good source of protein and dietary fibre.

**Keywords:** Dill seeds, different moisture content, physical properties

## Effects of process parameters on rice based extruded snack food

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### ABSTRACT

Extrusion cooking is a method of transforming raw components into ready-to-eat foods using a high-temperature, short-time shear process. A flour mixture was extruded using a twin-screw extruder. The impact of three independent variables with five varied die temperatures (90, 102, 120, 138, and 150 °C), screw speeds (200, 230, 275, 320, and 350 rpm), and feed moisture content (12, 14, 18, 22, and 24 percent w.b.) on various attributes of extruded items were explored. Extrusion process parameters that were discovered to be the best were 137.83 °C die temperature, 230.40 rpm screw speed and 14.43 percent (w.b) feed moisture content. According to the analysis, the bulk density was 89.37 kg/m<sup>3</sup>, the expansion ratio was 3.16, the water solubility index was 2.77 percent, the water absorption index was 6.34 g/g, the actual protein was 2.49 percent, and the calcium content was 52 mg/100g. Finally, the improved product had a true protein increase of 23.27 percent and a calcium increase of 18.18 percent when compared to the control sample.

**Keywords:** extrusion cooking, nutrient, die temperature, feed moisture, rice, snack food

**Standardization of recipe for noni and kokum blended RTS beverage**

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**ABSTRACT**

Standardization of blending of noni extract, kokum extract along with black pepper and cumin oleoresin for the preparation of blended RTD. The experiment comprised of eight treatments with three replications organized in manner of CRD. The combinations of treatments were arranged in two sets. Set 1 consists of 12.5 per cent and set 2 consists of 15 per cent overall juice content in RTD. First set have treatment combinations T<sub>1</sub> (100% NE), T<sub>2</sub> (84 %NE: 16% KE), T<sub>3</sub> (68 % NE: 32% KE), T<sub>4</sub> (52 % NE: 48% KE) and treatments of second set consists of T<sub>5</sub> (NE 100 %), T<sub>6</sub> (80 % NE: 20 % KE), T<sub>7</sub> (70 % NE: 30% KE) and T<sub>8</sub> (60 % NE: 40% KE). Each 200 ml of RTD contained 20 µl cumin and 13 µl black pepper oleoresin and blended RTD filled in 200 ml sterilized glass bottles. Among all the treatment combinations, RTD prepared by using combinations of 52 % NE and 48% KE showed the highest sensory score for overall acceptability (8.01 score out of 9 point hedonic scale) by a sensory panel with acidity (0.33%), pH (2.83), better instrumental colour values (*L\**, *a\** and *b\**) and also retain better medicinal properties.

**Keywords:** Noni extract, kokum extract, ready to drink, blending ratio

**An economics of harvesting, processing and marketing of *Phyllanthus emblica* in Mizoram: A case study of Champhai Serchhip and Aizawl District**

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**ABSTRACT**

The fruit Amla has large potential in Mizoram and has been used in value added products on a small and rudimentary scale. In this present investigation a survey was carried out in the state of Mizoram, to study the economic important of Aonla in the state. Primary data were collected from Amla collectors, processing industries and vendors through questionnaires. From the survey, 61% of the respondent were dependent on agriculture. The harvesting season starts from September to early March. 37.5 % of the respondent sold their Amla to the commission agents and 62.5 % of the respondents sold their Amla to the processing industries. The highest quantity of Amla was processed by MF Amla processing industry at 500 kg/day. The processing industries of Amla produces Amla juice, candy, powder, pickle, shampoo. The annual income of the industry range from 1 to 3 lakh. From this analyses Amla processing is a great income generating occupation for a small scale industry. Problem of transportation, lack of market information, uncertainties in market price was observed as main constraint of the study.

**Keywords:** Aonla, primary data, market chain, transportation

## **Postharvest technology: Agri value and supply chain for sustainable production**

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### **ABSTRACT**

Post harvest technology is very important branch of agriculture that deals with the all operations after harvesting for its protection, marketing, packaging, storage, processing and utilization to meet the food and nutritional requirements of the people in relation to their needs. It helps in increasing the market and trade as it decreases the losses of horticulture produces. The main aspects of this technology is to maintain the quality, protect food safety and reduce losses. Post harvest technology is an important need for today's increasing population as due to this technology we can ensure the availability of food for all for poverty alleviation. For this we have to minimize the losses by avoiding the entry of insects and rodents, maintaining the environmental conditions to manage the agricultural waste. By this technology the marketability rate increases which helps in trading because the product quality is good, its shelf life is more and the quality can attract the traders to buy the product and supply chain increases which will contribute to improved economic development, providing food security and fare price and help in achieving the sustainable production. This technology can help us in storage of products for longer periods of time. Technology that can applied like lowering the temperature to keep the products fresh can reduce the rate of wastage. Post harvest technology is very important as it gives the value to the agricultural products by maintaining its quality and good quality can increase the profits and increased in profits can increase the interest in the farmers soul as agriculture is the fundamental part of their life. This transformation is very important to achieving many aspects as our country is dependent on agricultural sector about 70 percent. Agriculture waste management can be done by recycle, reduce and make it usable for different purposes. The technology is very important for today as due to increasing population and their demand and post-harvest technology is more important as the food is the basic need for all increasing population day by day.

**Keywords:** Post harvest technology, supply chain for sustainable production, market and trade, agri-value agriculture waste management, food storage



## Nutritional evaluation of functional fermented non-dairy beverage from roselles calyces

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### ABSTRACT

The roselle (*Hibiscus sabdariffa* L.), native to Africa and South Asia, belongs to the Malvaceae family. The roselle's calyx possesses various health benefits due to its antioxidant and nutraceutical properties. To enhance the efficacy of the extract, the present study was taken up to assess the fermentation of roselle's calyces extract for 12 days by *Saccharomyces boulardii*. The effect of fermentation on the physicochemical, alcohol content, total sugar, reducing sugar, non-reducing sugar, total antioxidant activity, viability count and sensory characteristics were assessed during different fermentation time intervals. Results showed that after 12 days of incubation, there was a tolerance of acidic pH at 2.17, total soluble solids with 12°Brix and titratable acidity with 1.15 per cent citric acid content and change in total colour value was also observed. The alcohol content was increased by 0.81 per cent. The total sugar and non-reducing sugar were decreased whereas reducing sugar was increased with the increase in incubation time. The total antioxidant activity was increased at 8 days of incubation (50.76 % RSA) and there was slight increased from

106 CFU/ml after 12 days of incubation. Based on the sensory evaluation,

considerable acceptance was observed. Henceforth, roselle extract can be novel functional fermented beverages.

**Keywords:** Roselle, *S. boulardii*, antioxidant activity, viability

## Effect of temperature and period on the functional and bioactive compounds of pearl millet (*Pennisetum glaucum* L.) grains during storage

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### ABSTRACT

This work analyzed the impact of storage period and temperature (5, 25, and 45 °C) on the functional and bio-active compounds of pearl millet grains stored for 120 days. The result shows that the bioactive compounds of pearl millet grains had a significant ( $p = 0.05$ ) effect on the storage period and temperature. The total phenolics, flavonoids, and condensed tannin contents significantly declined during storage at all temperatures. Also, the grains stored at 45 °C shows more reduction in the bio-active compounds as compared to the grains stored at 5 °C, respectively. FTIR spectroscopy is one of the most important and advanced tools used to find out the functional groups present in the samples. Protein absorption bands including amide I and amide II bands mainly located between 1743 and 1637  $\text{cm}^{-1}$  were overlapped with other absorption bands within this region. Peroxides, C-O-O- stretch was more visible at a wavenumber of 844  $\text{cm}^{-1}$  on the 60<sup>th</sup> day of storage compared to other storage periods. The wavenumber at 1704.24  $\text{cm}^{-1}$  confirms the presence of phenolic groups in all the samples during the storage of grains due to the carboxyl C-O stretching. FTIR analysis of pearl millet grains show various functional groups on the 0<sup>th</sup> to 120<sup>th</sup> day of storage and as compared to the 0<sup>th</sup> and 120<sup>th</sup> day, pearl millet grains on the 60<sup>th</sup> day shows variations in functional groups with differences in their percentage transmittance.

**Keywords:** Storage, pearl millet, functional, bioactive compounds, FTIR, wave number





## Effect of pretreatments on shelf life of jackfruit bulbs

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### ABSTRACT

The present study focused on “effect of pretreatments on shelf life of jackfruit bulbs” was conducted during 2017-2019 at college of horticulture, Bagalkot. A known quantity of bulbs was pre-treated with nine different concentrations of calcium chloride (CaCl<sub>2</sub>), ascorbic acid (AA) and potassium metabisulphite (KMS). Different treatment combinations were T<sub>1</sub> (1% calcium chloride), T<sub>2</sub> (1.5% calcium chloride), T<sub>3</sub> (100 ppm potassium metabisulphite), T<sub>4</sub> (1% calcium chloride+ 0.5% ascorbic acid), T<sub>5</sub> (1.5% calcium chloride+ 0.5% ascorbic acid), T<sub>6</sub> (1% calcium chloride+100 ppm potassium metabisulphite), T<sub>7</sub> (1.5% calcium chloride+ 100 PPM potassium metabisulphite), T<sub>8</sub> (1% calcium chloride+ 0.5% ascorbic acid+100 ppm potassium metabisulphite), T<sub>9</sub> (1.5% calcium chloride+0.5% ascorbic acid+100 PPM potassium metabisulphite). Treated bulbs were packed in standup pouches and stored at 4°C. In the pretreated bulbs, T<sub>9</sub> (1.5% CaCl<sub>2</sub>+0.5% AA +100 PPM KMS) recorded lowest total soluble solids (29.16°Brix), maximum titratable acidity (0.442%), maximum L\* value (43.03), maximum b\* value (41.81), maximum texture (31.78 N), lowest physiological loss of weight (3.77 %), minimum microbial count of yeast and bacteria (2.95 and 2.84 log cfu/g) and maximum score for overall acceptability (7.85). Among treatments, T<sub>9</sub> was found with highest shelf life of 7.9 days. Therefore, among different treatments, it is found that treatment (T<sub>9</sub>) with 1.5% CaCl<sub>2</sub>+0.5% AA +100 ppm KMS revealed extended shelf life upto 7.9 days.

**Keywords:** Jackfruit bulbs, minimal processing, vitamin C, KMS, calcium chloride

**Shiitake (*Lentinula edodes*) mushrooms: An unexplored source of functional polysaccharides with anti-diabetic potential**

Shuvarghya Chakraborty<sup>1</sup>, Sanjeev Kumar<sup>1</sup>, Archana Singh<sup>1</sup>, Susheel Sharma<sup>2</sup>, Anil Dahuja<sup>1</sup> and Veda Krishnan<sup>1</sup>

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**ABSTRACT**

Mushrooms are a great example of “don’t judge a book by its cover”, as they are both nutritional and nutraceutical. Many more medicinal mushrooms like Shiitake (*Lentinula edodes*) is a promising agribusiness trend, with a growing estimate of 4.7 billion USD market by 2030. Among the valuable matrix components like ergosterol, Shiitake is also rich in functional polysaccharides like  $\beta$ -glucan, which has well-known anti-diabetic potential. Among the types of  $\beta$ -glucan, lentinan which has an approximate molecular mass of 500,000 D and triple-helical structure is of great commercial value being a FDA approved anti-tumor drug. In our study, we are attempting to extract functional polysaccharides (rich in lentinan) from the fruiting bodies of Shiitake using different methods (hot water extraction, solvent extraction and hybrid extractions) to optimize a cost-effective scale up method. Further aimed to purify functional polysaccharide-rich fractions using Sephadex LH20 and characterize using FTIR, XRD techniques. As most methods reported till date failed to differentiate between bio-active fraction and non-bio-active fractions of lentinan, a comprehensive characterization using spectral as well as other biophysical methods been planned to get a fine-tuned “molecular fingerprint” of this glucan. Apart from anti-tumor activity, as other bio-active potential of lentinan (namely anti-diabetic) are poorly ventured. Hence the purified lentinan-rich fraction will be utilized in an in-depth manner to unravel the anti-hyperglycemic activity by *in vitro* assays (carbolytic enzyme inhibition, starch hydrolyzation kinetics, glucose uptake on hepatocytes, glucose adsorption and retardation assays). This study not only aims to value add Shiitake mushrooms but also aim to understand as well as fill the existing gap in lentinan biochemistry. Thus, more functional polysaccharide-based low glycemic foods can be developed in near future.

**Keywords:** Mushrooms, value-addition, functional polysaccharides, lentinan, anti-diabetic potential.

**Value addition in strawberry (*Fragaria x ananassa* Duch.) through active packaging system**Swarup Anand Dutta<sup>1</sup> and Pritam Coomar Baruah<sup>2</sup>*Department of Horticulture, Assam Agricultural University, Jorhat-785013***ABSTRACT**

A lab experiment was conducted in Laboratory, Department of Horticulture, AAU, Jorhat during 2020-21 with a view to add value to the strawberry cultivation through enhancing the shelf life of strawberry (*Fragaria x ananassa* Duch.) by various treatments under active packaging system. Two packaging systems, plastic packaging (P<sub>1</sub>) and CFB packaging (P<sub>2</sub>) were used. The experiment was laid out in Factorial Randomized Block Design (RBD) with eight treatments viz. T<sub>1</sub> (Oxygen absorber + Chlorine dioxide (5ppm), T<sub>2</sub> (T<sub>1</sub> + Moisture Absorber), T<sub>3</sub> (Ethylene absorber + Chlorine dioxide (5ppm), T<sub>4</sub> (Ethylene absorber + Moisture absorber + ClO<sub>2</sub> (5ppm), T<sub>5</sub> (Chitosan 1% + Lemon essential oil), T<sub>6</sub> (Chitosan 1% + Potassium sorbate (0.3%), T<sub>7</sub> (Hexanol (as vapour), T<sub>0</sub> (Control (Without treatment)) with three replications. The results revealed that both the packaging materials and the treatments had a significant impact in boosting up the shelf life of strawberry along with the quality parameters like TSS, Anthocyanin and Total sugar. T<sub>4</sub> (Ethylene absorber + Moisture absorber + chlorine dioxide) performed best in boosting up the shelf life and quality of strawberry up to 8 days of packaging. CFB packaging performed better than plastic packaging in the entire experiment.

**Keywords:** Active packaging, value addition, shelf life**Standardisation of dehydration process and nutritional analysis of wild ginger (*Zingiber zerumbet*)**

Sinchana S. Shetty., M. L Revanna and Vijayalaxmi K.G

*Department of Food Science and Nutrition, University of Agricultural sciences, GKVK, Bangalore, 560065***ABSTRACT**

Wild ginger (*Zingiber zerumbet*) is a aromatic and tuberose plant belonging to *Zingiberaceae* family. In India it is found in Western Ghats possess unique aroma, colour (bright yellow) and resemble ginger in morphology. It is potential source of antioxidants and has plethora of medicinal properties. In the present study standardisation of the process of dehydration and proximate analysis of wild ginger was done. Wild ginger slices were pretreated with KMS, sugar, and citric acid at concentration 0.5, 1, 1.5 *per cent* and dried in hot air oven at temperature 55°C, 60°C, 65°C. In KMS (0.5%) at 55°C (hot air oven) colour retention was observed. The Spectrophotometric reading of L\* and b\* was 82.70, 36.62 respectively indicates more yellow in colour. a\* value is -6.01 indicates less red colour. Proximate analysis revealed that the rhizome have moisture (81%), appreciable amount of carbohydrate (14%), protein (1.44g), crude fibre (2.36g), and negligible amount of fat (0.80g). The mineral analysis revealed that the rhizomes to be potential source of potassium (2.01%), sodium (0.24%), calcium (2.12%), magnesium (0.55%), iron (74.91 ppm) and Zinc (26.75 ppm). On proper attention and greater diffusion of the crop can make it a easy alternative for conventional ginger (*Zingiber officinale*).

**Keywords:** Dehydration, colour, proximate analysis, *wild ginger*

## Effect of pre-treatments on drying and quality characteristics of infrared dried apple slices

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### ABSTRACT

Present study investigated the influence of natural antibrowning agents on the infrared drying characteristics and biochemical and physical properties of apple slices. Salt, turmeric and honey were used as antibrowning agents and treated slices were dried at 550 W. Rate of drying decreased with increasing treatment time and concentrations of anti-browning agents. Salt pre-treated slices took less time (65 min) followed by turmeric, honey and control. The control slices showed greater increase in browning index (BI) and greater decrease in lightness ( $L^*$ ) than pre-treated dried samples. Pre-treatments were effective in the controlling the enzymatic browning along with maintaining the quality properties of dried apple slices. The browning index found smaller in honey treated samples followed by salt and turmeric. The rehydration ratio of pre-treated samples range between 3.21 to 4.12 which is more than control (2.79). All pre-treatments were effective in retaining phenols, flavonoids, ascorbic acid and antioxidant activity in dried apple. The honey pre-treated dried apple slices had higher phenol (690.53 mg GAE/g), flavonoid (119.4 mg CAE/g), ascorbic acid content (14.85 mg/100g), DPPH % inhibition (79.35%) and antioxidant activity (8.2246 mg Trolox/g). Study concluded that the tested natural anti-browning agents are effective in controlling browning of apples during drying and in maintaining biochemical components.

**Keywords:** Infrared drying, Anti-browning agents, drying characteristics, biochemical properties, physical properties



**Impact of antioxidant and antimicrobial biodegradable based film on shelf-life extension of *chhana podo***

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**ABSTRACT**

*Channa podo* is a baked Channa-based Indian delicacy which is very popular in the eastern part of India, made from chhana, sugar, refined wheat flour with nuts, cloves and cardamoms are often used as garnishes. Despite its high demand, it is difficult to transport and market due to its perishability. The shelf life is only 3 days in ambient conditions and upto 21days in refrigerated condition. The recent trend is towards the use biodegradable films application in food and dairy industries to avoid the environmental problems caused by the synthetic polymers. Keeping in view of the above facts the present study was focussed on development of polycaprolactone and Tapioca starch based biodegradable film with the incorporation of gallic acid (antioxidant) and grapefruit seed extract (antimicrobial) which has been wrapped on *chhana podo* for shelf-life extension. The antioxidant like gallic acid released from the film at regular intervals and recorded radical scavenging activity (RSA%) upto 95% during its storage. The viable microbial count was significantly lower ( $p < 0.05$ ) in active biodegradable wrapped sample compared to the conventional packaging during storage period. From the research findings, it was concluded that the product wrapped in active biodegradable film showed a well acceptability up to 30 days in refrigerated conditions as compared to conventional packaging.

**Keywords:** Chhana podo, biodegradable films, polycaprolactone, tapioca starch, gallic acid, grapefruit seed extract

## **A comparative study of chemical and mineral constituents of Kolakhar produced from parts of different banana cultivars**

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### **ABSTRACT**

Kolakhar, a popular food additive in Assam, is basically an alkaline extract made from the ashes of burnt dried banana plant parts. A chemical and spectroscopic estimation of Kolakhar produced from peels and rhizomes of four banana cultivars with four different genomic groups *viz.* AAA (Amritsagar), AAB (Chenichampa), ABB (Kachkal) and BB (Bhimkal) was carried out to estimate the chemical and mineral constituents and to identify the cultivar suitable for preparation of Kolakhar. Chemical and mineral constituents of dried banana samples prepared from peels and rhizomes of the cultivars were also estimated during the course of study to identify the elements responsible for alkalinity in Kolakhar. The results of the present findings revealed that the four alkaline elements, *i.e.* calcium, carbonate, potassium and sodium contribute to the basic or alkalinity (higher pH) in Kolakhar. The concentrations of the alkali elements recorded in order of potassium>carbonate>sodium>calcium. Suitability of the banana cultivars for Kolakhar preparation decreased with increase in the *Musa acuminata* (A) genomic character and with the increase of *Musa balbisiana* strains in banana cultivars, pH increases in Kolakhar. Kolakhar prepared from Bhimkal (BB) was found to be the best in quality among four selected cultivars based on mineral contents and pH.

**Keywords:** Kolakhar, cultivars, alkalinity, genomic group

## **Thermal modification of *Acrocarpus fraxinifolius* Wight & Arn. (Pink cedar) wood: a sustainable and eco-friendly approach**

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### **ABSTRACT**

In a world of increasing environmental awareness, the development of sustainable processes that could substitute for traditional ones to improve the durability and end use applications of wood is of high interest. Although Pink cedar wood is a versatile and renewable material but dimensional instability, but lower durability and susceptibility to insect and fungal attacks are some limitations in its applications. Thus, to enhance the performance and service life of wood, thermal modification of wood samples of *Acrocarpus fraxinifolius* Wight & Arn. acquired from the twenty nine years old tree was carried out at 120, 160 and 200°C for three durations (2, 4 and 6 hours) to determine physico-chemical and mechanical properties. The results showed specific gravity of the wood increased with rise in temperature while, the maximum moisture content and shrinkage and swelling showed inverse relation with temperature. 120°C was considered best for maximum strength. Dimensional stability was improved and no significant effect on mechanical properties was shown. Ultimately, the physical, mechanical and chemical properties of wood were improved and wood became more durable, dimensionally stable and resistant to insect and fungal attacks without causing any harm to the environment.

**Keywords:** Thermal modification, Sustainability, Dimensional stability

**Role of ICAR-KVK, Ballari in handholding fig growers and SHGs through entrepreneurship development programme and linking them with PMFME's ODOP scheme**

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**ABSTRACT**

PMFME'S One District One Product project of Government of India, identifies unique food crop of district keeping in perspective the focus of the scheme on perishables. Support for these agri-products would be given for their processing along with efforts to reduce wastage, proper assaying, storage and marketing as well as to increase the income. Fig is ODOP crop identified for Ballari district of Kalyana Karnataka region and the district is known for growing delicious fig variety namely 'Ballari fig'. An effort to build agri-entrepreneurship through value addition of figs was taken up during 2019-20 by ICAR-KVK, Ballari under its Entrepreneurship Development Programme (EDP) before the launch of ODOP Scheme. The efforts resulted in setting up of 12 processing units in a village named Shrinivas nagara camp, Kurugod Taluk, Ballari district where fig is grown extensively. During 2019-20 COVID-19 lockdown the market was shut and figs were left un-harvested in the orchard. At this juncture KVK trained fig growers to convert their fruits into value added product-fig rolls under EDP programme. Further the success of these units drew attention of the line departments and district administration. This activity of KVK Ballari gained further momentum when fig got selected as ODOP crop for Ballari district. This paved way to link many government institutes and banks namely Department of Women and Child Development, NABARD, Zilla Panchayat's NRLM etc to these budding entrepreneurs to stand firmly and widen their production. At present four such enterprises have already been upgraded and have mechanised their value addition units under ODOP scheme. Other units are under the process to get benefit from the scheme. Cost to Benefit ratio in fig value addition is 1:2. Each SHG woman get on an average net profit of Rs.25000 to Rs.30000 by producing 200 kg of fig rolls each month. The over ripened fruits and the fruits with open heads were not preferred by the consumers in the market due to their appearance, but these fruits have become the sources for value addition for the entrepreneurs and thus the wastage of fruits has been reduced drastically. The market for these fig products is mainly southern cities of India namely Bangalore, Chennai, Hyderabad, Mumbai, Vijayawada, Davangere etc. The fig value added products from these entrepreneurs are also made available on e-Commerce platform 'Amazon'. Each value addition unit established entrepreneurs have employed 5-10 women on daily wage basis. Thus they have provided livelihood security to more than 100 families by giving employment. Fig value addition activity taken up by these SHGs has also helped to double their farming income. The success stories of fig value addition that appeared in state and national level news- papers and magazines helped the entrepreneurs to gain different marketing linkages across the country. KVK, Ballari thus played a pivotal role in collaborating with line departments, financial institutions, print and mass media to build a strong base for fig value addition activities in Ballari district. Fig entrepreneurs have thus found a remunerative and sustainable job that needs further widening and support.

**Keywords:** KVK, SHG, PMFME's ODOP, EDP, NABARD



**A study on standardization of fig value added products from different varieties of figs grown in Ballari district of Kalyana Karnataka**

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**ABSTRACT**

Fig (*Ficus carica L.*) belongs to the family moraceae. Fig is one among the major fruit crops grown in Ballari district of Kalyana Karnataka. Fig fruits are climacteric and highly perishable with high respiration rate and high ethylene production. And hence cannot be stored for longer period at ambient condition. Three varieties of figs are grown in the Ballari District are Ballari, Daenna and Turkey brown. The area under Ballari variety is more compared to other two varieties owing to preferred consumer carving from across Southern India. Though the production of the fig fruits is year round farming activity in the district, there are hardly few technologies of fig processing which one can adopt. Therefore KVK, Ballari took up an experiment to bring out newer value added products out of locally grown fig varieties. The process of making dry fruit fig burfi and fig + banana rolls were optimized using all the three varieties. The developed and standardised products were analysed for nutritional composition. Organoleptic evaluation and microbial analysis was carried out over a period of 60 days of storage. The results of nutritional analysis of fruits showed that Ballari fig had high calcium (20.65mg), iron (21.98 mg), fibre (1.53 g) and protein (1.46g) when compared to other two varieties. Dry fruit burfi made out of Ballari variety was found to be nutritionally rich when compared with other two varieties and also scored more in organoleptic test done by semi trained panel members. Fig+banana rolls made with Ballari variety figs were found to be nutritionally superior when compared with rolls made from other two varieties. They also scored more for organoleptic test and were on par with the control sample fig roll. The microbial load of all the products were within the acceptable limits of IFSA (International Flight Services Association) standards ( $< 10^6$  for food samples) when tested after 60 days of storage period. Total plate count in fig burfi made from Deanna figs was  $10.2 \times 10^2$ , Ballari figs  $8.94 \times 10^2$  and Turkey brown  $4.63 \times 10^2$ , whereas mould and yeast count was nil in all the products. Similarly total plate count of fig banana rolls made with Deanna figs showed  $8.2 \times 10^2$  against  $7.9 \times 10^2$  for Ballari, and  $5.63 \times 10^2$  for Turkey brown fig banana rolls, whereas mould and yeast count was nil in all the products.

**Keywords:** Standardization, organoleptic properties, fig



### Standardization of spray drying technology for production of custard apple powder

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#### ABSTRACT

The aim of this investigation was to standardization of spray drying technology for production of custard apple powder and analyses the quality parameters of spray dried custard apple powder. Custard apple pulp was mixed with maltodextrin and water in the proportion of 1:1:3 and added tricacium phosphate (TCP) as anticaking agent (0.10, 0.15, and 0.20%). Homogenized mixture was spray dried at different inlet air temperature (170, 180 and 190 °C) with feed flow rate of 2 ml. min<sup>-1</sup>. Spray dried custard apple powder was analyzed for its physiochemical properties, flow properties and reconstitution properties. The results on spray dried custard apple powder revealed that the chemical constituents, viz., non-reducing sugar (3.70 %), reducing sugar (15.54 %), total sugar (19.12 %), physical properties viz., loose bulk density (0.41 g.cc<sup>-1</sup>) and tapped bulk density (0.47 g.cc<sup>-1</sup>) and reconstitution properties of spray dried custard apple powder viz., wettability (9.66 s), and solubility (91.0 %) and powder recovery (13.14 %) of spray dried custard apple powder were found to be superior in T<sub>9</sub>-190 °C inlet temperature with 0.20% TCP.

**Keywords:** Custard apple, spray drying powder, maltodextrin, TCP, inlet temperature

### Process optimization for aqueous extraction of pigments from annatto (*Bixa orellana* L.)

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#### ABSTRACT

Annatto (*Bixa orellana* L.), a promising natural food colorant obtained from a tropical shrub that contains pigments in its thin, intensely colored resinous coating of triangular seeds found in brown or scarlet capsular fruits (E-160B). It is widely utilized because of its many beneficial properties and secured a significant value in global market. Modern technologies are required for the extraction of annatto pigments and its bioactive components with improved yield and purity. Bixin and norbixin are the two major coloring pigments found in annatto. The former is soluble in fat, whereas the latter is soluble in water. The present research work was done on aqueous extraction of annatto seeds by varying the seed-water ratio, temperature and residence time to find out the better extraction treatment conditions with improved yield of pigments that showed the better extraction at 50°C for about 30 minutes having seed-water ratio as 1:1.

**Keywords:** Annatto, food colorant, aqueous extraction, bixin, norbixin

## Optimization and value addition of functional surimi based nuggets

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### ABSTRACT

Functional Surimi based nuggets of *Nemipterus japonicus* was prepared out by incorporating banana pseudo stem flour (BPF). For the preparation of functional surimi based nuggets, frozen surimi (kept at -21°C) was thawed to room temperature and different concentrations of spices, salt, oil; starch was added and prepares the various formulations of surimi nuggets. And from the selected formulation most acceptable surimi nuggets was prepared by incorporating (1%, 2.5% and 5%) of banana pseudo stem flour along with control. The proximate composition of nuggets shown that moisture, fat, protein, ash, fiber and carbohydrate are in the range 51.78%, 20.68%, 18.11%, 6.26%, 0.48% and 4.69% respectively. The spoilage indicators like tri methyl amine (TMA) and total volatile base nitrogen (TVB-N) content was within the limit. The thiobarbituric acid value and free fatty acid value was 0.24±0.06 and 2.5 ± 0.32 respectively. The sensory evaluation showed that the texture of surimi nuggets incorporated with 5% banana pseudo stem flour was more acceptable than that of other samples.

**Keywords:** functional foods, banana pseudo stem flour, surimi based products, nuggets, value addition

### Processing and value addition from dragon fruit

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### ABSTRACT

Dragon fruit is a tropical fruit native to southern Mexico and Central America. It goes by many names, including pitaya, pitahaya, and strawberry pear. The two most common types have bright red skin with green scales that resemble a dragon - hence the name. The most widely available variety has white pulp with black seeds, though a less common type with red pulp and black seeds. Dragon fruit contains small amounts of several nutrients. It's also a decent source of iron, magnesium, fiber, vitamin C, Protein, Calories and several types of antioxidants. The product processes from fruit have special importance in daily diet of human beings. The main objective of fruit processing is to supply wholesome, safe, nutritious and acceptable food to consumers throughout the year. Pitaya can be converted into juice, jam, RTS beverage, nectare, squash, red wine, etc. Red and pink pulp of dragon fruit for coloring agent, flower bud to make soups and mixed with salad, peel dried to extract pectin and antioxidant. It is also used to produce industrialized products such as preserve, ice cream, sherbet syrup, yogurt, candy, pastry, ketch up, fruit juice as well as wine.

**Keywords:** Pitaya, vitamin c, antioxidants, fruit juice, jam



## **Impact of buckwheat flour incorporation on nutritional, structural and rheological characteristics of gluten free biscuits**

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### **ABSTRACT**

Buckwheat (*Fagopyrum esculantum*) is a pseudo-cereal belonging to the polygonaceae family. It is a gluten free having an excellent source of high quality protein and bioactive constituents with low glycemic index. In the present study, refined wheat flour was replaced with buckwheat flour at different proportions (10, 20, 30, 40 and 50%) to boost the nutritional and functional qualities of biscuit. Formulated buckwheat flour-based biscuits were investigated for nutritional, structural and rheological properties and compared with control biscuit. The results revealed that total fat, ash and protein content of formulated biscuits were ranged from 17.78% to 19.37%, 0.27% to 2.55% and 7.14% to 12.20%, respectively. Incorporation of buckwheat shear modulus increased slightly and cross over point reached at lower strain, implying decrease in elasticity. The scanning electron microscopy results showed that addition of buckwheat flour hindered the formation of protein structure in biscuits, making the biscuits crispy. In vitro study revealed significant decrease in starch hydrolysis index with incorporation of buckwheat flour, concomitantly reducing glycemic index of biscuits from 94.17 to 58.67. The study concluded that incorporation of buckwheat flour could be an effective way to develop a nutritious and sensorial acceptable biscuit with low-digestibility and desirable quality properties.

**Keywords:** Biscuit, buckwheat, nutritional, rheological, glycemic index

### Characterizing cotton seed for industrial applications

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#### ABSTRACT

A total of 32.5 million hectares of cultivable land are used to grow cotton. Cotton seed are an important raw material for the seed and oil industries. Engineering design criteria for sowing, harvesting, ginning, drying, compressing, sorting, grading, conveying equipment, and storage silos are highly influenced by the characteristics of the seeds. Properties play a crucial role as inputs in simulation studies. Five well-known cotton seed varieties were examined for their physical, mechanical, and aerodynamic properties in order to meet the requirements above. All of the varieties' lengths, widths, thicknesses, and mass values ranged from 6.05 to 10.99 mm, 3.73 to 6.91 mm, 2.94 to 5.73 mm, and 0.6 to 0.16 grams, respectively. Different mean diameter, projected area, volume, and other computations were made using the measured primary dimensions. The frictional forces produced by painted mild steel, wood, and rubber are greater than those produced by PVC, stainless steel, and aluminum. The flow of cotton seeds was characterized as transitional since its Reynolds number ranged from 3045 to 3994. It was discovered that its coefficient of restitution varied between 0.34 and 0.43, putting it in the middle of an elastic and a plastic body.

**Keywords:** Cotton seed, DEM, design, engineering properties, simulation

#### An investigation of the predictors of losses and the constraints in post-harvest management

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#### ABSTRACT

A significant portion of total horticultural production is lost each year due to post-harvest losses. These losses vary significantly in different segments of the supply chain and These variations are primarily due to various farm-level factors. Present study was carried out during 2019–20 to isolate the predictors of post-harvest losses in potatoes in the purposively selected Khandoli block of Agra district, Uttar Pradesh. The total sample size was 160 included 120 farmers; 10 wholesalers; 15 retailers and 15 institutional stakeholders. The study used ordered logistic regression analysis and found that the knowledge level of the producers, training received, variety, timely labour availability, quantity harvested, and storage duration influenced the amount of losses in potatoes. The major constraints identified in the potato value chain were small operational size, absence of storage facilities, inadequate insurance coverage and poor market intelligence. The study suggested focusing more on capacity building, breeding & disseminating improved varieties; creating local-level storage infrastructure; ensuring financial risk coverage and price policy support; creating strong marketing intelligence network and farmer mobilization into 'farmers' groups for effective post-harvest management.

**Keywords:** constraints, predictors, potato, post-harvest losses, ordinal logistic regression



## **Impact of FPO-led maize marketing on farmers income in Karnataka**

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### **ABSTRACT**

Maize (*Zea mays* L.) is one of the most important cereal crops in terms of production, third only to rice and wheat. The domestic demand for maize has substantially increasing owing to the rapid growth of the poultry industry in India. Based on the relative comparative advantage, feed industries are primarily located in and around Davanagere district of Karnataka. Presence of poultry feed industries, starch industries and other food processing industries have accounted for diversified marketing channels in Davanagere. Higher yields are seldom indicative of good returns, because it is the prices which makes a farmer better off. Marketing of maize in selected villages of Davanagere district was carried by four channels, marketing through village traders (channel I), wholesalers (channel II), marketing through FPO (channel III) and direct selling to companies (channel IV). Channel I and Channel II were the most followed though they returned lesser net income to farmers compared to other channels. Net income of farmers following channel I, II, III and IV were 42799.57, 49136.56, 52430.27 and 52769.09 rupees/ha respectively. Marketing through FPO had significance in case of small and marginal farmers. Impact assessment of FPO-led market channel revealed that the farmers marketing through channel III receive 6307.813 rupees/ha more than the farmers marketing through other channels. Out of all the factors influencing farmers in adopting FPO-led marketing channel, distance of FPO, source of credit (institutional or non-institutional), and whether the nearest FPO to the farmer was marketing maize were having significant effect. Participation in FPO is advantageous to farmers by way of backward and forward integration.

**Keywords:** Maize, poultry, feed, market, channel, FPO.



## **Development and performance evaluation of lucerne harvesting machine**

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### **ABSTRACT**

Fodder harvesting is one of the enumerative as well as job creative farming. Lucerne is one of the oldest cultivated fodder crops in the world. In a present day, mostly harvesting of fodder in India and Gujarat done by manually. The well matured lucerne are harvested manually by sickle which is time consuming and inefficient. More over manual harvesting is done in a Squatting position which is arduous to the farmer and causes backache. Therefore, a project on development and performance evaluation of lucerne harvesting machine was undertaken. A lucerne harvesting machine was developed which consisted of main frame, diesel engine, conveyor unit, reel unit, cutting unit, handle, cutting height wheel and transporting wheel. The developed lucerne harvester were divided in two part (1) cutting unit having knives of 30 mm width and 2 mm thickness and (2) conveying unit which convey the harvest crop. A power transmits from engine to the cutting unit and conveying unit done by the help of belts and pulleys. The power required for cutting and conveying were 97 W and 215 W, respectively. The push force required for transportation in field. The performance of the developed lucerne harvester was evaluated in the field at three forward speeds. Such parameters were measured that the average harvesting efficiency, field efficiency and plant damage were 76.87 %, 74.55 % and 11.65 % respectively. The effective field capacity was 0.177 ha/h, at forward speed of 1.3-1.6 km/h, whereas by traditional method *i.e.*, by sickle was 0.0041 ha/h. After harvesting average height of stubble found to 6 cm. The total cost saved by developed lucerne harvester ware 19.5%.

**Keywords:** Fodder crop, harvesting, squatting position, mechanization, efficiency

### **Possibility of underusing cereals in the human diet**

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#### **ABSTRACT**

The underutilized cereals mean the cereals which are not used commercially as much as the other crops are used. The underutilized crops are generally used by local communities and very less out of that. The underutilized cereals like red rice were cultivated from 700 BC and well documented in Ayurveda. Sometimes, underutilization is due to the adverse growing conditions of some crops and they are habitat in that environment. The underutilized cereals are rich in nutrients but they are forgotten crops. Wheat, rice and maize constitute the major cereal crops that sustain over 50% of the caloric demand of the world population over the years, but they have lesser nutritional as well as medicinal value against some underutilized crops. Approximately 90% of the world's calories are provided by less than one percent of the known 250,000 edible plant species. Cereals like buckwheat, sorghum, red rice, kodo millet, horse gram, oats, etc. are underutilized. In human diet the potential of these cereals is very important as some of the nutrients are not provided by the major cereals like wheat, corn, etc. and the underutilized cereals are rich in these nutrients. Some people have allergy from the gluten of wheat and other cereals are recommended to these people like sorghum, which is gluten-free and often recommended as a safe food for celiac patients. The fortification of whole wheat flour with 20% of buckwheat flour enhances nutritional quality as well as the sensory quality of the biscuits. The partial replacement of rice with finger millet and sorghum in *idli* batter enhance enzyme activity, increase fermentation and also increase overall acceptability as improvement of colour. In the present world, there is limiting nutritional and functional quality in daily diet of many people and hence a need of fortified foods or addition of nutrients in daily human diet. The fortification of the food products like cake, biscuits, muffins, noodles, etc. with these underutilized cereals can enhance the nutritional, functional as well as sensorial quality of the product. Instead of high nutritive value these cereals are underutilized and the research is needed so that the underutilized word can be removed.

**Keywords:** Ayurveda, buckwheat, fortification, nutritional



### **Preservation and processing of fish**

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#### **ABSTRACT**

The fish is a highly nutrient food consumed by a large part of the population. However, it spoils quite soon. Therefore, preservation is crucial. For increasing the fish productivity, the current technology that is being used for fish preservation and processing needs to be improved. Chilling fresh fish is the simplest approach to extend its shelf life. Fish can be preserved on ice (preferably in the crushed form) for one to two weeks if the temperature is regulated around 0°C. If ice and a controlled atmosphere containing CO<sub>2</sub> are combined, the shelf life may also be extended further. It's vital to note that chilling appears to be far more effective in tropical areas than in colder regions. This is mainly because psychrotrophic spoiling microbes are not present in the warm waters. Hence it is crucial that clean fresh water is used for ice formation in such cases. Otherwise, psychrophilic spoilage bacteria may be enhanced in the ice plant, causing them to be introduced along with the ice when the fish is chilled. Getting adequate contact between the fish and the cooling medium is crucial when chilling fish. Lipid rancidification and protein denaturation are the principal quality issues. The advantage of canning over other methods of fish preservation is that the product may be kept at room temperature for extended period of time. Heating, freezing, regulating water activity (by adding chemicals or drying), and irradiating are the four fundamental processes employed in the final processing of fish products. All of these processes improve the fish's shelf life by preventing the mechanisms that caused degradation. The nutritional qualities of the finished product are also impacted by each of these processes. After being taken out of its aquatic environment, fish must be handled carefully to retain its nutritional qualities and product quality. Fish from the world's oceans and freshwater bodies have been a significant source of food for humans from the ancient prehistoric times.

**Keywords:** Chilling, lipid rancidification, protein denaturation



### **Role of foodomics in food safety and quality assurance**

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#### **ABSTRACT**

Foodomics is an emerging tool which is defined as a discipline that studies the domains of food and nutrition through the application of advanced omics technologies to improve the well being of consumers, improving health and gaining consumer trust. It is used to determine various food constituents and nutrients at molecular level by numerous analytical techniques like proteomics, metabolomics, lipidomics, nutrigenomics, metagenomics and transcriptomics etc. The composition of food varies as it contains various macro and micronutrients such as carbohydrates, proteins, fats, minerals, vitamins, phytochemicals, antioxidants due to which the omics technology is considered in both food quality and assurance. The reliability and reproducibility of the analytical methods are of key importance to ensure food quality and food safety. These analytical methods are also used for the detection of some exogenous compounds which have a harmful impact on human health and the chief concern for food safety. Moreover, these analytical techniques are also able to detect food allergens and some other exogenous compounds which might have a harmful impact on human health and is now-a-days a major concern for food safety. Recently, some green techniques according to “Green Foodomics” are being considered for extraction, sample preparation, analysis and development of functional novel products on the subject concerning environmental sustainability. It majorly focuses on replacement of toxic reagents by safer options, reduce the usage of chemicals in analytical methods and energy along with minimizing waste volume. However, the effect of these food processing techniques on nutritional value and health status still needs to be studied further, thereby encouraging more investigation in this critical issue.

**Keywords:** Omics, food, metabolomics, food safety, quality, green



**Time course of changes in physico chemical, sensorial and microbiological qualities in freshly extracted coconut milk**

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**ABSTARCT**

Fresh coconut milk extracted from the nuts of 12 months maturity exhibited mean density, pH, moisture, total solids, total soluble solids, and titratable acidity of  $0.97 \pm 0.01$ g/ml,  $6.1 \pm 0.1$ ,  $57.3 \pm 0.3\%$ ,  $42.67 \pm 0.3\%$ ,  $12.1 \pm 0.5^\circ\text{B}$  and  $0.04 \pm 0.001\%$ , respectively. A time course study, at an interval of 30 minutes, was conducted to document the changes in these parameters after storing the milk under ambient ( $30 \pm 2^\circ\text{C}$ ) condition. A gradual decrease in pH of the milk over time was observed. Changes in total soluble solids did not follow any specific trend. Sensorial parameters showed marked reduction with an increase in storage period. Viscosity of the milk exhibited an increasing trend, from 15.36 cP (0h) to 22.56 (7h). Results of biochemical and sensorial attributes were further corroborated based on methylene blue reductase test- a standard methodology followed in dairy milk to assess the relative microbial load. Further, a direct method of microbial load determination was performed and the microbial count was enumerated at regular intervals. The microbial population in coconut milk was found to increase with increase in holding time at room temperature of  $30^\circ\text{C}$ . Coconut milk was found to be safe within one hour of keeping at room temperature, there after fermentation sets in and the microbial population increased exponentially. There was = 250-fold increase in microbial population after 7 hours of keeping the coconut milk at room temperature. Similar increase in microbial population was detected following enumeration of microbial load on two different laboratory growth media. Nonetheless, no filamentous fungi were observed in coconut milk on both the media at any point of the holding period. Though the total colony forming units increased with time, the morphological observations suggest a reduction in number of colonies morphotypes as the fermentation of coconut milk progressed. Implications of this study for improving the shelf-life and preservation of coconut milk are also discussed.

**Keywords:** Food quality, microbial load, shelf-life, preservation, sensory parameters

## Proximate composition of developed composite flour used for bakery products

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### ABSTRACT

Now a days most of the people depend on wheat, oats, soybean, and millet as staple foods in comparison to rice as diabetes and other degenerative diseases increased in alarming rate. Refined wheat flour is one of the major ingredients for preparation of baked foods. Generally, bakery products are rich in calories but lack in other nutrients. This study was designed to formulate composite flour by incorporating finger millet, soy & oats with refined wheat flour at 20%, 40%, 60% & 80% substitution. 100gm refined wheat flour was taken as control. The proximate composition of composite flour was determined by using the methods of AOAC. There were five flours were developed i.e., CF<sub>0</sub>, CF<sub>1</sub>, CF<sub>2</sub>, CF<sub>3</sub>, CF<sub>4</sub>. There were significant differences in the proximate compositions of the flours ( $p = 0.05$ ). The moisture content of the flour blend was highest in CF<sub>0</sub> 10.27% & lowest in CF<sub>4</sub> 9.31%. The crude protein content of the composite flour ranged from 9.68% to 15.92%. The percent crude fibre content of the flours also ranged from 1.06% to 2.11%. As the composite flour quantity increases the ash content also increased from 1.16% to 4.94%. The increase in ash content shows the flour are rich in micronutrients. Crude fat content of the flour ranged from 1.22% to 4.16%. The percent carbohydrate content of the flours ranged from 76.64% to 63.57%. As the quantity of composite flour increases other nutrients increased but the carbohydrate quantity decreases without affecting the sensory qualities of the developed bakery products.

**Keywords:** Composite flour, proximate composition, bakery products, nutrients

### Exploring the nutritive and functional properties of by-products from mango fruits

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### ABSTRACT

Mango is an important tropical fruit commercially cultivated in more than 103 countries, globally. Mango peels and seeds are major by-products from industrial processing or consumption of mango fruit, contributing to 40-50% of its total weight. Although, use of mango waste as an ingredient in animal feed is well known, most of this by-product is considered waste and becomes a source of environmental pollution. Mango peels have high content of valuable compounds, such as phytochemicals, polyphenols, carotenoids, dietary fibre and vitamins, which have predominant functional and antioxidant properties. Likewise, mango seed contains high content of bioactive compounds (phenolic compounds, carotenoids, vitamin C and dietary fibre) that have potential to improve human health. It presents an attractive profile of essential amino acids and lipids (6-16%), mainly oleic and stearic acids which contributes to functional properties similar to vegetable butter. Attributing to their high antioxidant activity, they exhibit anticancer activity against breast and colon cancer and antimicrobial activity against variety of microbial species. The proper use of mango waste as raw material or food additive could generate economic gains for food industry, contributing to reduction in nutritional deficiencies, promoting health and reducing the environmental implications related to this generated waste.

**Keywords:** Antioxidant, antimicrobial, functional, dietary fibre, carotenoids



**Production and quality evaluation of ready to eat fortified rice extrudates from selected NRRI rice varieties**

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**ABSTRACT**

Increased nutrition levels in rice consumers can be achieved through the effective extrusion nutrient fortification of rice. Performance of extrusion-based fortification is influenced by nutrient retention, better bioavailability, low post-processing losses, prolonged storage stability, and minimal sensory alterations. The objective of this study was to develop extruded snacks made of rice that were more nutrient-dense. The extruder processing parameters, such as screw speed and barrel temperature, were optimised for the development of extrudates based on rice. Additionally, study focused on how fortificants and variations in the rice variety affected the physico-chemical, nutritional, and sensory properties of the developed extrudates. Each independent variable had a significant ( $p < 0.01$ ) effect on all product responses. The levels of protein in raw material (rice flour) and extruded products are very different. The glycemic index (GI) of the finalized extruded product was also found to be significant among the enhanced formulations. Numerical optimization was used to select the optimum processing conditions for the development of extruded products. These parameters included the appropriate screw speed (350 rpm), barrel temperature (113°C), and feed moisture (17%). The current study thus supports the feasibility of producing protein- and mineral-rich extruded snacks made from rice utilising maize and dal flour, which might be used in food fortification programmes to meet public health needs.

**Keywords:** Rice extrudates, fortificants, maize flour, dal flour, screw speed, barrel temperature

**Fortification of Aonla candy using karonda extract**Vijay Rakesh Reddy S<sup>1,2</sup>, Mukesh Berwal<sup>2</sup>, Ramesh Kumar<sup>2</sup> and Preethi P<sup>1</sup><sup>1</sup> ICAR-Indian Institute of Horticultural Research, Bengaluru- 89<sup>2</sup> ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan-06**ABSTRACT**

The aonla fruit is valued high for its medicinal properties in India and is traditionally used as an anti-scorbutic, diuretic, laxative, antibiotic and immune boosting food. Despite its huge medicinal value, the aonla fruits can't be consumed in fresh form due to the presence of astringent compounds such as tannins and phenols. However, they can be converted into easily consumable forms like candy. During preparation of candy, the fruits are blanched initially for few minutes to soften the fruits and aid in easy separation of segments from seed. This short period of blanching results in loss of heat sensitive bioactive components through degradation. Thus an attempt was made to replenish the lost nutrients through impregnation of nutrient rich karonda fruit extract into the aonla segments during the candy preparation. The karonda juice being rich in anthocyanins, iron and many other nutrients had helped in replenishment of nutrients lost through blanching and also improved the consumer appeal through imparting anthocyanin pigmentation to the aonla candy segments. The anthocyanin content was found to increase with increasing concentration of karonda extract (1-5 %) to the impregnating solution. The iron content was found to increase by 5 times compared to the plain aonla candy. There is significant increase in the contents of titratable acidity, ascorbic acid, phenols, flavonoids and total antioxidant activities among the fortified candy compared to the traditional candy.

**Keywords:** Aonla candy, karonda extract, iron fortification**Extraction and characterization of liquid smoke from locally available wood smoke**Reshma CS<sup>1</sup>, Bindu J<sup>2</sup>, and Sathish Kumar K<sup>2</sup><sup>1</sup>Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies  
Panangad, Kerala, 682506, India<sup>2</sup>Fish Processing Division, ICAR - CIFT, Cochin, Kerala, 682029, India**ABSTRACT**

Liquid smoke is generally obtained by the condensation of wood smoke produced by smouldering wood chips or sawdust and widely used to enhance the smoke flavour to food products. In the present study, liquid smoke (LS) was extracted from three locally available saw dust of trees such as mango, jackfruit and coconut, and were compared to commercially available liquid smoke. Liquid smoke obtained from jackfruit tree sawdust showed high acidic pH of 2.36 followed by commercial LS (2.78), coconut LS (3.73) and mango LS (3.82). The total carbonyl content of extracted LS's was higher than the commercial LS. In DPPH analysis, the extracted LS's had higher inhibition which is similar to the commercial LS's. Among that, jack fruit LS (92.08%) exhibited high percentage of inhibition. In FRAP analysis, there is no significant difference between the antioxidants exhibited by coconut (121.75 µM/ml) and mango LS (122.12 µM/ml), whereas commercial LS showed higher values (714.12 µM/ml). Similarly, commercial LS showed high total phenolic content (TPC) compared with locally available wood LS. The study revealed that the locally available wood LS had comparable antioxidant properties with commercial LS and can be used as a food preservative / flavour enhancer with low cost effective method.

**Keywords:** Liquid smoke, phenol content, carbonyl content, antioxidant

## Potential of selected underutilized leafy vegetables against CCl<sub>4</sub> induced oxidative stress on wistar rats

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### ABSTRACT

Nutritional immunology might become even more important in prevention of disease. Underutilized leafy vegetables are the richest source of many bioactive compounds especially phenolic compounds with excellent antioxidant properties. Increased consumption of diets containing leafy vegetables may give positive results to human health. The underutilized leafy vegetables which include Indian pennywort, Sessile joyweed, Red amaranth, Red spinach, Asiatic day flower, Indian sorrel, Roselle leaves are quantified for its phenols, flavonoids and vitamins contents by HPLC-LC MS method. The phenols, flavonoids and vitamins ranged from 0.186 – 12014 µg/g, 0.018 – 785.25 µg/g and 0.361 – 18466.56 ng/g in the underutilized leafy vegetables. Based on the bioactive compounds present, herbal preparations are developed and evaluated for hepatoprotective property against CCL4 induced intoxication in wistar rat model. Biochemical estimation in blood serum (AST/SGOT, ALT/SGPT, ALP, Total bilirubin) and antioxidant enzyme estimation in liver homogenate (SOD, GOD, LPO) showed positive results to reduce hepatotoxicity in CCL4 intoxicated wistar rat model. This exploration can helps in addressing importance of bioactive components present in underutilized leafy vegetables in combating various degenerative diseases and also proved the nutraceutical potential of leafy vegetables. Further which can be used for development of functional foods with the present pre-clinical data.

**Keywords:** Underutilized leafy vegetables, nutraceutical potential, hepatoprotective and oxidative stress

**Impact of drying temperature and pretreatment on non-enzymatic browning and its associated biochemical changes in white guava (cv. Allahabad Safeda) fruit bar**

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**ABSTARCT**

Guava is one of the important tropical fruit crops available all-round the year except for summer. The fruit bar is an important processed product of guava. White-fleshed guava types used to make fruit bars are more prone to browning within a short period. Non-enzymatic browning affected the sensory and functional attributes of the white guava fruit bar and shortened its shelf life. Drying temperature and anti-browning agents are the two main factors that can influence non-enzymatic browning. Consequently, attempts were made to comprehend the significance of various drying temperatures (40°C, 50°C, 60°C) and anti-browning agents (0% KMS, 0.5% KMS) and also to assess the non-enzymatic browning through biochemical markers. The guava bar developed using anti-browning agents at different drying temperatures were examined for various physico-chemical analysis *i.e.*, moisture content (%), water activity, color (browning index), titratable acidity (%), sugars (%), free amino acids (mg Leu/100g), ascorbic acid (mg/100g), total phenols (mg GAE/100g), and non-enzymatic browning. HPLC analysis was performed to detect and quantify biochemical markers *viz.*, furfural (ng/g), and hydroxymethylfurfural (ng/g). Results revealed that drying at low temperature (40°C) and pre-treatment of guava slices with 0.5% KMS played a significant role in minimizing the non-enzymatic browning of white guava fruit bar which was highly determined by reducing sugars (15.69%), titratable acidity (1.79%), free amino acids (1.90 mg Leu/100g), ascorbic acid content (246.28 mg/100g) and total phenols (560.97 mg GAE/100g).

**Keywords:** Guava fruit bar, non-enzymatic browning, drying temperature, anti-browning agent, nutritional quality, bio-chemical markers

## ***In vitro* digestion improved the bioactive properties of the optimized formulation of eggnog**

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### **ABSTRACT**

Eggnog, a dairy beverage, is prepared with the combination of milk, egg, sweeteners, salt, and stabilizers. Optimization of formulation using response surface methodology following Box-Behnken design revealed the responses of dependent variables (heat coagulation time, thermal gelation temperature and viscosity). Around 62.2% milk, 23% cream, 6.8% eggnog base with 4% each sugar and skim milk powder were selected as the optimized formulation. Further, *in vitro* digestion of optimized eggnog (OE), control sample (CE), pasteurized milk (PM) and pasteurized egg (PE) was performed by using the harmonized INFOGEST *in vitro* digestion to study the effect of digestion on protein pattern and bioactivities. Degree of hydrolysis was significantly ( $P < 0.05$ ) higher for OE ( $80.83 \pm 0.85\%$ ) than PM (61.0%). SDS-PAGE of OE showed protein bands at 10-14kDa, 38-55kDa and 200kDa corresponding to pepsin, lipase, trypsin and protease and several apolipoproteins, respectively. However, no difference ( $P > 0.05$ ) was observed in DPPH radical scavenging activity of CE and OE. Further, digested OE showed higher ( $P < 0.05$ ) radical scavenging activity ( $681.50 \pm 2.09 \mu\text{mol/mL}$ ) than undigested OE ( $430.20 \pm 5.21 \mu\text{mol/mL}$ ). Angiotensin-converting enzyme inhibitory activity was also significantly higher ( $P < 0.05$ ) for digested samples. In conclusion, eggnog samples showed more bioactive properties after digestion indicating its health potentiating virtues.

**Keywords:** Eggnog, *in vitro*, bioactive properties, SDS-PAGE, antioxidant activity



## Sensory characteristics and proximate composition of food products developed from minor millets

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### ABSTRACT

Millets are nutritionally superior than other cereals. There has been a sharp decline in the production and consumption of millets especially in Punjab due to lack of knowledge of their nutritional virtues and difficulties faced in food preparation. The present study has been planned to formulate and nutritionally evaluate the minor millet-based food products which are accepted by Punjabi population and suits their palate. Two minor millets i.e. Foxtail and Proso millet were used to prepare four value added food products namely *rusk*, *kheer*, *pinni* and millet bars by replacing cereal. The products prepared from Foxtail millet were found to be more acceptable than the products prepared from Proso millet where *Rusk* was found to have highest acceptability score of (8.04±0.48) followed by *Kheer* (8.00±0.5), *Pinni* (7.98±0.46) and millet bar (7.8±0.50). The developed products were also found to be high protein content ranging from 12.67 to 16.10g/100g with highest protein in *rusk*. The crude fat, fibre and ash content of the developed food products of both the millets were observed in the range of 3.98 to 30.56g/100g, 2.27 to 4.47g/100g and 1.9 to 4.17g/100g on dry basis respectively. The findings concluded that the value-added products prepared from minor millets were highly acceptable and had good nutritional content and must be included in the diets of the population.

**Keywords:** Foxtail Millet, proso millet, value added products, sensory characteristics, nutritional content

## Antioxidant and anti-diabetic activities of banana pseudostem and inflorescence extracts

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### ABSTRACT

Banana (*Musa spp.*) is a very popular tropical fruit native to South Pacific region. The pseudostem and inflorescence of banana plant are generally considered as agro wastes, though they are potentially rich sources of nutraceutically valued phytochemicals. *Palayankodan* is the most widely cultivated variety of banana in Kerala. The ethanolic extract of pseudostem and inflorescence of *Palayankodan* variety showed good antioxidant activity for various *in vitro* antioxidant assays namely 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay, 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid (ABTS) free radical scavenging activity assay and ferric reducing antioxidant power. The half-maximal inhibitory concentration (IC<sub>50</sub>) in the DPPH assay was 0.82 mg/ml and 0.92 mg/ml respectively for pseudostem and inflorescence extracts in comparison with gallic acid standard. The *in vitro* anti-diabetic activity was measured using  $\alpha$ -amylase and  $\alpha$ -glucosidase assays with acarbose as standard. In both the assays, pseudo stem extracts have shown better anti-diabetic activity when compared to blossom. The results showed that ethanolic extract of banana pseudostem and inflorescence of *Palayankodan* variety has promising antioxidant and anti-diabetic activities.

**Keywords:** banana pseudo-stem, inflorescence, antioxidant, anti-diabetic



## **Value addition of underutilised little millet as a ready to reconstitute smoothie mix**

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### **ABSTRACT**

The present era of fast-paced urban lifestyle, rising disposable income and globetrotting people spurred the adoption of convenience foods in India. The underutilised little millet is nutritionally superior to regularly consumed cereals with vast untapped potential. Malting of little millets enhanced the digestibility, reduced anti-nutritional components and provided appropriate food-based strategy to derive nutrients maximally. A ready to reconstitute smoothie mix was developed with most organoleptically acceptable formulation being 45.0% malted-pregelatinised little millet flour, 45.0% milk powder and 10.0% sugar powder. Malting and pregelatinisation enhanced flavour, taste, overall acceptability and reduced lumping, reconstitution time of smoothies. The developed smoothie mix reconstituted well with fruit pulps and juices in both 1:1 and 1:2 combinations within 2-3 min with sensorially acceptable scores. These smoothies with blend of malted little millets and locally available seasonal fruits served as nourishing drinks with abundant supply of calories, fibre, vitamins and minerals relished by all age groups with huge market potential. The estimated cost of production of fruit based little millet smoothie per serving (200 ml) was ? 35.0-45.0 depending on type and proportion of fruit pulp or juice added. The feasible price range make it suitable for further commercialization.

**Key words:** Little millet, nutri-cereal, malting, smoothie mix, convenience food

### **Genetically Modified Food: Bane or Boon**

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#### **ABSTRACT**

Advances in plant biotechnology have made it possible to identify and modify genes controlling specific characteristics. Nowadays, scientists can transfer genes from one organism to another unrelated organism producing what is known as genetically modified organism or transgenic plant. Genetically modified food refers to crop plants and their product which are created for consumption of mankind or animals employing molecular biology techniques. The purpose of employing molecular biology techniques is to incorporate desired traits, which could be helpful in growing of crops, improving the nutritional content and making the food more palatable. It was analyzed that world's hunger, malnutrition problems, environmental pollution and phytoremediation in agriculture are the challenges for the scientist as well as governments those can be combated by the application of genetic engineering in crops. A number of commercialized, genetically engineered varieties such as canola, cotton, maize and soybean, were created using this technology. Biotechnology offers a variety of potential benefits and risks. Genetically modified crops possess one or more useful traits such as herbicide tolerance, insect resistance, abiotic stress tolerance, diseases resistance and nutritional improvement. However, widespread adoption of transgenic crops has also raised concerns about its potential risk of toxicity and allergenicity to human beings and potential environmental risk such as chances of gene flow, adverse effect on non-target organisms, evaluation of resistance in weeds and insects. So, the growing concern about increased population and healthy lifestyle give rise to concern about safety assessment test used for the GM crops. Thus, the generation of GM food explores new vistas for the future food requirement but the assessment of policy regarding environmental and health risk is also to be concerned.

**Keywords:** Biotechnology, genetic, allergenicity

## **Influence of common processing methods on the storage stability of foxtail and proso millet**

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### **ABSTRACT**

Millets are the nutri-cereals with high nutritional value and has the potential to provide food and nutrition security in the country. The presence of high amount of lipids and essential fatty acids effect its consumption due to the rancidity caused by the enzymes leading to a short shelf life and restricting its product commercialization. The present investigation was conducted to study the influence of common processing methods on the shelf life of foxtail and proso millet flour. Two processing treatments namely roasting and germination were applied to the flour and tested for its rancidity parameters i.e. peroxide value, acid value and free fatty acids for a period of six months. The peroxide value, acid value and free fatty acid content at the time of milling, of the roasted foxtail millet flour was found to be  $2.24\pm 0.53$ ,  $2.10\pm 0.31$ ,  $0.685\pm 0.013$  and roasted proso millet flour was  $3.6\pm 0.046$ ,  $2.20\pm 0.162$ ,  $0.946\pm 0.023$  respectively. The corresponding values of the germinated foxtail and proso millet flour were found to be higher as compared to the roasted flours. The rancidity parameters increased significantly ( $p < 0.05$ ) in both the treated flours after an interval of six months. The investigation revealed that the treated flours had higher shelf life as compared to the untreated raw millet flour. Therefore, common processing techniques should be applied to the millet flours to increase their shelf life and use in the commercial food preparations.

**Keywords:** Foxtail millet, proso millet, shelf life, rancidity, roasting, germination.

**Detection of adulterants in honey: Need of an hour**

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*Department of Processing & Food Engineering, PAU Ludhiana-141004 (PUNJAB)***ABSTRACT**

Honey is a yellowish-colored newtonian fluid composed of honey bee secretions derived from plant nectar extraction. The demand for honey is increasing day by day due to the medicinal properties and health benefits. The increased demand for honey further increases the adulteration as production of honey is lower. The main adulterants were found to be corn syrups (CS), high fructose corn syrups (HFCS), invert syrups (IS), or high fructose insulin syrup (HFIS), either directly or indirectly through floral sources. The current study focused on the various available techniques for detecting adulteration, such as physicochemical analysis, gas chromatography, spectrometry, and so on. The novel techniques are AAS, HPLC, GC-MS, ES-MS, TLC, HPAED-PAD, NMR, FT-Raman, electric tongue, and NIR used to detect sugar, water content, HMF, polyphenol content, diastase, high fructose syrup, and major sugar composition, which are fast and accurate. The current techniques cannot detect all adulterants simultaneously. It is necessary to develop more techniques that can quickly identify all adulterants, such as sensor-based methods or portable kits to detect adulteration in honey.

**Keywords:** Honey, adulterants, chromatography, spectrometry, sensors

**Post-Harvesting Technology: Agri-Value & Supply Chain for Sustainable Production  
Agricultural Waste Management**Mehvish Bashir<sup>1</sup>, Shijaatt Hussain Bhat<sup>2</sup>, M.A Dar<sup>3</sup>, S.S Kubravi<sup>4</sup>, Quadri Javeed Ahmad<sup>5</sup>,  
Huzaifa Farhein<sup>6</sup>, Tehniya Bashir<sup>7</sup> and Beenish Khuroo<sup>8</sup>

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**ABSTRACT**

The output of the agricultural production which has less economic values than the cost of its collection, transportation and processing is called agricultural waste. India produces around 620 million tonnes of agri. wastes annually, of which 20-30% is utilized as livestock fodder and energy production. Residue burning practice is common in India to clear the field for timely sowing of the next crop, which leads to the release of harmful gases like CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub>O that causes Air pollution and various other harmful effects on humans. Majority of the farmers are fully aware of this and are also having awareness regarding the management of the agri. wastes of crops like Paddy, Wheat, Mustard etc however they still fail to take advantage of the agri. wastes produced from their fields. So, there is a need to suggest some efficient ways of utilization and management of agri. wastes, so that the farmers would adopt those ways to convert this waste into useful products and earn some money from it, which will prove beneficial to the farmers and would also help in improving environmental conditions.

**Keywords:** Agricultural waste, management, energy production, awareness

**Comparative anthocyanin purification capacity of adsorbent and ion-exchange resins**Anindita Paul<sup>1,2</sup>, Anirban Dutta<sup>1</sup>, Aditi Kundu<sup>1</sup>, Supradip Saha<sup>1</sup><sup>1</sup>Division of Agricultural Chemicals, ICAR-Indian Agricultural Research Institute, New Delhi- 110012<sup>2</sup>Division of Crop Chemistry and Soil Science, ICAR-Central Tobacco Research institute, Rajahmundry-533105**ABSTRACT**

In the past decades, both academy and industry have put a lot of efforts into the recovery of polyphenols including anthocyanins from plant sources which is an inexpensive source of natural antioxidants. Resin adsorption technology is a unique technology which is generally explored to concentrate polyphenols and to remove sugars. Significant amount of phenolics are retained among the major impurities during the purification process of anthocyanin. There are different types of macroporous resins that can be used for the adsorption of phenolics and other impurities. In the present investigation, anthocyanins obtained from four different sources were purified by different adsorbent and ion exchange resins and thereby comparative performances were evaluated in terms of their adsorption capacity. Among adsorbent resins, two polystyrene-divinyl benzene (PSDB-A, PSDB-B), two polyacrylic ester-based resins (PAE-A, PAE-B) were selected and among ion exchange resin acid cation resin A and B were screened. In case of non-acylated anthocyanin sources (rose, black rice), PSDB-A is the best having more than 92% adsorption capacity, whereas for acylated anthocyanin sources (black carrot, black cabbage) PSDB-A and B both are best (more than 96% adsorption capacity) and there was no significant difference between them. Among ion exchange resins, acid cation resin A proved best having 74-88% adsorption capacity. Better performing resins may be utilized for large scale purification purpose.

**Keywords:** Anthocyanin, purification technology, macroporous resin, antioxidant, adsorption

**Development and validation of a reverse phased UHPLC-PDA method for determination of major phytosterols ( $\beta$ -Sitosterol, Stigmasterol and Ecdysterone) present in stems of *Tinospora cordifolia* (giloe)**Rohan Sarkar<sup>1</sup> and Satyanshu Kumar<sup>1</sup><sup>1</sup> ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand, Gujarat-387310**ABSTRACT**

Several health promoting effects (hypolipidemic, anti-inflammatory, antioxidant activity) of giloe are associated with presence of different phytosterols among which  $\beta$ -sitosterol, stigmasterol and ecdysterone are the major ones. That's why proper optimised and validated method is required for determination of these useful bioactive compounds. Chromatographic separation was achieved using C-18 column and combination of water and acetonitrile as mobile phase. The targeted compounds were eluted at retention time of 9.75 min (ecdysterone), 14.47 min (stigmasterol) and 16.36 min ( $\beta$ -Sitosterol) at 254 nm of wavelength. Limit of detection (LOD) was 0.27  $\mu\text{g/mL}$  for  $\beta$ -sitosterol, stigmasterol and 0.18  $\mu\text{g/mL}$  for ecdysterone, similarly limit of quantification (LOQ) was 1  $\mu\text{g/mL}$  for all the analytes. Overall recovery was in the range of 93–108% with less than 2% of relative standard deviation (RSD) for intraday and interday precision. Effect of different solvents on extraction yield was observed, where 25% acetone-water provided highest yield, 13.76%. The analytes were found highest in 50% methanol-water i.e., 31.23, 22.72 and 48.09  $\mu\text{g/mL}$  for  $\beta$ -sitosterol, stigmasterol and ecdysterone respectively. This study can be useful for quality check of different giloe based herbal supplements and also to develop phytosteroids rich extracts as well as suitable nutraceutical products.

**Keywords:** Giloe, phytosterols, UHPLC, method validation



## Effect of pretreatment on engineering properties of pearl millet (FBC 16) and foxtail millet

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### ABSTRACT

Millets are known as nutri-cereals, gluten free cereals and super foods as almost all millets are three to five times more nutritious in terms of sulphur containing amino acids, proteins, vitamins, fiber, iron and calcium than the most common cereals. The bio-availability of micronutrients can be enhanced by different pretreatments (steaming, blanching, etc.). The present study was aimed to evaluate the effect of different pretreatment such as soaking, blanching, steaming etc. prior to drying on several engineering properties of pearl and foxtail millet. The mean geometric diameter of pearl and foxtail millet samples ranged from  $2.11 \pm 0.11$  mm to  $2.24 \pm 0.20$  mm and  $1.34 \pm 0.05$  mm to  $1.51 \pm 0.04$  mm respectively for all samples. The sphericity value of the pearl and foxtail millet was varied in between 0.65–0.68 and 0.96–0.99 respectively. The weight of one thousand grains increased after hydrothermal and steam treatment. Porosity for steamed pearl and foxtail millet was observed to be highest i.e., 64.17% and 57.44% respectively. The angle of repose increased for blanched sample and decreased for steamed samples comparatively. The moisture content was found highest for blanched sample of both pearl and foxtail millet i.e.,  $11.6 \pm 0.01\%$  and  $12.3 \pm 0.37\%$ , respectively. The steamed pearl and foxtail millet showed the best results required for further milling and other unit operations for processing of millets.

**Keywords:** Drying, engineering properties, foxtail, hydrothermal pretreatment, pearl millet

## Bioactive compounds of turmeric powder affected by grinding method and feed temperature

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<sup>2</sup>Department of Biotechnology, Junagadh Agricultural University, Junagadh, Gujarat- 362001

### ABSTRACT

The turmeric used as a ground powder. Turmeric grinding is carried out in grinding mill. During grinding operation, the temperature inside the grinding mill increases. The bioactive compounds along with their biological activity and stability depends on the grinding temperature. High temperature during grinding reduced the bioactive compounds along with their biological activity and stability. Four grinding methods and two feed temperature were chosen on the hypothesised mechanisms of reduction in temperature during the grinding. The effects of grinding temperature and feed temperature on the phenolic content, flavonoid content, antioxidant activity and curcumin content of turmeric ground powder were studied. Antioxidant activity, flavonoid content, curcumin content and phenolic content increased with decrease in grinding temperature. The temperature inside the grinding chamber at the end of grinding of 3 kg sample of turmeric reached to 43° C for traditional grinding, and this was reduced to 18.33 ° C for coolant circulation with low temperature feed. This reduction in grinding temperature resulted in the highest phenol content (3.13%), flavonoid content (1.43%), and antioxidant activity (59.31%) for coolant circulation with low feed temperature. Chilled water circulation with low temperature feed resulted the highest curcumin content (2.48%). This bioactive compound were significantly differed with grinding method as well as feed temperature.

**Keywords:** Turmeric powder, low temperature grinding, curcumin, flavonoid, phenolic, antioxidant activity



## **An investigation causes of post –harvest losses of major fruits in district Prayagra, Uttar Pradesh**

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### **ABSTRACT**

India is the second largest producer of fruits and vegetables in the world. Only 17% of arable land is being utilized for the cultivation of horticultural crops (27.2 million ha) and produced 329.86 million tonnes in 2020-21 with 2.05% higher than the previous year and 8.5% higher than the previous five years. The total production of fruit was 102.76 million MT with an average productivity of 14.51 MT/ha and vegetable production was 196.27 million MT with an average productivity of 17.11 MT/ha. The estimated economic value of post-harvest losses in India was INR 926.51 billion (USD 15.19 billion) in 2014 (Jha et al. 2015).<sup>1</sup> This was 0.6 percent of the country's GDP and two-and-a-half times higher than the budget of the Ministry of Agriculture and Farmers Welfare (MoAFW) in fiscal year (FY2014). The COVID-19 pandemic is exacerbating nutrition insecurity in India (Singh 2020). In a world where hunger and malnourishment are on the increase, unacceptable levels of food loss and waste call for urgent action. So far as its contribution to Indian economy is concerned, fruits and vegetables are grown only on 7 – 8 per cent of gross cropped area but contribute more than 18.8% of the gross value of agricultural output and 52% export earnings from total agricultural produce.

**Keywords:** Post-harvest, losses, crops vegetables fruits, malnutrition

## **Optimization of ultrasonic assisted hydrophobic deep eutectic solvent-based extraction of lutein esters from marigold using response surface methodology**

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### **ABSTRACT**

A hydrophobic deep eutectic solvent (HDES) based on two fatty acids namely caprylic (C<sub>8</sub>) and capric (C<sub>10</sub>) acid was employed as green solvent for extraction of lutein esters from marigold (*Tagetes erecta* L.) florets. Ultrasonic assisted extraction (UAE) technique was implemented for efficient extraction of lutein esters with HDES. HDESs with different molar ratio of the two fatty acids were prepared and characterized using FT-IR, NMR (H<sup>1</sup> and C<sup>13</sup>), DSC, density and conductivity measurements. Experiment was carried out following Box-Behnken design (BBD) of response surface methodology (RSM) to optimize the extraction conditions for maximum yield. Highest yield of lutein esters (7570.80 µg g<sup>-1</sup> d.w. on the basis of lutein equivalence) was obtained by extraction with the HDES having molar ratio 2:1 (caprylic acid: capric acid) at 60 mL g<sup>-1</sup> solvent to solid ratio (v/w) for 32.97 minutes of ultrasonication, closely matching with the model predicted value (7862.61 µg g<sup>-1</sup> d.w.). At the same solvent to solid ratio and ultrasonication time, conventional organic solvents (hexane-acetone 1:1 v/v) yielded only 5706.90 µg g<sup>-1</sup> (d.w.) lutein esters. SEM images suggested rupture of cells by cavitation process for high extraction efficiency of the technique. This green solvent therefore can easily replace the hazardous organic solvents for efficient extraction of lutein esters from marigold.

**Keywords:** Extraction, ultrasonication, deep eutectic solvent, response surface methodology, lutein esters

## Utilization of pomegranate by-product for oxidative and microbial stability of muffins

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### ABSTRACT

Pomegranate by-product especially rind portion which accounts about 50% of total fruit was utilized as a natural antioxidant and antimicrobial agent for oxidative and microbial stability of muffins. The pomegranate peel powder (PPP) was incorporated at the rate of 0% (control), 2% (T<sub>1</sub>), 4% (T<sub>2</sub>), 6% (T<sub>3</sub>), 8% (T<sub>4</sub>) and 10% (T<sub>5</sub>) by substituting refined wheat flour in preparation of muffins. The effect of incorporation of PPP on physical, nutritional, sensorial properties and shelf life of muffins was studied. The muffins fortified with PPP resulted to increase in fiber content from 4.39% to 10.66%, total phenols from 0.443 mg GAE/100g to 48.53 mg GAE/100g and antioxidant activity from 75.94% to 99.36%. On positive sides, for consumers on low calorie diet, can prefer the muffins with pomegranate peel powder which showed the reduction in energy values from 371.85 kcal/100g to 308.38kcal/100g. The significant reduction in the height, volume and specific volume of muffins was found with increase in the level of PPP. Moreover, the specific gravity and viscosity of muffins batter increased with incorporation of PPP. Muffins with up to the level of 8% PPP was organoleptically acceptable. The free fatty acid content was significantly increased from 0.27% to 1.36% in control sample and 0.18% to 0.71% in muffin with PPP. Similarly, peroxide value was increased from 3.04 to 6.08 meq. of O<sub>2</sub>/kg of oil (control) and 2.50 to 3.15 meq. of O<sub>2</sub>/kg of oil (T<sub>5</sub>). The muffins fortified with pomegranate peel powder showed higher oxidative stability when compared with control sample. The fortification of PPP in muffins not only retards the lipid oxidation, but also slow down the microbial growth and provide additional nutrition with respect to fiber content and bioactive compounds. The shelf life of muffins extended by 07 days when stored at room temperature and 15 days when stored at low temperature (5°C) as compared to control.

**Keywords:** Pomegranate peel powder, antioxidant activity, antimicrobial properties, muffins

## **Digestibility and stabilising properties of citric acid esterified cassava starches prepared at various concentrations and hydrolysis time**

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### **ABSTRACT**

Cassava (*Manihot esculenta*) root is the world's most important crop and is grown in every tropical country. South India produces the highest percentage of cassava in Asia. It has some superior qualities such as bland taste and flavour, high paste clarity, and a lower tendency to retrograde suitable for Citric acid (CA) modification. Compared to harsh chemicals, starch citrates are safe for human health. The properties of citrate starches (CS) are influenced by the modification process conditions and the botanic source. CA was applied to native cassava starch (NS) in three concentrations and hydrolysis times. CS was studied for its digestibility and stabilising properties. The stabilising properties, such as swelling power, solubility, and water absorption capacity, were higher than NS. CS had different pasting properties depending on concentration and time, but they had a higher pasting temperature than NS. SEM analysis revealed that NS granules (spherical and polygonal with a smooth surface) differed from CS (corrosion and exfoliation). The amylose content of citrate starches increases as the hydrolysis time increases. Resistant starch (RS) yield was directly proportional to amylose content. It could be a viable method for preparing RS with thermal stability and would be a good stabiliser.

**Keywords:** Citrate starch, starch modification, stabilizer, resistant starch

## **Export of Indian Spices –Analyses of Growth, Instability and Direction**

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### **ABSTRACT**

Indian spices and spice products were exported to 180 destinations globally in 2020-21 accounting to 15,65,000 tonnes valued at Rs. 27,193.20 crores and is the milestone for the first time. The study was planned to evaluate the growth and instability in export of Spices and analyze the direction of export. The study used secondary data for the period 2012-13 to 2020-21 for India. The findings revealed that seven major countries were importing spices and China was the major country which registered a growth in quantity of 41.44 per cent and in value terms 18.68 per cent. The coefficient of variation which reflects instability in exports was found to be the highest for China 14.65 per cent in terms of quantity as against value terms it was Sri Lanka with 134.92 per cent. The Markov Chain Analysis revealed that Indonesia was the main buyer of Indian Spices retaining 72.05 per cent of the previous year's share followed by China 69.31 per cent. The countries Sri Lanka and UAE would not be able to retain their share. The prediction of Spices exports indicated that China, Vietnam and UAE were the most important markets for India to concentrate for its exports. There is a need to concentrate on quality improvement, post-harvest management, export friendly policies, exporting to other countries through participatory approach involving all stake holders.

**Keywords:** Indian spices, export, growth, instability, Markov chain, prediction



**Valorisation of jack fruit seed instant soup mix - a sustainable food based approach to meet the challenges of malnutrition**

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**ABSTRACT**

Natural products have received considerable attention in recent years as key agent in antioxidant properties due to their diverse pharmacological properties. There are various food components which are known to improve the nutritional status and have antioxidant properties and provision of high quality protein with anti-catabolic and anti-inflammatory ingredients. Recent studies reported positive health benefits of jackfruit seed flour based products. The supplementation of jackfruit seed flour may improve the body composition, muscle strength, etc. However, evidence on the role of clinical efficacy is limited. Hence the study was conducted to evaluate the clinical efficacy of instant soup mix developed from jackfruit seed flour in patients with cancer related malnutrition. Randomly selected malnourished patients with cancer were included in the study. The basic design of the study was 30 days intervention trail. Selected biochemical and anthropometric measurements were observed before and after intervention period. Student t-test was used to detect significant changes within each group. Significant improvement was observed with jackfruit seed flour soup mix intervention in anthropometric and biochemical parameters. Highly significant difference was in weight ( $P < 0.000$ ) was observed. Total proteins ( $P < 0.001$ ) and albumin ( $P < 0.000$ ) were also observed significant results along with muscle strength and drastic reduction in urinary albumin was found. Malnutrition is a huge issue in India owing to a lack of protein consumption, to combat the malnutrition, the jackfruit seed flour may be utilised as coeffectve alternative protein sources for therapeutic benefits.

**Keywords:** Jackfruit seeds, cancer patients, proteins, albumin, soup mix, intervention

### Natural colour pigments as functional food ingredients

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#### ABSTRACT

Pigments of plant origin are gaining importance globally as a potential source of natural food colours for their versatility and avoid a variety of health hazards caused by synthetic colours. Palatability of food is enhanced by attractive colours. Colour, more than any other factor, influences the acceptance of products by consumers. Synthetic food colourants are being recognized as carcinogenic and harmful to the consumers, hence plant pigments are the alternatives. Regulating the use of synthetic colour and use of natural food colours are promising to have additional health benefits. The color of a food affects the consumer's choice and oftentimes adds a value to the food. Natural colors are associated with perceptions of being fresh and healthy and lead to willingness of purchase and increased appetite. Natural pigments of plant origins--such as chlorophyll, anthocyanins, and carotenoids--add not only colors to the food, but also potential health benefits to the consumers. Natural colour has long been used as a means of enhancing the aesthetic value of foods, beverages and cosmetics and for identifying drugs and other products. Extraction and purification of bioactive compounds from natural sources have become very important for the utilization of phyto-chemicals in the preparation of dietary supplements or nutraceuticals, functional foods and cosmetic products. Microencapsulation is a technology that is used for the protection, stabilization, and the slow release of core materials. There are several techniques and carrier materials that are available for microencapsulation of natural food colourants to overcome their instability, solubility and handling problems. The demand for natural source of such compounds is increasing day by day because of the awareness of positive health benefits natural compounds. It is therefore, essential to explore various natural sources of food grade colourants and their potentials.

**Keywords:** Natural colourants, pigments, nutraceuticals



## Quality Function Deployment (QFD)-Fuzzy logic approach to deduce consumer's requirement for the quality attributes of kheer

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### ABSTRACT

Product development and its acceptability into the market predominantly depends on consumer acceptance. Quality Function Deployment is a technique that throws light on importance of acceptability of the product from the consumer's perspective. Fuzzy logic is a mathematical approach which can be used to interpret vague and imprecise data to make strong decisions about vital characteristics of foods with regard to acceptability or ranking the superior and inferior attributes. In the present study, rice *kheer* samples were analyzed for sensory acceptability using the QFD-Fuzzy logic approach. The various stages employed for the QFD analysis included identification of consumer attributes (collected through online and offline survey tools) to computation and construction of a matrix to rate the quality parameters. Based on the analysis, it was deduced that cooking time of kheer had highest correlation with cooking temperature and rice: milk ratio in the product. Fuzzy logic was employed to conduct a similarity analysis for the product acceptability attributes by subjective evaluation with help of expert panel, that was pre-refined by adopting a ladder selection approach. The quality attributes for kheer were ranked as Taste & Flavour (extremely important)>Sweetness (highly important)> Colour & Appearance (important) > Body & texture (important). This study demonstrates the application of QFD-Fuzzy logic approach as a means to create a channel between consumer and the industry to customize product development activities based on consumer requirements.

**Keywords:** Quality Function Deployment, fuzzy logic, rice kheer, consumer acceptance, quality attributes

## Cooking quality, nutritional composition and consumer acceptance of functional jackfruit pasta enriched with red amaranthus

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### ABSTRACT

Jackfruit is an important tropical fruit grown extensively in homesteads of Kerala. Even though jackfruit is a pack house of nutritional components, it remains underexploited and faces huge postharvest loss. Jackfruit bulb and seed are rich in carbohydrates, proteins, fibre and other bioactive compounds and can be utilised for the development of value-added products with health benefits jackfruit pasta is promising as demand for nutritious pasta is increasing domestically as well as internationally. The present study aimed to develop red amaranthus enriched functional jackfruit pasta with natural red colour, nutritional qualities and consumer acceptability. The red amaranthus paste was added in two different proportions (5% and 10%) to different formulations of jackfruit pasta comprising of jackfruit bulb flour, seed flour and cassava flour replacing a portion of refined flour. The enrichment with 10% of red amaranthus as a paste to jackfruit pasta formulations reduced cooking loss, improved the cooking quality characters, nutritional quality, and sensory attributes and produced naturally coloured pasta with higher consumer acceptability.

**Keywords:** Red Amaranthus, enriched jackfruit pasta, cooking quality

### Development of enzyme linked immunosorbent assay using recombinant cathepsin B5 antigen for early diagnosis of bovine tropical fasciolosis: A new approach

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### ABSTRACT

Bovine tropical fasciolosis caused by *Fasciola gigantica* is a major parasitic disease in the tropical countries responsible for significant production losses in animal husbandry practices. In the early stage of the parasite i.e., juveniles cause havoc damage in the bovine host while migrating through liver. Globally the diagnosis of the disease is done by the detection of adult parasite's ova passed in the faeces and unfortunately no test is available to detect the infection at early stage when it causes maximum harm. The cathepsin B5 is a cysteine protease which is present in excretory-secretory product of the fluke predominantly in juvenile stage. The present study is aimed to develop an enzyme linked immunosorbent assay (ELISA) using recombinant cathepsin B5 protein as antigen. The developed ELISA showed 95.3% sensitivity and 92.4% sensitivity with a cut-off of 60% percent positive. It also showed 0.768 (95% CI 0.648 to 0.889) weighted Kappa value when compared with ELISA using native cathepsin antigen. 906 bovine samples collected from different parts of the country were screened and around 40 per cent seroprevalence was recorded. The developed assay can be exploited as a potential tool in the diagnosis of bovine tropical fasciolosis.

**Keywords:** Bovine, fasciolosis, cathepsin, ELISA

## **Influence of ultrasonication-assisted enzymatic extraction on physico-chemical, structural and prebiotic potential of soluble dietary fiber extracted from pomegranate peel**

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### **ABSTRACT**

Peel is a major bio-waste and a proficient source of numerous bioactive with no commercial significance. Thereby, ultrasonication-assisted enzymatic extraction was employed at varied sample concentrations as 2%, 5%, and 10% (sample to solvent ratio) for maximum extraction of soluble dietary fiber (SDF). The effect of sample concentration was perceived on the yield, techno-functional, structural, and prebiotic potential of extracted SDF. The maximum SDF yield was observed at 5% w/v sample concentration from the peel of two Indian pomegranate varieties namely Bhagwa and Daru as 27.74%, and 24.43% respectively. The proximate, and techno-functional properties of SDF unveiled competent activity with improved thermal stability and structural characteristics explicated *via* TGA and FT-IR respectively. The SEM unveiled porous and loosened structure with distinctive aspect ratio for voids. In addition, SDF samples also exhibited effectual prebiotic activity with the production of major short-chain fatty acids (SCFAs) as propionic (3.57±0.03 mg/ml) > acetic (2.40±0.01 mg/ml) > butyric acid (1.16±0.01 mg/ml) quantified *via* UPLC. Thereby, this study provides significant evidences to highlight the imminent role of waste fruit peel as an effective source of SDF unveiling profound prebiotic activity with impending industrial application.

**Keywords:** Soluble dietary fiber, peel, prebiotic, short-chain fatty acids, UPLC

## **Exploring the nutritional perspective of Azolla for its application as functional food ingredient**

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### **ABSTRACT**

Aquatic plants are unexploited sources of bioactive and functional compounds having potential as food ingredients for developing novel functional food and nutraceutical products. Azolla, an aquatic fern is an excellent source of nutrients, secondary metabolites and hence finds application possibilities in human diet. In the present work, the nutritional aspects as well as anti-nutritional factors in two species of Azolla; *Azolla pinnata* and *Azolla caroliniana* was carried out using standard methods. Results indicated its richness in protein with a good profile of essential aminoacids. Further its fatty acid as well as mineral profile indicated its suitability as functional ingredient in foods. The determination of the antinutritional factors showed that phytic acid, oxalate, tannin, saponin and hydrocyanide were present in both species of Azolla, but were below the critical limit. Among the anti-nutrients, saponin 0.0002%, respectively for *A.pinnata* and *A.caroliniana*. Results indicated the suitability of Azolla species for its food fortification on account of its rich nutrient profile as well as lower anti-nutrients.

**Keywords:** *Azolla pinnata*, *Azolla caroliniana*, water fern, nutritional profile, anti-nutrients



## Value addition and post-harvest technology of fruits and vegetables in India

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### ABSTRACT

The term "post-harvest technology" refers to a group of handling techniques and applications that keep fresh fruits and vegetables fresh from harvest till consumption. Increased post-harvest handling and processing are required to ensure that high-quality products reach to the markets, even while increased output is essential for a healthy agricultural industry. Transformation of agricultural raw materials, increases the value of marketed agricultural goods. In terms of global output of fruits and vegetables, India comes in second. Production of fruits and vegetables is around 45 million tonnes and 85 million tonnes, respectively. Lack of effective infrastructure for harvesting, processing, and storing the Rs 230 billion worth of crops is expected to result in losses of 20–30%. In order to increase agricultural productivity, post-harvest support mechanisms like normal and cold storage facilities, packaging facilities, agro-processing industries, crop sterilization and sanitation facilities, and an effective marketing reach to international markets must be developed concurrently. Ultimately, post-harvest technology is essential for ensuring that crops are transported and stored appropriately. It might cut down on waste and raise crop quality. The optimal technology must be selected for each crop out of the several that are available.

**Keywords:** Value addition, post-harvest, productivity, processing

### Preparation of porous corn starch: Optimization, characterization and its application studies

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### ABSTRACT

Porous starch (PS) was prepared using enzymes amyloglucosidase (AMG) and amylase (AM) from corn starch (NS) and was standardized using two factorial experimental design with respect to pore size and surface area distribution. The porous structures in the granules was confirmed by SEM images. Based on statistical analysis 300U AM and 250U AMG for 6h incubation was proposed for the preparation of PS. The PS and NS was compared on the basis of physico chemical characteristics such as FTIR, DSC, XRD, zeta potential, contact angle and rheology, which proposed the capability of PS as stabilizer for oil in water emulsions. The emulsion stabilizing efficiency of PS was confirmed with creaming index of 5.0 % and NS with 16.6%. Microstructure characteristics of emulsion via fluorescence microscopy stained with Nile red and Safranin confirmed that PS act as Pickering particle. Further PS serve as better bioactive carrier, while using curcumin as model system, compared to NS system. PS shows curcumin holding capacity of  $82.24 \pm 1.07$  whereas NS shows  $61.03 \pm 1.43$  %. This study suggested the efficiency of PS as Pickering particle and as carrier of active molecules and bioactive phytochemicals in food, pharmaceutical and nutraceutical applications.

**Keywords:** Porous starch, pickering particle, fluorescence microscopy, bioactive carrier

## **Combined effects of 1-MCP and MAP on fruit quality of guava cv. Arka Mridula during cold storage**

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### **ABSTRACT**

The study aimed to investigate the effects of 1-MCP combined with MAP on guava stored at 12 °C and 8 °C. Guava fruits treated with 1-MCP 500 ppb were packed in polypropylene (PP 40 µm), low density polyethylene (LDPE 40 µm) and Cryovac® PD-961 (PD 31.5 µm) with and without micro-perforations along with a set of control fruits. The results revealed that 1-MCP treated fruits packed in PP-NP had higher firmness (10.34 kg/cm<sup>2</sup> and 17.73 kg/cm<sup>2</sup> at 12 °C and 8 °C respectively), with higher negative a\* value and lesser b\* value when compared to MA packed fruits alone. 1-MCP treated fruits integrated with MAP (PP-NP) had lower PLW (3%) when compared to 1-MCP treated fruits alone. 1-MCP treated fruits integrated with MAP (PP-NP) had higher retention of all major biochemical parameters like TSS (9.81 and 12.71 %), acidity (0.67 and 0.53 %), vitamin C (72.03 and 125.33 mg/100g), reducing sugar (4.63 and 5.82 %) and total sugar (6.59 and 7.60 %) at 12 °C and 8 °C respectively. The study also showed that the 1-MCP 500 ppb plus PP-NP had lower enzyme activity for peroxidase (267.75 X 10<sup>3</sup> ΔABS/min/ml). The other useful combinations were PP-MP +1-MCP and PD-NP +1-MCP that helped to extend the storage life in guava. Thus, integration of ethylene action inhibitor with modified atmosphere package can enhance the storage life in guava up to 3 weeks and 4 weeks at 12 °C and 8 °C respectively with acceptable all quality attributes.

**Keywords:** Guava, 1-MCP, ethylene inhibitor, quality, shelf-life

**Development of coloured guava varieties as bio-fortified guava**

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**ABSTRACT**

Guava (*Psidium guajava* L.), traditionally known as a good source of vitamin C. This 'super fruit' have numerous amazing health benefits. This Mexican fruit well adapted under Indian conditions also and India considered as major guava producer of the world. Guava is liked as fresh fruit as well as for processing purposes. This indicates scope of utilization of this nutritious fruit in number of ways. Coloured guavas although well-known from decades, but their importance and utilization did not recognized fully. 'Colour' not only adds attractiveness and makes more appealing to the consumer; but the responsible pigments for colour add nutritive value also. Breeding guavas for colour adds more nutritive value to the vitamin C rich normal guava. It also makes it more suitable for various types of processed products. Our guava improvement work for coloured guava varieties started from standardization of parents for pulp colour, selection of parents for hybridization, F<sub>1</sub> population generation, molecular and biochemical evaluation of F<sub>1</sub> population for pulp colour. Promising results are coming in terms of understanding of basis of various pulp colour, their molecular regulation and most importantly promising coloured guava F<sub>1</sub>s to release as varieties in future.

**Keywords:** Anthocyanins, guava, lycopene, pigment, pulp colour

**Engineering properties of pretreated sorghum and kodo millet**

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**ABSTRACT**

Millets, also termed as miracle grain and superfood, are an umbrella term for 20 types of cereal grasses belonging to the Poaceae family those grains are cultivated for human food and animal fodder. Millets are super rich in proteins, crude fiber and micronutrients like calcium, phosphorus and iron. The qualities of millets can be improved if pre-treatments (steaming, blanching, etc.) are applied before processing and engineering properties such as geometric mean diameter, true and bulk density, porosity, can be impacted. The present study was conducted to investigate the effect of pretreatment on the engineering properties of pretreated dried samples. The standard AOAC methods were used to determine the engineering properties of pretreated sorghum and kodo millet. The moisture content of blanched sorghum and kodo millet was observed highest to 11.40±0.06% (wb) and 12.89±0.05% (wb), respectively. The size of sorghum grains was observed to be highest for blanched samples. There was no significant change observed in the sphericity of the samples that is due to uniform absorption of water. The increase in the 1000 grain weight was observed approximately 50% for blanched sorghum and kodo millet. The porosity of pretreated samples was increased when compared to original sample and angle of repose was observed the highest for blanched kodo and sorghum millet due to high moisture content. The results showed that blanched sorghum and kodo millet have better effect on engineering properties required for further milling and processing of respective grains.

**Keywords:** Angle of repose, kodo, moisture content, porosity, pretreatment, sorghum

## Evaluation of nutritional composition of traditional foods prepared from black rice

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### ABSTRACT

Traditional foods namely *cooked rice*, *chak-hao tan* (fried pancake), *kheer* and *chak-hao kabok* (black rice laddoo) were prepared from black rice (*Poireiton chak-hao*) and evaluated for its nutritional composition. AOAC method was used to analyze proximate composition and mineral content whereas, DPPH method was followed to evaluate the antioxidant activity of traditional food prepared from black rice. Proximate analysis revealed good amount of protein content in the black rice traditional foods with the highest recorded in *Kheer* (13.48 %). Traditional foods had the fat, ash, crude fibre and total carbohydrate content of 2.03 to 5.05, 1.51 to 1.65, 1.73 to 2.26 and 72.92 to 84.82 % respectively. Iron content was found highest in black rice laddoo (4.53 mg/100g) followed by *kheer* (3.67 mg/100g). Zinc content of traditional foods ranged from 1.33 to 1.93 mg/100g. Phytonutrient analysis showed highest polyphenol content and antioxidant activity in black rice *kheer* with the value of 55.46 mg GAE/100g and 51.21 % DPPH respectively. Traditional foods prepared from black rice has good amount of nutrients and phytonutrients, therefore should encourage consuming traditional foods of black rice to the public.

**Keywords:** Black rice, nutrient composition, antioxidant activity

### Essential oils: a lucrative business option in India

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### ABSTRACT

Essential oils are aromatic essences extracted from natural plant sources and synthesized artificially. They can play a significant role in the day to day life used in perfumery, pharmaceutical, paint industries, packing material, food additives, sanitary and cosmetic products. India is one of the few countries in the world having varied agro climatic zones suitable for the cultivation of most of essential oil bearing plants. Due to increased awareness of health hazards associated with synthetic chemicals coupled with the increase cost of petroleum products, the use of essential oils has been gradually increasing. A number of essential oils from palmarosa, citronella ginger grass, mint, lemon grass, eucalyptus cedar wood, lavender oil, davana oil, celery seed oil and other oils have been widely used in a variety of products in India. Approximately 90% of the present requirement of essential oil in the country is met by the indigenous production and 10% from import. New technologies are now available for increasing the production of natural essential oils at farm level and value added products and end products at factory level. The increasing importance of essential oils and pigments aids not only as potent ingredient and coloring agents but also being a wide opportunity for global marketing.

**Keywords:** Essential oil, pigments, packing material, pharmaceutical, food additives

**Feasibility of vacuum based cooling system for on farm cooling of milk**

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**ABSTRACT**

India ranked 2<sup>nd</sup> in term of population and 1<sup>st</sup> in milk production but still the value addition of milk is about 23%. However, increasing incidences of malnutrition throughout the world, it become necessary that every grain of food and each drop of milk must be saved and delivered to the consumer in a scientific manner. Though, milk is considered as complete food, but its perishable nature resulted in its easy spoilage, if not stored at proper temperature specially in tropical country like India. The microbes easily grow in the ambient temperature, so the cooling of milk immediately after milking is necessary to suppress the growth of microbe. Most of the current cooling systems are based on the refrigerants like R134a (HFC refrigerant) having high coefficient of performance but, these refrigerant have disadvantage of emission of harmful gases like CFCs which results in global warming and ozone depletion. A double cavity insulated system was designed with vacuum assembly. Vacuum based cooling system for on farm cooling of milk which helps to cold supply chain of milk. In this cooling system water used as refrigerant so it is eco-friendly. With the designed system, the milk temperature drops from 37<sup>0</sup> C to 12.5<sup>0</sup> C within one hour so it may possible to prevent the milk spoilage up to 8 hours.

**Keywords:** Malnutrition, milking, global warming, vacuum, milk spoilage

**Exapansion of a low - cost ripening chamber for ripening of mango and all fruits**

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**ABSTRACT**

Mango (*Mangifera indica*) is a widely consumed fruit in tropical/subtropical regions around the world due to its excellent flavor and taste, and valuable source of nutrients and phytochemical compounds. As a climacteric fruit, mango is easily found everywhere here we see that ripening chamber can be commercially used for ripening of mango where ethylene gas would be used and temperature, relative humidity and other parameters are maintained during ripening process. The cost of ripening chamber and operating cost are the major limiting factors for its adoption by small traders or farmers. In this study, a low cost plastic ripening chamber was developed where ripening mixture of water (1.2 litre), ethrel (0.93 ml) and sodium hydroxide (0.5 g) was used for release of ethylene gas. The unripe mature mangoes (Alphonso) in plastic crates were kept inside the air tight ripening chamber for 24 h for enhancing ripening process. The sensory study showed that mangoes ripened with ethylene gas were superior to untreated ones. The operating cost for mango ripening was 1.96 paise per kilogram.

**Keywords:** Mango, ripening chamber, commercial, water, ethrel

**Fruit and vegetable waste: a potential source of bioactive composites**A. D. Chaudhary<sup>1</sup>, Archana V. Mahida<sup>2</sup>, T. R. Ahlawat<sup>3</sup>, M. S. Sankanur<sup>4</sup>, and Vrutti K. Patel<sup>5</sup><sup>1,2,3</sup>CAAST Secretariat, Directorate of Research, NAU, Navsari, Gujarat -396450<sup>3</sup>Director of Research & Principal Investigator, NAHEP-CAAST Sub Project, NAU, Navsari, Gujarat -396450<sup>4</sup>Assistant Professor, Department of Forest Biology & Tree Improvement, NAU, Navsari, Gujarat -396450**ABSTRACT**

Fruits and vegetable wastes are one of the major horticulture wastes generated during the harvesting, post-harvest handling, storage processing of these perishable commodities. Waste utilization of horticulture produce from supply chain of horticultural commodities and postharvest industries is highly indispensable and challenging task all around the globe. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security India has achieved the average annual growth rate of 3.7% of GDP in agriculture and allied sectors during the eleventh five-year plan, against the target of 4%. Fruits and vegetable crops are highly nutritious and crucial role and major portion of our daily diet. It also rich in some other secondary metabolites that can be beneficial as adjuvant in the management of several health care issues other degenerative diseases. The United Nations and FAO has estimated that losses and waste in fruits and vegetables are the highest among all types of foods, and may reach up to 60%. However, these wastes showed magnificent potentiality of re-utilization in several industries owing to as rich source of different bioactive compounds and phytochemicals. These significant huge amounts of lost and wasted fruits and vegetables, and their components, represent not only losses of edible food materials but also the wasting of by-products including bioactive compounds of great potential benefits for various industries.

**Keywords:** Phytonutrients, horticulture wastes, secondary metabolites and bioactive compounds

**Analysis of shrimps products export from India using Markov-chain analysis**K. M. Santhosha<sup>1</sup>, A. D. Naik<sup>2</sup>, B. K. Naik<sup>3</sup>, Vilas Kulkarni<sup>4</sup> and Narayan Moger<sup>5</sup><sup>1,2,4</sup>Department of Agribusiness Management, UAS, Dharwad- 580 008<sup>3</sup>Department of Agricultural Economics, UAS, Dharwad- 580 008<sup>5</sup>Department of Agricultural Biotechnology, UAS, Dharwad- 580 008**ABSTRACT**

The present study was conducted to examine the market and product wise growth and direction of shrimps export from India. This study was based on secondary data on market and product-wise marine export in terms of quantity and value collected from Marine Products Export Development Authority of India Website. Markov Chain Analysis and Growth rate tool were employed to analyse the direction of export of shrimps over time. The finding reveals that from 2011-12 to 2020-21; the USA was the major importer of shrimps with 18.66 per cent as well as recorded the highest growth except for South East Asia with growth in shrimps export to all countries was positively significant. In 2011-21, among all shrimp products exported, frozen shrimp was the major product exported to the other countries. With respect to product wise growth, all items have shown significant positive growth but frozen shrimps have recorded the highest significant and positive growth. With respect to export competitiveness of markets USA, SEA and China are the more loyal among importers of shrimps as reflected by a higher probability of 1.0, 0.79 and 0.72 respectively whereas in case of shrimps product item wise, frozen shrimps was the only product which is maintaining the stable market and remaining product has moderate to least market.

**Keywords:** Shrimps products, export, Markov chain, transitional probability matrix



### **Nanoencapsulation of bioactive components: A cutting edge technology**

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#### **ABSTRACT**

The use of various nanoencapsulation techniques to include food ingredients into diverse food items, or "functional foods," has drawn increasing study attention over the past two decades. Emulsification, spray drying, coacervation, liposomal/niosomal entrapment, protein-polysaccharide complexation, inclusion complexation, encapsulation within solid lipid nanoparticles/nanostructured lipid carriers are some of the encapsulation methods. Various bioactive ingredients like polyphenols, carotenoids, vitamins, minerals, essential oils and flavours can be delivered which has therapeutic potential to cure several lifestyle disorders. Encapsulation can be used to protect and release bioactive substances under regulated conditions at the appropriate time and location. Besides this method offers some promising benefits in terms of increasing the solubility and dispersibility of bioactive compounds (especially water - insoluble compounds) in food, managing their release in the digestive tract, concealing their unfavourable sensorial properties, enhancing the physical and chemical properties in food during processing and storage and sustaining their effectiveness in the human body. Dairy products, breakfast cereals, meat products, bakery products are some of the examples of food products that contain nanoencapsulated bioactive compounds. Henceforth, nanotechnology has the potential to enhance the quality of food in terms of taste, packaging and storage, as well as making it more wholesome and palatable.

**Keywords:** Nanoencapsulation, capsules, bioactive components, functional foods, therapeutic potential.

## Formulation and sensory evaluation of Grand-9 banana pseudostem flour incorporated laddu

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### ABSTRACT

In the modern world, especially food industries were focused on the utilization of agricultural wastes and the development of value-added products. India, one of the largest producers of bananas, produces a huge amount of biological waste after harvesting. The pseudostem of bananas had high nutritional properties. It can be utilized by the food industries to develop value-added products. The present study was done with the objective of formulation and sensory evaluation of laddu prepared with banana pseudostem flour. The control laddu was prepared with besan flour. The pseudostem incorporated laddu was prepared by the addition of 2-10% Grand-9 banana pseudostem flour (GBSF). Five formulations of laddu were designed by substituting the besan flour with GBSF in different proportions (2%, 4%, 6%, 8% and 10%). All five formulations of laddu were subjected to sensory evaluation and assessed sensory quality characteristics to select the best accepted laddu using 9-point hedonic scale. The 6% incorporated laddu scored maximum in all the sensory attributes i.e. appearance (8.33), flavour (8.16), taste (8.00), texture (8.13) and overall acceptability (8.06) except colour (7.73) which was high in 2% formulated laddu (8.26) among all five formulations. Thus, 6% incorporated GBSF laddu had better sensory characteristics and can be encouraged to enhance nutritional value, especially fibre content of food products. In this way, agriculture plays a vital role in food security and helps people in improving their diets.

**Keywords:** Grand-9 banana pseudostem, laddu, food security, value-added, nutritional value

### Chemical analysis of grape seed powder

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### ABSTRACT

Grape seeds (*Vitis-Vinifera L.*) are good sources of phyto-chemicals and are suitable raw materials for the production of antioxidant rich dietary supplements. Grape seeds are rich in proanthocyanidins which possess potent free radical scavenging activity. The proximate composition of grape seed and micro nutrients were 38.2% fiber, 15.8% total lipids, 10.7% proteins, 2.58% ash, 22.37% carbohydrates and 10.4% moisture, micronutrients and phytochemical analysis of grape seed extract revealed the presence of steroids, terpenoids, anthocyanins, emodins, glycosides, flavonoids and phenols in acetone (70%), ethanol (70%) and methanol respectively. Both steroids and terpenoids were absent in water extract. Saponins were absent in methanol and water extracts. *DPPH* assay was used to estimate the antioxidant activity and the results revealed that antioxidant activity in grape seed % inhibition IC<sub>50</sub> (µg/ml) method shows that extraction was followed in methanol 96.35, followed by ethanol 90.25, acetone and water. In IC<sub>50</sub> (µg/ml) high value of antioxidant in grape seed water followed by ethanol and least one methanol and ethanol. Acetone (70%) is the most efficient solvent to extract the total phenolic compounds and flavonoids from grape seed when compared to the other selected solvents for the study.

**Keywords:** Grape seed, chemical, phenolic, flavonoids, antioxidants, and phytochemicals



## Phytochemical profile, antioxidant and antimicrobial activities of methanolic extracts of betel leaf (*Piper betel*)

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### ABSTRACT

The presence of unique phytochemicals as secondary metabolites is accountable for the traditional and commercial uses of *Piper* species. Currently, demand for its products such as herbal drugs and medicines has increased. In view of this, the current study is designed with the aim to investigate the physio-chemical, phytochemical, antioxidant, and antimicrobial properties of methanolic extracts of three different cultivars of *Piper betel*. *Piper betel* Nadan, Koottakkodi nadan, and Salem variety (FRLH 123436, FRLH 123437, and FRLH 123438) were collected from local farms in Malappuram district, Kerala. Crude lipid content was observed to be similar in all the varieties, while crude protein ranged between 3.4-4.1 g%. The calcium content was relatively high in Salem (6600 ppm). The Nadan variety was found to have high phenolic (42.7mgGAE/g) and tannin content (1.9 mgTAE/g), while Salem had high flavonoid content (1.90 mgRE/g). The DPPH assay indicated the relatively radical scavenging activity for Nadan variety that could be attributed to the high phenolic content. Nadan variety showed significant antimicrobial activity against *S. aureus* and *E. coli* whereas Koottakkodi nadan showed against *B. cereus* and *P. aeruginosa*. The antioxidant and antimicrobial properties of methanol extract of *Piper betel* could be harnessed for various applications. The bioactive components may exhibit immense biological significance which reveals their uses for various therapeutic purposes and food applications.

**Keywords:** *Piper betel*, antioxidants, phytochemicals, antimicrobials

### Development of exotic jambu fruit (*Syzygium samarangense*) incorporated ice-cream

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### ABSTRACT

The Jambu fruit (*Syzygium samarangense*) is rich in vitamin-C, potassium and calcium, which has a unique sour-sweet taste and texture. The fruit is extensively grown in southeast Asia and parts of India. It has high medicinal value, rich in antioxidant and antimicrobial constituents. In the context of value addition jambu fruit ice-cream was developed. The product was prepared by mixing jambu pulp with sugar in a ratio of 2:1 on weight basis and whipping cream at 5°C was added to the mixture followed by addition of condensed milk. The mixture was homogenized at 1500 rpm for 2 min to achieve uniformity. The mixture was then allowed to freeze at a temperature of -20°C for 8 hr. The ice cream had a brix value of 12.63%, TSS 38.45% and color values L: 47.34, a: 44.58, and b: 15.16 and has soft consistency with a pleasant aroma and flavor. The sensory evaluation constituting 30 people of different age groups has shown larger acceptability among all the age groups.

**Keywords:** Jambu fruit, ice-cream, new product development, value addition

## Optimization of process parameters for extraction of wild jamun (*Syzygium cumini* L.) juice

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### ABSTRACT

The present study was conducted to prepare wild jamun juice from pulp extracted by using different physical (T<sub>1</sub>: crushing followed by heating then pulping, T<sub>2</sub>: crushing and pulping, T<sub>3</sub>: hot pulping without crushing, T<sub>4</sub>: cold pulping without crushing) and enzymatic methods along with their quality evaluation. The treatment T<sub>3</sub> (hot pulping without crushing) obtained the highest sensory quality scores for color (7.90), body (7.60), taste (7.54), aroma (7.67) and overall acceptability (7.54). Highest juice yield, TSS, sugars and total phenol content of juice was recorded in the same treatment. The pulp obtained by hot pulping without crushing was subjected to different enzymatic treatments viz. Pectinase (0.04-0.12%), Viscozyme (0.05-0.50%) and Pectinase +Viscozyme (1:1) for extraction of juice. On the basis of sensory attributes and some physical characteristics of juice it was concluded that to convert pectin rich pulp of wild jamun into a juice of desired apparent viscosity and quality, the use of 0.08 per cent Pectinase enzyme for 90 minutes of holding time at 45° C temperature was found most effective treatment as compared to others. Thus, free flowing juice from mucilaginous wild jamun pulp can easily be converted into various commercial value-added products.

**Keywords:** Jamun, juice, pectin, pectinase, quality, wild

## Buckwheat's physico-chemical and functional properties as well as its exploration in multigrain bread as a functional food

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### ABSTRACT

The present experiment was conducted to study buckwheat's physico-chemical and functional properties of its grains and flour (s) for developing multigrain bread. Buckwheat's physico-chemical properties viz., bulk density, true density, porosity, hydration capacity, hydration index, swelling capacity, and swelling index, and its flour addition in composite flours had considerable effects on their functional properties. Composite flours of wheat, buckwheat, and sago in the ratios T<sub>1</sub> (50:50:05), T<sub>2</sub> (50:50:10), T<sub>3</sub> (50:50:15), T<sub>4</sub> (60:40:05), T<sub>5</sub> (60:40:10), T<sub>6</sub> (60:40:15), T<sub>7</sub> (70:30:05), T<sub>8</sub> (70:30:10) and T<sub>9</sub> (70:30:15) contain all functional properties i.e. bulk density, swelling capacity, foam capacity, foam stability, water absorption capacity and oil absorption capacity in the right proportion to develop good quality multigrain bread. It can be concluded that the utilization of such functional food (s) will not only give relatively cheap and nutritious value-added food products which can also find popularity in the mass market and contribute to national food and nutritional security.

**Keywords:** Bread wheat, buckwheat, sago, value added food products



## Good agriculture practices for sustainable agriculture: A case of mango in Malihabad region of Uttar Pradesh

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### ABSTRACT

Mango is the major fruit crop produced in Malihabad region of Uttar Pradesh. Dashehari mango is widely grown in this region and it is the major source of livelihood for the farmers. Malihabad's Dashehari mango bears Geographical Indication (No. 125) from India's Geographical Indication Registry, attesting to its excellence taste and aroma. However, the capacity of mango orchards to meet the livelihood of the farmers is declining over the years. This is due to the changing pest dynamics, climate change, old and senile orchards, besides other factors such as large number of market intermediaries, huge post-harvest loss coupled with lack of processing industries. Participatory Rural Appraisal techniques were carried out initially to identify the constraints in mango production. Non application of fertilizers, indiscriminate use of pesticide and insecticide, traditional method of harvesting, low price realization, lack of branding and modern packaging was the major hurdles. Good Agricultural Practices (GAP) in mango was demonstrated in three villages of Malihabad region under Farmers FIRST project. Data was collected from 135 adopters and 250 non adopters. Total variable cost of GAP adopters increased marginally as the expenditure on fertilizer human labour, packaging, marketing increased while, expenditure on chemicals decreased. GAP adopters realized an increase in yield by 17 percent. Linkages were also developed for direct and distant marketing of mangoes. The impact of GAP adoption was assessed using Propensity Score Matching (PSM) Technique and the results indicated that the average treatment effect on treated (ATT) was Rs. 88732.00 per ha. Adoption of Good Agriculture Practices (GAP) contributes towards sustainable agriculture aiding to meet the Sustainable Development Goals (SDGs).

**Keywords:** Mango, GAP, impact, SDG, PSM

## Nano coatings for improving the post-harvest life of vegetables

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### ABSTRACT

India is the second largest producer of vegetables in the world and about 30% losses occur due to pre and post-harvest losses. Fresh vegetables have short shelf life because of high respiration rate, high moisture content, bulky nature and pathogen attack. We can enhance the shelf life by introducing new technologies. Nanotechnology refers to the creation and utilization of materials, devices and systems through the control of their properties and structure at a nanometric scale. For post-harvest loss management, nanotechnological aspects like nanosensors, nanopackaging and nanocoating are used in vegetables. Nanocoatings are preferred over edible coatings these days. These coatings are biodegradable and environmental friendly. Experiments conducted using nanocoating revealed that the shelf life of the vegetables increased along with preservation of moisture, flavor and quality. There are no reports regarding any ill effects of nanocoatings till date. So, there is a need for extensive studies in this area to increase the shelf life and other properties of the vegetables without any harmful effect on the humans and well-being.

**Keywords:** Vegetables, nanocoatings, edible films, environment

### Development and evaluation of instant *dosa* mix from underutilized millet brown top millet

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### ABSTRACT

Millet has immense potential health benefit and play important role in national food security. An experiment was carried out to develop an instant *dosa* mix from brown top millet. The formulation of millet based *dosa* mix at 30 per cent rice, 40 per cent brown top millet, 25 per cent black gram and 5 per cent fenugreek seed accepted as best formulation with over all acceptability score of 8.5. The instant *dosa* mix had moisture 7.1 g, protein 15.87 g, carbohydrate 67.73g, crude fiber 10.16 g total mineral 3.64 g, total energy 337 kcal, dietary fiber 9.0 gm, calcium 39.6mg and iron 6.7mg per 100g. Shelf life study revealed that overall acceptability scores decreased gradually in samples stored at ambient condition (8.5 to 5.50). Moisture and peroxide values increased with increased storage period (7.15 to 7.70g and 0.05 to 0.11 MEA/kg respectively). *E. coli* was not detected during storage period.

**Keywords:** Instant *dosa*, millet, brown top



### Development of *gulabjamun* with incorporation of kodo millet

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#### ABSTRACT

Milk and dairy products are considered as ‘nearly complete’ foods but are poor source of iron and fibre. Millets are good sources of minerals and fibre but are deficient in lysine. The present study was an attempt to formulate a food product from milk-millet combination. *Gulabjamun* is a sweet indigenous commodity, commonly prepared from *khoa* in the country's northern, western, and central regions. The present study was undertaken to develop value added *gulabjamun* with *khoa* and kodo millet for better nutritional profile. Value added *gulabjamun* was prepared by incorporating kodo millet flour at 20% (GJK1), 30% (GJK2) and 40% (GJK3) based on the weight of *khoa*. Sensory evaluation study revealed that GJK1 was best accepted among the variations and obtained an overall acceptability score of 8.53. The value added *gulabjamun* GJK1 had a moisture content of 33.41%, 12.39g fat, 8.86g protein, 1.26g ash, 1.24g crude fibre, 26.8µg vitamin A, 148.67g calcium and 0.789mg iron per 100g. Though the rheological attributes showed a decreasing trend with incorporation of kodo millet, the native texture of *gulabjamun* was retained. Millet incorporated *gulabjamun* (GJK1) had a shelf life of 5 days at room temperature and 15 days at refrigeration temperature. Thus, kodo millet can be successfully incorporated to *gulabjamun* with highly acceptable sensory attributes.

**Keywords:** Gulabjamun, kodo millet, nutritional analysis, texture analysis, shelf life study

**Paper sweet (*Pootharekulu*)– A traditional sweet of two Telugu states**Sivamma P<sup>1</sup> and Jagannadha Rao P.V.K.<sup>2</sup><sup>1</sup>*Dept. of Processing and Food Engineering, Dr. N.T.R. College of Agricultural Engineering, ANGRAU, Bapatla, Andhra Pradesh, India-522 101*<sup>2</sup>*Dept. of Processing and Food Engineering, Regional Agricultural Research Station, Anakapalle, Andhra Pradesh, India-531 001***ABSTRACT**

Paper sweet is one of the famous and must have sweets of Andhra Pradesh. It is a thin layered sweet made of rice starch based edible film, jaggery/sugar, clarified butter and chunks of dry fruits and/or nuts. In the two Telugu states (Andhra Pradesh and Telangana), paper sweet is very well known and is widely recognized because of its taste and mark looks. The crispy rice paper is the heart of the sweet and prepared by using rice starch based batter spread on wood-fired earthen pot. Edible film is coated with clarified butter and wrapped itself expertly along with sugar or jaggery powder and chunks of dry nuts/fruits. A gentle application of clarified butter softens the paper to allow folding in the fillings. Paper sweet significance extended not only to Indian cities but also in abroad. In spite of its popularity, paper sweet is limited to its geographical origin due to the limited production because of the tedious process involved in preparation of rice paper. Therefore, the scope of introducing technology for mechanizing the process can be explored and research can be initiated in this line.

**Keywords:** Edible film, paper sweet, *pootharekulu*, rice batter, rice paper and traditional sweet

**Nutraceuticals: an overview**

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**ABSTRACT**

Nutraceutical is a term framed by combination of two terms 'nutrition' and 'pharmaceutics'. These are foods or a part of food that protect us from chronic diseases like Parkinson's disease, Alzheimer's disease etc., and help us in improving our health as an alternative to modern medicine. Nutraceuticals are gaining attention in recent days to avoid chronic diseases as prevention is better than cure. These are also well-known for increasing life expectancy and delaying aging process. There are four groups of nutraceuticals like functional food, dietary supplements, medicinal food, and pharmaceuticals. Examples of nutraceuticals include minerals, vitamins, ginger, dietary fibre, garlic, hydrolyzed proteins, soybeans and so on. We are considering the therapeutic values of natural products from centuries and in recent times these substances are considered as antimicrobial, anticancer, immunity booster and so on. At the present time as people are more concerned about their health nutraceuticals are having high demand in the market.

**Keywords:** Nutraceuticals, health, chronic diseases

**Production and storage studies of fermented beverages from blood fruit and aonla**Rapunga Flory H<sup>1</sup>, Arvind Kumar Chaurasiya<sup>2</sup> and Elavena War<sup>3</sup>*Department of Horticulture, North Eastern Hills University, Tura-794001***ABSTRACT**

An investigation on “Production and Storage Studies of Fermented Beverages from Blood Fruit and Aonla” was Conducted in the Laboratory of Department of Horticulture, NEHU, Tura Campus, Tura, Meghalaya during the academic year 2019-20. Blood fruit and aonla pulp were blended in different proportion and laid out in Completely Randomized Design. From the finding it was observed that, there was decrease in total soluble solids, reducing sugar, ascorbic acid and total monomeric anthocyanin content while ethyl alcohol %, acidity content and taste score increases after six months of storage. T<sub>1</sub> (Blood fruit 100 %), was considered the best treatment securing highest ethyl alcohol and maximum score for overall acceptability as compared to other treatment. Blending proportion Blood fruit + aonla (90%+10%) recorded highest total monomeric anthocyanin content while maximum ascorbic acid and acidity were recorded in T<sub>2</sub>(100% aonla). The results revealed that the fermented beverages prepared from all the treatments were acceptable .So, they can be recommended for commercial production, generate employment and reduce post harvest losses.

**Keywords:** Blood fruit, aonla, fermented beverages, storage.

**Post-harvest preservation of jasmine (*Jasminum multiflorum*) by increasing its shelf life by using sucrose solution**B. Ameer Pasha B<sup>1</sup>, B. S Nalini<sup>1</sup>, R. M. Salamankhan<sup>1</sup> and R. Muthuraju<sup>1</sup>*<sup>1</sup>Department of agricultural microbiology, University of agricultural sciences Bengaluru-560065***ABSTRACT**

The jasmine (*Jasminum multiflorum*) is intensely attractive and these species do not have any scent, but they are an extremely short shelf-life which limits the commercial use of flowers which deteriorates within four days. In order to find some novel processing technologies which can extend the shelf-life and ensure the commercial use of flowers. We conducted an experiment using sucrose solution with different concentrations. The sucrose was weighed at 10gm, 20gm, 30gm, 40gm, and 50gm and dissolved in 1000ml of water separately to prepare concentration. The jasmine weighed 100gm of each and dipped in a solution of different concentrations for 15min and then the entire water is drained out and air dried at room temperature, once the flower is air dried then it is packed in high-density polyethylene bags mildly punctured with needles in the bag and observed for its shelf life. Among them the concentration of 40gm and 50gm showed long shelf life of up to seven days.

**Keywords:** Jasmine, shelf-life, quality

## **Utilization of unmarketable as well as surplus mango fruits using combined processing technologies for sustainable mango production & consumption**

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### **ABSTRACT**

Mango production in India suffers from abnormal weather conditions, rains & wind etc. which results in dropping of huge quantity of fruits which sometimes become unmarketable causing economic loss to farmers. Apart from this, about 30-40 % of harvested mangoes are discarded due to uneven ripening, misshapen, sourness, fineness including minor damage to raw fruits. The technologies to convert such inedible fruits which mostly are discarded is discussed in this paper with an aim to make mango production and consumption more sustainable. Various combined processing techniques involving deacidification, vacuum impregnation, osmotic infusion, freezing, drying was adopted to convert unmarketable raw mango fruits into ready-to-eat snacks. Raw Totapuri fruits were used to develop crispy snack bars which was highly acceptable. Dehydrated crispy bars using grated raw Totapuri with infusion of ripe mango juice of variety Alphonso and Amrapali improved colour flavour and carotenoids content. Raw Banganpalli mango slices infused with ripe Alphonso mango juice resulted in product with intense colour, mild to intense flavour & desirable sweetness. Hence, it is concluded that through combination processing unmarketable raw and discarded mango fruits can be utilized for making nutritious and crispy snacks which in turn can make mango production more sustainable.

**Keywords:** mango, combination processing, vacuum impregnation, snack, dehydration



**Collagen peptide incorporated instant seafood soup: development and characterization**B. Meenu<sup>1</sup>, K. Anokhi Chandrababu<sup>1</sup>, U. Parvathy<sup>2</sup>, P. K. Binsi<sup>2</sup> and K. Sarika<sup>2</sup><sup>1</sup>Kerala University of Fisheries and Ocean Studies, Kochi<sup>2</sup>ICAR-Central Institute of Fisheries Technology, Kochi**ABSTRACT**

Seafood fortification has reduced the occurrence of previously frequent micronutrient deficiencies and improved the health of a huge proportion of the population engaged. Among the wide array of seafood in the commercial market, instant seafoods have a major demand among customers. Convenience products like a fish soup can bring about rapid improvements in the micronutrient status of a population, at a reasonable cost, especially by taking advantage of existing technology and local distribution networks. The nutritional benefits of soup made from seasonal low-value but nutrient-dense raw materials such as *Stolephorus sp.*, *Leiognathus sp.*, *Parapenaeopsis sp.*, and *Cynoglossus sp.*, as well as marine processing remnants like tuna frame meat, were demonstrated in this study. Seafood soup mix formulated using standardized methods was further incorporated with collagen peptide optimized for its bio-potency at 2.5 to 10% levels. As a control, an instant seafood soup mix without added peptides was used. The developed instant seafood soup formulation was characterized by its nutritional, functional as well as bioactive properties. The present study explored the valorization potential of seasonal fishery resources, more over by-products like bioactive peptides for its application in convenience products to meet the nutritional as well as health aspects of the targeted customers.

**Keywords:** Seafood, soup, processing discards, collagen peptide, convenience products

**Standardization of process for preparation of extracts and concentrates based on soluble tea constituents (volatiles) using response surface methodology (RSM)**Riya Barthwal<sup>1</sup>, Deepa Saini<sup>1</sup> and S. K. Sharma<sup>1</sup><sup>1</sup>Department of Food Science and Technology, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand-263145**ABSTRACT**

The present study was conducted to separate the volatile aromatic part of black tea from that of non-volatile part by using hydro-distillation method and optimize the levels of water: tea ratio and collected aroma distillate. RSM with Three Level Factorial Design was performed to determine the optimum conditions for extraction of tea aroma volatiles. Three levels of water: tea ratio (50:10, 100: 10 and 150:10) and collected aroma distillate (5, 12.5 and 20 %) were used and 13 RSM runs were performed. The aroma extract was evaluated using threshold test. Results revealed that, for maximum extraction and collection of black tea aroma, the optimum water: tea ratio of 118:10 and 20 % of collected distillate was most effective treatment as compared to others. Preparation of aroma extract from RSM optimized levels and their evaluation indicated that the above stated values were best for getting odour detection threshold dilution of more than 50,000 times and extractability up to 78 % and above. Therefore, during the preparation of concentrate, aroma losses can be reduced by the above mentioned technique and thus the collected aroma can be added back to tea products.

**Keywords:** Aroma, concentrate, soluble solids, tea, volatiles



**Development on anardana from unmarketable fruits of commercial pomegranate.**  
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<sup>1</sup>*Department of Food Science and Technology Dr. YSP UHF, Nauni Solan H.P-173230*

**ABSTRACT**

Post-harvest processing and value addition maintains and enhances quality of the products to makes it readily available in the market. The present investigation is based on “Development of anardana from unmarketable fruits of commercial pomegranate”. Pomegranate fruit is rich source of anthocyanins, phenols, crude fibre, sugars, vitamins, minerals and antioxidants. It has become one of the commercial fruit of HP in recent years. However, sufficient amount of this crop goes waste because of fruit cracking. So, the investigations were conducted to develop anardana from the cracked/unmarketable fruits of Kandhari Kabuli cultivar of this fruit. The arils after manual extraction were steam blanched and best steam blanching time was standardized to inactivate enzymes. Treated arils were then dipped in citric acid solution of varying concentrations for different time periods followed by sulphur fumigation and one best treatment was selected for drying under various drying modes. Anardana prepared in the best drying mode i.e, mechanical cabinet drier was packed in four different packaging material including jute bags, polyethylene pouch (PEP), aluminium laminated pouches (ALP) and ALP with vacuum and stored under ambient and refrigerated temperature conditions for 6 months. Anardana packed in ALP with vacuum and stored under refrigerated conditions retained better quality during storage. However, quality changes were observed faster in ambient as compared to refrigerated storage conditions. Treated arils can also be dried under solar tunnel drier for the development of anardana with slightly higher moisture content as compared to mechanical cabinet drier. The cost of anardana prepared in mechanical cabinet drier was comparable to the cost of similar product available in the market.

**Keywords:** Pomegranate, packaging, vacuum, refrigeration

## Standardization of harvesting stage and pre-treatment for dehydration of okra (*Abelmoschus esculentus* L. Moench)

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### ABSTRACT

The study was conducted to know the suitability of variety, harvesting stage and pre-treatment for dehydration of okra at KrishiVignana Kendra, Babbur farm, Hiriya, Chitradurga, during 2019-20. The experiment I consists of three varieties (Arka Nikhita, Arka Anamika and Hiriya Local) and three harvesting stages (4 DAA, 6 DAA and 8 DAA). The design of the experiment was Factorial RCBD. The Varieties and Harvesting stages were assessed for physicochemical characters in all possible combinations. Among different varieties and harvesting stages, V<sub>1</sub>(Arka Nikhita) and H<sub>1</sub> (4 DAA) recorded maximum pod weight, dry matter, rehydration ratio, chlorophyll content, magnesium, calcium and iron and recorded minimum dehydration ratio and crude fiber content. Interaction of varieties and harvesting stages were found significant with respect to physicochemical characters. The treatment combination V<sub>1</sub>H<sub>1</sub> (Arka Nikhita harvested at 4 DAA) recorded significantly higher values with respect to pod weight, dry matter, rehydration ratio and mineral content. The results of Sensory evaluation of dehydrated and rehydrated okra shown that V<sub>1</sub>H<sub>1</sub> (Arka Nikhita harvested at 4 DAA) treatment combination received highest score for overall acceptance. The experiment II was conducted based on the results obtained from experiment I. Arka Nikhita variety harvested at 4 days after anthesis is selected for further studies. These were either blanched or brined or combination of both before dehydration and assessed for physicochemical characters. The results shown that T<sub>4</sub> (Brining solution concentration 1.0 %) treatment recorded maximum score for overall acceptability.

**Keywords:** Okra, harvesting stage, pre-treatment, dehydration

**Fruit and vegetable by-products- a sustainable packaging**Aastha Verma<sup>1</sup>, Ruchi Sharma<sup>1</sup>, Anupama anand<sup>1</sup>, Harpreet kaur saini<sup>1</sup>, Chahat thakur<sup>1</sup><sup>1</sup>Department of Food Science and Technology, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, HP-173230**ABSTRACT**

Petroleum-derived plastics dominate the food packaging industry even today. These packaging materials have brought a lot of convenience and attraction into agro, food and packaging industry with the problems related to the disposal and renewability. Due to the growing concern over environmental problems interest has shifted towards the development and promoting the use of eco-friendly packaging from fruit and vegetable by-products. Food processing industry is the 2nd largest waste generator in the environment after household usage, with an increase in the processing of fruits and vegetables there is a significant increase in the processing waste in the form of by-products. Fruit and vegetable processing units generates huge amount of waste such as peels, seeds, stones, unused flesh in both form i.e. liquid and solid, which contain some reusable substances having high value and large economic potential. As a next step of waste valorization, food packaging technology may be an efficient solution to reduce the amount of food waste and by-products derived material into the food packaging. Focused research is needed in bringing more values, making the packaging material simpler but smarter, where consumer is able to assess the quality, safety, shelf-life, and nutritional values of the packet with cost effectiveness.

**Keywords:** Renewability, eco-friendly, waste valorization, biodegradability, petroleum based plastic, bio-plastic

**Exploring the nutritive and functional properties of by-products from mango fruits**Harpreet Kaur Saini<sup>1</sup>, Devina Vaidya<sup>2</sup>, Manisha Kaushal<sup>3</sup>, Anupama Anand<sup>4</sup>, Ruchi Sharma<sup>5</sup>, Chahat Thakur<sup>6</sup>, Aastha Verma<sup>7</sup>, Anjali Gautam<sup>8</sup><sup>1-8</sup>Department of Food Science and Technology, Dr. YSP UHF, Nauni, Solan, H.P-173230**ABSTRACT**

Mango is an important tropical fruit commercially cultivated in more than 103 countries, globally. Mango peels and seeds are major by-products from industrial processing or consumption of mango fruit, contributing to 40-50% of its total weight. Although, use of mango waste as an ingredient in animal feed is well known, most of this by-product is considered waste and becomes a source of environmental pollution. Mango peels have high content of valuable compounds, such as phytochemicals, polyphenols, carotenoids, dietary fibre and vitamins, which have predominant functional and antioxidant properties. Likewise, mango seed contains high content of bioactive compounds (phenolic compounds, carotenoids, vitamin C and dietary fibre) that have potential to improve human health. It presents an attractive profile of essential amino acids and lipids (6-16%), mainly oleic and stearic acids which contributes to functional properties similar to vegetable butter. Attributing to their high antioxidant activity, they exhibit anticancer activity against breast and colon cancer and antimicrobial activity against variety of microbial species. The proper use of mango waste as raw material or food additive could generate economic gains for food industry, contributing to reduction in nutritional deficiencies, promoting health and reducing the environmental implications related to this generated waste.

**Keywords:** Antioxidant, antimicrobial, functional, dietary fibre, carotenoids

## Texture profile analysis of composite bread with blend of white finger millet flour [*Eleusine coracana L.*] and wheat flour with emulsifiers

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### ABSTRACT

Finger millet (*Eleusine coracana*) is also known as ragi, mandua (major crop of Uttarakhand) nagli and nachani and is widely grown on hilly areas and southern part of India. Among all cereals calcium content is higher in ragi as well as iodine content is also rich in Ragi among all food grains. Ragi is easily digestible as it contains higher level of antioxidants, phytochemical and calcium. That is why they act as Nutraceutical. In view of the trends in diversification of bakery products and important of health bakery products composite bread containing millets such as Ragi has great scope. The purpose of the study is to formulate and develop composite bread from white ragi flour (WRF) composited with wheat flour (WF). This study investigated the effect of emulsifier with composite flour by blending white ragi flour with wheat flour in the ratio of 80:20, 60: 40, and 50:50 respectively with 0.5% glycerol monostearate (GMS) on final bread quality with respect to Texture Profile Analysis. Initially the bread characteristics were studied for physical characteristics further the textural qualities such as Hardness, Adhesiveness, Springiness, Cohesiveness, Gumminess, Chewiness and Resilience during storage period of 10 days. Initially the hardness was high (1555.23 g) with 50% white ragi flour when compared with the control (407.63) and increased with increased concentration of white ragi flour with GMS. The springiness (0.81) of the product increased with addition of GMS when the compared with control (0.761) which is without emulsifier and springiness was increased to 0.929, 0.889 & 0.903 with increased concentration of WRF with WF, the gumminess (8864.65g) of the product was decreased with the addition of GMS with control to 341.93g which is noticeable changes in the texture followed by 429.42g, 1201.09g, 957.91g respectively with increasing concentration of WRF and WF with GMS. The springiness of the product (6802.088g) decreased to 277.32g with control along with GMS and the values were in the range of 277.31 to 1064.89g with addition of WRF and WF with emulsifier, the resilience is how well a product fights to regain its original position was very well improved with the addition of GMS emulsifier from 0.264 to 0.385 for control and from 0.267 to 0.333 with 20% WRF and WF with GMS, overall textural properties were noticeable improved with addition of addition of 0.5% glycerol monostearate (GMS) on final composite bread quality blended with (20%) white ragi flour (WRF) and (80%) wheat flour (WF).

**Keywords:** White finger millet, composite flour, emulsifier, texture and quality of bread



## Revision of existing seed multiplication ratio and its significance in quality seed production system in India

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### ABSTRACT

Quality seed production system of India, there exists a vast scope in improving Seed Replacement Rate (SRR) and Seed Multiplication Rate (SMR) through use of improved varieties and hybrids with respect to yield, other genetic potential concerning to climate, soil and geographic adaptation and also in response to improved management using advanced technology adoption. Regarding farmers' adoption of quality seed production and use of quality seed per se, major constraints are coming from lack of awareness on use of quality seed, supply shortage of quality seeds at right time. The report on state of agriculture (State of Indian agriculture-2012-13, DAC, GOI) stated that seed multiplication ratio from breeder seed to foundation seed and from foundation seed to certified seed needs to be addressed by all the seed producing agencies, both in public and private sectors. Comprehensive database on seed production and distribution in India by public and private sectors needs to be built for the benefit of all the stakeholders. In this regard this study analyses the SMR of various crops using data compiled from ICAR Seed project, which clearly depicts the improvement in productivity of various crops through advances in technology. The SMR data, which was already in use for various crops, was compared with the data obtained from varied centers of ICAR Seed Project. The comparison shows a need to revise the old / obsolete SMR, which is currently used for estimating demand and supply requirement of quality seed in the country and more importantly an essential cog in seed certification for seed yield realization from unit area.

**Keywords:** Seed multiplication ratio, ICAR seed project, seed demand estimation



## Use of robotics in food and beverage industry: Technology towards agriculture 5.0

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### ABSTRACT

The corona pandemic brought about a change in the buying habits of consumers and introduced a new set of demands on food manufacturers. Numerous industries are experiencing a shift right now as companies are under demand to digitize their operations. Further, more the human contact with food products, more the risk of contamination. Automated equipment limits the amount of human contact on food and beverages during packaging. As technology becomes more flexible and configurable, companies can improve logistics and quality. Food and beverage industry digitization can include using smart sensors to track products, cloud-based inventory tracking and advanced order processing. Due to repeatability, speed, accuracy and flexibility of robots and automation technologies, including robots, are becoming a core element for food and beverage processing and packaging companies and are integral to protecting brands, market shares and ultimately profitability. Robotics have made it possible for food and beverage processing and packaging companies to vastly increase the scale of factory automation over the past few decades. One of the components is usually an arm, perhaps a multi-jointed robot arm, or an overhead picking arm called a “delta” or “parallel” robot. Delta robots are commonly found in food and beverage processing operations. Robots must be computer controlled and have an electronic control system with without artificial intelligence capabilities. With the use of this novel technology we can **increase production output rates, boost manufacturing flexibility, avoid workplace safety hazards and reduce product waste. This automation technology also helps in meat processing, dairy processing, food delivery etc.** In the next 20 years, many activities that humans perform while processing, packaging and delivering foods will become fully automated and robots are likely to replace them in the food industry.

**Keywords:** Robotics, food and beverage industry, automation, delta robots



### **Apple pomace use for value-added products in food industry**

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#### **ABSTRACT**

Apple fruit mainly comprises of around 75 per cent of fresh weight in juice and remaining 25 per cent is the solid material that remains after extraction of juice and is known as pomace. Apple pomace is one of the main by-products of apple juice processing industries accounting for about 25 per cent of the original fruit mass comprising 85 per cent (wb) of moisture content. which is generated in several million metric tons worldwide every year. Apple pomace is a rich source of health-benefitting nutrients, including protein, fat, dietary fiber, pectin, vitamins, minerals, antioxidants, phenolic compound and anthocyanin. Generally, apple pomace is used for animal feed as it is low-cost waste utilization and it is also used for fuel purpose and bioethanol production. Safety studies have shown apple pomace to be a safe livestock feed additive and to have pesticide concentrations within safety thresholds established for human consumption. Commercial development of apple pomace for human consumption requires more research focusing on standardized methods of nutrient reporting, mechanisms studies, and human clinical trials positive effect on health as reduction in gastrointestinal problems, weight management, lowers risk of coronary heart diseases, better glycemic control, improves serum lipid concentration, improves immune function, lowers blood pressure and possibility of certain type of cancer. Recently, many researches have been done on the utilization of apple pomace for the development of new functional foods as the apple pomace is rich in many bioactive compounds and dietary fibre can be utilized as ingredient in bakery, extruded, meat, confectionary, dairy and beverage industry not only to enhance their functional value but also for better utilization of pomace (waste material) which will not only reduce the environment problem but also help in development of novel products.

**Keywords:** Apple, pomace, utilization, functional food



**Studies on vase life of *Asparagus densiflorus* ‘Sprengeri’ as influenced by different chemical preservatives**

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**ABSTRACT**

The present study focused on “Studies on vase life of *Asparagus densiflorus* ‘Sprengeri’ as influenced by different chemical preservatives” was carried out at College of Horticulture, Bagalkot, Karnataka during the year 2018 - 2019. The foliage which were having uniform size, free from pests and diseases were selected and harvested for assessing the keeping quality. Immediately after harvest, the foliage were brought to the laboratory for imposing the treatments. The experiments were conducted at ambient condition in the laboratory, at relative humidity of 55 - 60 per cent and at a temperature of 25 °C to 30 °C. Different treatment combinations include T<sub>1</sub>: Distilled water, T<sub>2</sub>: 10 % Sucrose+ 100 ppm 8-HQC, T<sub>3</sub>: 10 % Sucrose + 200 ppm 8-HQC, T<sub>4</sub>: 10 % Sucrose + 25 ppm BA, T<sub>5</sub>: 10 % Sucrose + 0.5 % Boric acid, T<sub>6</sub>: 10 % Sucrose + 25 ppm BA + 0.5% Boric acid. The amount of pulsing solution absorbed was maximum (3.23 g) when foliage were pulsed with 10 % Sucrose + 0.5% boric acid. The treatment T<sub>5</sub> (10%Sucrose + 0.5% boric acid) recorded the lowest physiological loss in weight (35.12%) which was followed by the treatment T<sub>4</sub> (10% Sucrose + 25 ppm BA) with 36.02 per cent. The highest vase life (10.50 days) was recorded in the treatment T<sub>5</sub> (10 % Sucrose + 0.5% boric acid). Therefore, among all different treatments, T<sub>5</sub> (10 % Sucrose + 0.5 % Boric acid) found best in extending the longevity of asparagus foliage.

**Keywords:** *Asparagus densiflorus* ‘Sprengeri’, pulsing, sucrose, boric acid



## **Village-city partnership**

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### **ABSTRACT**

For the families living in cities, fresh and quality food product is an infrequent sight. Since most of the products are not produced locally, transporting them to the cities, without any loss is a difficult process. Further chemicals are used to keep the food products fresh which can be wholly detrimental to the society. On the other side, farmers could not get fair prices for their produce and a major part of the price paid by the consumers are taken up by the sellers in between. We have come up with a solution to overcome the problems faced by both sides. The usage of Radio Frequency Identification (RFID) tags for the produces which gives all the information about the produce such as the harvesting date, the practices involved in its production, it's nutritional value etc when scanned can be practiced. This will increase the reliability of the product and consumers could get products of better quality. This will also increase the demand of the product which in turn paves way for increasing the income of the farmers. Also we suggest the conveyance of the products through PACS (Primary agricultural cooperative credit society) where they procure the farm products directly from the farmers at a premium price and deploy RFID tags in the products, then transport it to the cities through postal service or railway mail service). By establishing this method, both farmers and consumer could get benefitted.

**Keywords :** RFID, PACS, post, railway, price, quality

## Supply chain management in Indian agriculture: Issues and opportunities

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### ABSTRACT

Agricultural commodities produced have to undergo a series of operations such as harvesting, threshing, winnowing, bagging, transportation, storage, processing and exchange before they reach the market, and as evident from several studies across the country, there are considerable losses in crop output at all these stages. A recent estimate by the Ministry of Food and Civil Supplies, Government of India, puts the total preventable post-harvest losses of food grains at 10 per cent of the total production or about 20 million Mt, which is equivalent to the total food grains produced in Australia annually. In a country where 20 per cent of the population is undernourished, post-harvest losses of 20 million tonnes annually are a substantial avoidable waste. According to a World Bank study (1999), post-harvest losses of food grains in India are 7-10 per cent of the total production from farm to market level and 4-5 per cent at market and distribution levels. These losses would be enough to feed about 70-100 million people, *i.e.* about 1/3rd of India's poor or the entire population of the states of the Bihar and Haryana together for about one year. Thus, it is evident that the post-harvest losses have impact at both the micro and macro levels of the economy.

**Keywords:** Agriculture, agriculture supply chain management, agri food market

### Comparative study on ohmic and induction heating of milk

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### ABSTRACT

Major focus of the food industry nowadays is towards alternative heat treatment technologies for thermal processing of milk products to avoid the loss of nutrients. Ohmic heating is an emerging technology for thermal processing of food products based on Joule's heating. Induction heating is yet another but simple technique for rapid heating of foods. A comparative study was done to evaluate the performance of Ohmic and induction heating of 5 litres milk from 20 to 90 °C. Heating time, rate of heating, thermal gradient and sensory attributes of the milk treated by both the processes was compared. Using inductive heating, the time for heating was 36 min. while it took only 16.5 min to raise the temperature using Ohmic unit indicating higher heat generation and heating rate. Temperature gradient for Ohmic heating varied from 0-1 °C indicating uniform heating throughout, whereas for induction heating the temperature gradient was in the range of 1-3 °C. Slight burnt flavor was observed in the milk heated by induction heating where as in Ohmic heating no such off flavors were observed. On the basis of thermal performance data, Ohmic heating was found to be more suitable for milk heating than induction heating.

**Keywords:** Ohmic heating, induction heating, milk, emerging technology

## Effect of salicylic acid on postharvest quality of bitter gourd (*Momordica charantia* L.) fruit

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### ABSTRACT

Bitter gourd is important tropical and subtropical climacteric vegetable rich in charantin, saponin and ascorbic acid. Under ambient storage conditions, it spoils rapidly due to excessive mass loss, tissue softening, yellowing, fungal attack and quality loss. To address these problems immature green bitter gourd fruits were treated with different concentrations of SA (3, 5, 10 mM) and control fruits were dipped in distilled water for 10 minutes. All the treated and untreated (control) fruits were stored at 10 °C and 85–95% relative humidity (RH) for 20 days. Among the treatments, SA @10.0 mM treated fruits retained higher total phenol (26.28 µg GAE 100g<sup>-1</sup>) and anti-oxidant capacity (27.95%) after 20 days of storage. SA @ 10.0mM also showed highest inhibition of α-amylase, α-glucosidase and lowest decay percent than control. Higher fruit firmness, lower PLW and PME activity were recorded in SA @ 10mM treated fruits. The results indicated that bitter gourd fruit can be successfully stored up to 20 days at 10 °C by pre-storage treatment of SA with maximum retention of several bioactive compounds and higher antidiabetic potential.

**Keywords:** Bitter gourd, quality, storage shelf-life

## **Influence of preservatives and biodegradable nano silver film on post-harvest life of *Jasminum sambac* cv. “Mysuru Mallige”**

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### **ABSTRACT**

Experiment was carried out in the Department of Floriculture and Landscape Architecture, College of Horticulture Mysuru during 2019-2021 to find out the effect of chemical preservatives and biodegradable nano silver film on post-harvest life of *Jasminum sambac* cv. Mysuru Mallige. The experiment was laid out in Factorial Completely randomized Design (FCRD) with 15 treatment and two replications. The periodical observations recorded every 12 hrs from 0 hrs to 36 hrs. were physiological loss of weight, freshness index and shelf life. Results of this experiment envisaged that flowers which are treated with 5 per cent boric acid and packed in 60 micron biodegradable nano silver film recorded less physiological loss of weight with maximum fragrance index and shelf life of the flower.

**Keywords:** Jasmine, preservatives, nano silver film, shelf-life

### **Stitching Mechanisms for FCV Tobacco Leaves**

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### **ABSTRACT**

Tobacco is a traditional item of India's foreign trade. Tobacco may also be referred to as Virginian tobacco or cultivated tobacco and originates from South America. India is one of the leading tobacco exporting countries in the world. Major FCV tobacco growing areas are Rajahmundry, A.P and Hunusur, Karnataka. Post harvest operations of tobacco leaves involve stringing & curing which are time-bound. At the peak time of harvest labour shortage will be there. Farmers may lose their profit if these operations are delayed. The quality of the cured leaves will also be affected. Stringing tobacco leaves upon sticks is the preliminary step to curing. In farmers field indigenous barns of different sizes are available to hold stringed leaves sticks ranging from 900 to 2000. The manual stringing method, number of labor, stringing time, labor costs, and total costs are high. This manual stringing method varies with location. Generally, one stick size is approximately 2 meters length and 3 labors are required for arranging 2-3 leaves in a bunch on a stick. There are about 40 bunches, 20 on each side of the stick. Total number of laborers required for stringing is 20 per barn (curing chamber). This stringing operation should be proper otherwise the leaves will drop as it loses its moisture during curing/drying and dried leaves may cause/ chances of fire in barn operating at increasing temperature from 40°C to 70°C for 6 days for yellowing, color fixation, lamina drying and mid rib drying. Owing to the above facts we attempted chain stitch mechanism and lock stitch mechanism for leaves stringing. We found that chain stitching mechanism was suitable with pitch width 20 mm; speed of the needle 210 RPM operated with 1 hp motor. It is an indigenous stringing machine with reduced number of labor, energy and time.

**Keywords:** FCV, stringing, curing, tobacco



**Thermal modification of acrocarpus fraxinifolius Wight and Arn. (Pink cedar) wood: a sustainable and eco-friendly approach**

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**ABSTRACT**

In a world of increasing environmental awareness, the development of sustainable processes that could substitute for traditional ones to improve the durability and end use applications of wood is of high interest. Although Pink cedar wood is a versatile and renewable material but dimensional instability, but lower durability and susceptibility to insect and fungal attacks are some limitations in its applications. Thus, to enhance the performance and service life of wood, thermal modification of wood samples of *Acrocarpus fraxinifolius* Wight & Arn. acquired from the twenty-nine years old tree was carried out at 120, 160 and 200°C for three durations (2, 4 and 6 hours) to determine physico-chemical and mechanical properties. The results showed specific gravity of the wood increased with rise in temperature while, the maximum moisture content and shrinkage and swelling showed inverse relation with temperature. 120°C was considered best for maximum strength. Dimensional stability was improved and no significant effect on mechanical properties was shown. Ultimately, the physical, mechanical and chemical properties of wood were improved and wood became more durable, dimensionally stable and resistant to insect and fungal attacks without causing any harm to the environment.

**Keywords:** Thermal modification, sustainability, dimensional stability

## Impact of FPO-led maize marketing on farmers' income in Karnataka

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### ABSTRACT

The main objective of this paper is to examine the maize value chain and price realization under different marketing channels existing in the Davanagere district of Karnataka. This study is based on primary data collected from different stakeholders of the district. A regression adjustment model for treatment effects was used to find out the impact of FPO-led marketing channels on farmers' income. The binary logit regression model was used to find out factors influencing farmers to undertake FPO-led marketing channel. Marketing through village traders (channel I) and wholesalers (channel II) yielded less net income compared to other channels. Marketing through FPO (channel III) and direct marketing (channel IV) gave better net income. Income received by farmers who were following channel I, channel II, channel III and channel IV was 42799.57, 49136.56, 52430.27 and 52769.09 rupees/ha respectively. Marketing through FPO had significance in the case of small and marginal farmers. Farmers who marketed the produce through FPO got 6307.813 rupees/ha more than the farmers who did not market through FPO. Factors like distance of FPO, source of credit and whether the nearest FPO is marketing maize were having significant influence on farmers' adapting FPO-led market channel.

**Keywords :** FPO-led marketing, maize market channel, farmers income, small farmer

### Development of low-fat and anthocyanin-rich purple sweet potato vacuum fried chips

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### ABSTRACT

Vacuum frying technology has proven to be one of the best methods to produce snack products with higher retention of health- promoting/protecting nutraceuticals with reduced- fat content. In this work, application and optimization of vacuum frying process for purple sweet potato have used response surface methodology- based Box–Behnken design to produce low-fat and anthocyanin- rich purple sweet potato vacuum fried chips. The study showed the significant impact of frying temperature, vacuum pressure, and frying time on the chip's moisture and oil content, level of anthocyanin, visual impressions like color and texture. The selection of optimized frying parameters was carried out using a numerical optimizer and found to be 105°C for 7.08 min at a reduced pressure of 14.79 kPa. Compared to the atmospheric deep- fried chips, the vacuum fried chips showed 86% retention of anthocyanin content and a 35.6% decline in oil content with a lower breaking force of 0.69 N. Overall, the study confirmed that vacuum fried purple sweet potato chips could be a viable option to produce snacks with high functional value to meet the current consumer demands. Purple sweet potatoes have the potential to produce healthy snack chips with lower fat content and higher functional characteristics when vacuum frying technology is used with optimized processing variables.

**Keywords:** Purple sweet potato, vacuum fried chips, anthocyanins, low-fat chips

### Osmotic assisted tray drying of pomegranate arils

Nilesh N. Gaikwad, Namrata Ankush Giri, Swati K. Suryavanshi and R.A. Marathe  
*ICAR-National Research Centre on Pomegranate, Solapur-413255, Maharashtra, India.*

#### ABSTRACT

Pomegranate has got attention in recent past due to its myriad health benefits and disease fighting ability. The fruits are grown in arid and semiarid regions of the world and are not available round the year across the globe. The availability can be ensured through the drying process. However, the process is energy intensive, costly and affects adversely to bioactive compounds present in arils. The osmotic dehydration has been studied as pre-treatment before tray drying. Response surface methodology has been employed to optimize the process conditions. The three factors temperature (30, 45 and 60°C), time (50, 150 and 250 minutes) and TSS (40, 50 and 60 °B) were studied for their effect on responses such as water reduction (%), water loss (%), solid gain (%), total anthocyanin (mg/100g FM),  $\beta$  E, total phenols (mg GAE /kg FM), and antioxidant activity (mg AAE /100 g FM). The final optimized process conditions obtained were temperature (48.52 °C), time (209.65 min) and TSS (51.31°B). The observed responses at optimized process conditions were water reduction (29 %), SG (3.11 %),  $\beta$  E (6.98), anthocyanin (19.77 mg/100g FM), total phenols (1405.43 mg GAE /kg FM) and antioxidant capacity (20.32 mg AAE /100 g FM) and were very close to the predicted one thereby highlighting the accuracy of the models for prediction. The fresh arils were osmotic pre-treated at optimized condition and further dried in a tray dryer at temperature of 50°C, tray loading of (1.25 kg/m<sup>2</sup>) up to the moisture content of 10% (wb). It has been observed that the osmotic dehydration pretreatment has reduced the moisture content of the arils by 12.58 %wb. The drying time has been reduced by 9 hours with corresponding reduction in the power consumption with maximum retention of bioactive compounds as compared to control in osmotic pretreated arils.

**Keywords:** Pomegranate arils, osmotic dehydration, bioactive compounds, antioxidant activity.



**SPI-Encapsulated fish collagen peptides used as anti-osteoporotic functional food**

Anil Kewat, R. Jeya Shakila, G. Jeyasekaran, M. Rosalind George and Priti Mishra

*Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Thoothukudi 628008, Tamil Nadu, India**Nanaji Deshmukh Veterinary Science University, 482001, Madhya Pradesh, India***ABSTRACT**

Osteoporosis is a serious problem in aged old people. Drugs (bisphosphonates) applied for treatment are often accompanied by adverse side effects. Thus, collagen hydrolysates/peptides from marine source could be a safe source of anti-osteoporosis agents. In this study, fish bone waste was hydrolyzed using 1% alcalase and lyophilized to obtain fish bone collagen peptides (FBCP) having <3 KDa molecular mass and 74.31±2.1% protein. The total amino acids of FBCP contained 82.791mg/100mg protein, constituted mainly Gly, Pro and Asp amino acids. The major mineral were Ca, Mg and Fe. The FBCP were encapsulated using soy protein isolate (SPI) as carriers by a spray drying. The zeta potential and glass transition temperature ( $T_g$ ) of the SPI encapsulated CP (SPI-ECP) were -20.5 and 70 °C, respectively. Thereafter, mouse pre-osteoblast cell line ME3T3-E1 was used to test the anti-osteoporotic properties of SPI-ECP based on cell proliferation, cell differentiation, alkaline phosphatase and bone mineral assays. The results showed that SPI-ECP (100 µg/mL) could promote cell proliferation. Nevertheless, SPI-ECP at 100 µg/mL had enhanced differentiation, ALPs activity and increased mineralization during the 21 days of culture. Moreover, SPI-ECP cells had higher calcium depositions than the control. The SPI-ECP showed the better results than the FBCP alone. *In-vitro* gastrointestinal digestion study proved the bio-accessibility of SPI-ECP showed 61.5% in vitro digestibility. Therefore, this indicated the ECPs prepared with SPI utilizing fresh bones accelerated bone growth and shall serve as a functional food to treat bone loss. In addition, this is the best way to utilize the fish waste and to save the environment.

**Keywords:** Encapsulation, functional food, spray drying**Food processing techniques and strategies for improved food safety****Shuchi Mehra***Meerut Institute of Technology***ABSTRACT**

Food processing and value addition are key steps in the food value chain. Developing food processing technologies that are environment friendly that can substantially contribute to the food value chain. Some methods of food processing have been challenged in the recent years but food processing cannot be focused entirely because of the ever-growing human population that has to be nourished. The increase in global population during the past two centuries has made food processing one of the most important subjects in the food value chain. The need for processed food is expected to increase even further when the global population increases further. Environmental concerns related to food processing that require consideration, will have to be reviewed. This research paper will provide strategies that can be used by industries to enhance the use of environment friendly technologies for food processing and enhance value addition.

**Keywords:** Climate-smart technology, food safety, food security, food technologies, food value chain

## Production of microencapsulated fruit powders with higher retention of bio-actives

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<sup>1,2,3</sup>Central Arid Zone Research Institute, Jodhpur-342003, India

### ABSTRACT

Higher moisture content and inefficient post-harvest handling is major drawback for fruit growers. Spray drying is cutting edge technology to handle the problem of lower shelf life of fruits and vegetables. Powder production provides tremendous increase in shelf stability while minimizing storage and transportation cost and intricately suitable for instant food product development like beverage mixes, baking and dairy products. High retention of bio-actives components is another significant advantage of this technology. This study provides a detailed description about the process of spray drying of arid fruits and their effect on powder characteristics. Stickiness is a major problem due to the low  $T_g$  of fruit juices which is elevated by addition of encapsulating carrier agents such as maltodextrin or cyclodextrin which enhance retention of nutritional and bio-active components. Maltodextrin (D.E.10-20) was used at different proportions 20-30% for spray drying of arid fruits at a temperature range of 120°C-180°C with 1-2ml/h feed flow rate. Yield recovery was 31-33% with  $a_w$  of dried powders 0.2-0.3. Excellent retention of vitamin-C (1491-8596 mg %), flavonoids (53-238mg %), pantothenic acid (144-251mg/kg), thiamine hydrochloride (3.1-9.3 mg/kg), pyridoxine hydrochloride (12.2-79.7 mg/kg), nicotinic acid (15-39 mg/kg) was estimated with UHPLC chromatogram of water soluble vitamins in Microencapsulated Fruit Juice Powder. Phenolic compound screening through HPLC shows the presence of Gallic acid, Chlorogenic acid, Caffeic acid and Quercetin as bio active components in microencapsulated fruit juice powders.

**Keywords:** microencapsulated, glass transition temperature ( $T_g$ ), maltodextrin, chlorogenic acid, caffeic acid

### Osmotic assisted tray drying of pomegranate arils

Nilesh N. Gaikwad, Namrata Ankush Giri, Swati K. Suryavanshi and R.A. Marathe  
*ICAR-National Research Centre on Pomegranate, Solapur-413255, Maharashtra, India.*

#### ABSTRACT

Pomegranate has got attention in recent past due to its myriad health benefits and disease fighting ability. The fruits are grown in arid and semiarid regions of the world and are not available round the year across the globe. The availability can be ensured through the drying process. However, the process is energy intensive, costly and affects adversely to bioactive compounds present in arils. The osmotic dehydration has been studied as pre-treatment before tray drying. Response surface methodology has been employed to optimize the process conditions. The three factors temperature (30, 45 and 60°C), time (50, 150 and 250 minutes) and TSS (40, 50 and 60 °B) were studied for their effect on responses such as water reduction (%), water loss (%), solid gain (%), total anthocyanin (mg/100g FM),  $\beta$  E, total phenols (mg GAE /kg FM), and antioxidant activity (mg AAE /100 g FM). The final optimized process conditions obtained were temperature (48.52 °C), time (209.65 min) and TSS (51.31°B). The observed responses at optimized process conditions were water reduction (29 %), SG (3.11 %),  $\beta$  E (6.98), anthocyanin (19.77 mg/100g FM), total phenols (1405.43 mg GAE /kg FM) and antioxidant capacity (20.32 mg AAE /100 g FM) and were very close to the predicted one thereby highlighting the accuracy of the models for prediction. The fresh arils were osmotic pre-treated at optimized condition and further dried in a tray dryer at temperature of 50°C, tray loading of (1.25 kg/m<sup>2</sup>) up to the moisture content of 10% (wb). It has been observed that the osmotic dehydration pretreatment has reduced the moisture content of the arils by 12.58 %wb. The drying time has been reduced by 9 hours with corresponding reduction in the power consumption with maximum retention of bioactive compounds as compared to control in osmotic pretreated arils.

**Keywords:** Pomegranate arils, osmotic dehydration, drying, bioactive compounds, anthocyanin, antioxidant activity.

**Studies on preparation of guava blended wood apple jelly cubes**Ashwini N<sup>1</sup>, Sanjana G<sup>2</sup>, K. Vijaya Lakshmi<sup>3</sup> and Wankhede Dashrath Seema<sup>4</sup><sup>1,2</sup>Department of Fruit Science, Dr. PDKV, Akola, Maharashtra-444104,<sup>3,4</sup>Department of Agricultural Economics and Statistics, Dr. PDKV, Akola, Maharashtra-444104**ABSTRACT**

A laboratory experiment “Studies on preparation of Guava blended wood apple jelly cubes” was conducted during the year 2021 to study the effect of different combinations of wood apple and guava pulp jelly cubes and to find out suitable combination of wood apple and guava pulp for preparation of wood apple jelly cubes. The experiment was laid out in Randomized Block Design with nine treatments. It was aimed to develop the blended jelly cubes by using various proportions of wood apple and guava fruit juices viz. 100:0, 95:5, 90:10, 85:15, 80:20, 75:25, 70:30, 65:35 and 60:40. The blended wood apple and guava jelly cubes were evaluated for physical, chemical and sensory quality parameters during 90 days of storage to standardize the proportion of wood apple and guava fruit juices in the blended jelly. Significant variation was observed in the storability of jelly prepared from different combinations. Treatment T<sub>6</sub> [wood apple (75 %): guava (25 %)] recorded superiority in attributes viz., TSS, pH, moisture, titratable acidity, moisture, ascorbic acid, pH, reducing sugars, total sugars, non-reducing sugars and calcium, while treatment T<sub>2</sub> [wood apple (95 %): guava (5 %)] showed minimum values for chemical parameters. On the basis of sensory evaluation of jelly cubes prepared with treatment T<sub>6</sub> [wood apple (75 %): guava (25 %)] better organoleptic properties as well as good storage stability under ambient storage conditions up to 3 months storage period was recorded.

**Keywords:** Wood apple, guava, blended jelly, organoleptic, storage

**Development and characterization of environment friendly starch and protein based packaging materials for food applications**

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*College of Dairy Science and Technology, Guru Angad Dev Veterinary & Animal Sciences University (GADVASU), Ludhiana (Punjab) India-141 004***ABSTRACT**

The non-biodegradability of synthetic polymer based packaging materials leads to environmental concern to the society, opened the way for eco-friendly biodegradable materials which come from agro-food industry wastes which will be helpful for food products packaging. Different preliminary trials were conducted with broader range of different ingredients and plasticizers to study the detailed overview of these variables. Corn starch, whey protein concentrate, whey protein isolate, carrageenan, polyvinyl alcohol (PVA) taken as base component for the formation of film. Glycerol 2% was used as plasticizer in composite film applications because of its plasticization ability due to its low molecular weights and give better handling properties like flexibility and elasticity. From the studies, it was concluded that the addition of corn starch @ 2.5%, whey protein concentrate and whey protein isolate each @ 2.5%, carrageenan @ 0.25%, poly vinyl alcohol @ 0.5% having better film forming properties and easy to peel off for application in food products. The developed film also having better biodegradable in nature which will be helpful to reduce to environmental burden.

**Keywords:** Starch, protein, packaging materials, food application, film properties.



## COMBINED EFFECTS OF 1-MCP AND MAP ON FRUIT QUALITY OF GUAVA CV. ARKA MRIDULA DURING COLD STORAGE

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### ABSTRACT

The study aimed to investigate the effects of 1-MCP combined with MAP on guava stored at 12 °C and 8 °C. Guava fruits treated with 1-MCP 500 ppb were packed in polypropylene (PP 40 µm), low density polyethylene (LDPE 40 µm) and Cryovac® PD-961 (PD 31.5 µm) with and without microencapsulated ethylene absorbers along with a set of control fruits. The results revealed that 1-MCP treated fruits packed in PP-NP had higher firmness (10.34 kg/cm<sup>2</sup> and 17.73 kg/cm<sup>2</sup> at 12 °C and 8 °C respectively), with a negative a\* value and lesser b\* value when compared to MA packed fruits alone. 1-MCP treated fruits integrated with MAP (PP-NP) had lower PLW (3%) when compared to 1-MCP treated fruits alone. 1-MCP treated fruits integrated with MAP (PP-NP) had higher retention of all major chemical parameters like TSS (9.81 and 12.71 %), acidity (0.67 and 0.53 %), vitamin C (72.0 and 25.33 mg/100g), reducing sugar (4.63 and 5.82 %) and total sugar (6.59 and 7.60 %) at 12 °C and 8 °C respectively. The study also showed that the 1-MCP 500 ppb plus PP-NP had lower enzyme activity for peroxidase (267.75 X 10<sup>3</sup> µABS/min/ml). The other useful combinations were PP-MCP and PD-NP +1-MCP that helped to extend the storage life in guava to 4 weeks and 4 weeks at 12 °C and 8 °C respectively with acceptable all quality attributes.

**Keywords:** Guava; 1-MCP; ethylene inhibitor; Quality; Shelf life

## ENHANCING COSMETIC APPEAL, QUALITY AND SHELF-LIFE OF GUAVA DURING POSTHARVEST STORAGE USING PLANT-BASED EDIBLE COATING

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### ABSTRACT

Edible coating forms a semi-permeable membrane film which retards the degradation of fresh fruits. Guavas are incredibly healthy and abundant in vitamin C. An experiment was run utilising a completely randomised design with three replications to improve the glossiness and storage ability of guava fruits for longer days. Due to their climacteric nature, fruits have a short shelf life of 2-3 days at room temperature (22–25 °C, 80–85%RH). Gum Arabic and tragacanth gum at concentrations of 5 and 10%, Guar gum was used at concentrations of 0.5 and 1%, and distilled water was used as the control in seven treatments. Both qualitative and quantitative investigations were carried out at every two days whilst gum-treated fruits were kept at room temperature (22-25°C, 80-85%RH) for six days. Tragacanth gum-treated fruits demonstrated the best outcomes in terms of weight loss, ascorbic acid, increased chlorophyll, phenol, and flavonoid content, stronger DPPH radical scavenging activity, and a slower increase in carotenoid content. By preserving the colour and biochemical as well as visual aspects, natural gum coatings have been found to effectively preserve the overall sensory quality of guava fruit. This study provided evidence that tragacanth gum is a viable plant-based coating formulation for guava fruits that could increase their post-harvest life while preserving their aesthetic value when stored at room temperature.

**Theme - 6**  
**Advances in Dairy and Veterinary Sector**  
**Towards Sustainable Development Goals**



## GENESIS AND PROGRESS OF 'ONE HEALTH' RESEARCH: A SCIENTOMETRIC

### APPROACH

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### ABSTRACT

One Health is a collaborative, multi-sectoral and trans-disciplinary approach - working at the local, regional, national, and global levels, with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants and their shared environment. Therefore, one health can be considered as a global strategy to maintain health of human beings, animals and ecosystem. The present study plots the one health research outputs during 1997 to 2021 with the help of Web of Science (WoS). Globally, a total of 4397 literatures were published. In Indian context, about 230 scientific literatures were published and only 94 publications were found relevant to policy makers. Further, data were analysed using bibliometrix R-package to evaluate scientific productivity of authors, the annual growth rate of publications and citation analysis to understand the status of 'One health' research in India. The annual growth rate of publications in India was 47.48 per cent with collaboration Index 6.58, which is greater than global collaboration index. Three-fields plot displayed that in Guru Angad Dev Veterinary and Animal Science University (GADVASU), Ludhiana, dedicated research on 'one health' is being carried out. The collaboration network analysis found that Indian authors are highly collaborating with researchers from Australia, USA and Germany. Other than formal collaborations, strengthening informal inter-personal relationships and collaboration platforms have also been suggested like Google Scholar, ResearchGate, LinkedIn, Facebook, Google+, Twitter etc.

**Keywords:** One health, multidisciplinary, zoonosis, collaboration, health policy, India





## EVALUATION OF QUALITY OF PANEER BY A DIELECTRIC CAPACITANCE BASED SENSOR

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### Abstract

The production of milk in India is highest among other countries (about 198.4 MT in the year 2019-20) (MFAHD, 2019). But as milk and milk-based products are vital sources of essential nutrients, and India's population is growing very fast, it became an easy target of menace as well as comprise in maintaining the safety and quality of these products. Dielectric spectroscopy is an emerging technology that is used for quality analysis of various agricultural products, but the data on quality analysis of coagulated dairy products by dielectric spectroscopy is very scarce in literature. Therefore, in the present study a dielectric capacitance-based sensor was developed to detect presence of the skimmed milk powder or, reduction of fat content in *paneer*. Results depict a strong correlation between the % of SMP used for the production of *paneer* and proximate composition of *paneer* with capacitance ( $R^2 > 0.95$ ). Dielectric capacitance is highest for cow milk *paneer* ((177.173  $\mu\text{F}$ ) followed by buffalo milk *Paneer* (155.587 $\mu\text{F}$ ); however, the difference is non-significant. The capacitance also found to reduce as the skimmed milk powder (SMP) increases in the blend of milk for making *paneer*. For *paneer*, made with 100% SMP, dielectric capacitance is lowest (67.227  $\mu\text{F}$ ) irrespective of its higher moisture content. This study suggests a relevance between dielectric properties and quality characteristics of *paneer*.

Keyword: paneer, dielectric, capacitance, quality, adulteration



## SEROPOSITIVITY OF INFECTIOUS BOVINE RHINOTRACHEITIS IN INDIA

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### ABSTRACT

Infectious bovine rhinotracheitis (IBR) is a highly contagious disease of bovines causing respiratory problems, abortions, and reduced milk yield leading to huge economic losses. Reports on seroprevalence in bovines in India are available restricting to districts/state. In the present study, a nationwide seroprevalence of IBR in bovines was conducted to provide a scenario of national seroprevalence of IBR to the Chief Veterinarian who in turn can design the control strategies. A total of fifteen thousand five hundred and ninety two bovine serum samples from twenty five states and three Union Territories viz., Jammu and Kashmir, Puducherry and Andaman and Nicobar Islands were tested for IBR antibodies using Avidin-Biotin (AB) ELISA. Cumulative seropositivity was found to be 31.37%. Maharashtra and Rajasthan states showed the highest and lowest seroprevalence respectively and were part of the west zone of the country. A total of eleven thousand four hundred twenty three cattle and four thousand one hundred and sixty nine buffalo serum samples were tested which showed 33.91% and 24.39% seropositivity respectively. India has the highest buffalo populations. Presently, India does not vaccinate bovines against IBR and should take a call on vaccination of dairy cows/buffalo.

**Keywords:** ELISA, IBR, India, Prevalence.



## EXPLORING THE VECTORIAL CAPACITY OF *RADIX* SP. SNAIL FOR THE TRANSMISSION OF FASCIOLOSIS

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### ABSTRACT

Fasciolosis in ruminants, caused by *Fasciola hepatica* and *F. gigantica*, is transmitted by lymnaeid snails. In India, *F. gigantica* is the prevalent species. Spatial distribution of fasciolosis depends on the presence and population dynamics of lymnaeid snails which in turn linked to the presence of appropriate water bodies and on adequate climatic characteristics suitable for the parasite development. Epidemiological surveillance of the transmission foci of fasciolosis where infected snails occur could be essential to effectively focus on to the control strategies. In the present study, A total of 1558 *Radix* spp. (*Lymnaea*) snails were collected from 75 water bodies covering 5 states (Karnataka, Kerala, Madhya Pradesh, Uttar Pradesh and Bihar) of India and were morphologically identified. Molecular characterization of the snails was carried out by targeting Cytochrome oxidase 1 (COX-1) gene. The representative snails were screened for larval stages of *Fasciola* sp. by PCR targeting 28S ribosomal DNA. Eventhough it is well established that *F. gignatica* infection in India is transmitted by *R. auricularia*, our studies revealed the involvement of *Radix rufescens* as the intermediate host for *F. gigantica*.

**Key words:** Fasciolosis, snail, epidemiology, COX-1



## PREVALENCE OF BRUCELLOSIS IN LIVESTOCK OF AFRICAN AND ASIAN CONTINENT: A SYSTEMATIC REVIEW AND META-ANALYSIS.

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### Abstract:

Brucellosis is an endemic zoonotic disease in Asian and African countries and has a significant impact on both animal and human health. Brucellosis is a highly contagious bacterial disease that mainly affects ruminants, but it may affect equines, canines, and felines. The disease is of utmost significance from an economic standpoint in countries where there is no national brucellosis prevention and eradication policy in operation. Hence, information about disease burden, incidence, prevalence, and geographical distribution plays a critical role in planning appropriate intervention strategies for the control and prevention of Brucellosis. Research articles that were published during the period 2000-2020 were considered for this study after reinforced scrutiny by two independent authors. Heterogeneity was analyzed using meta-regression, while subgroup and sensitivity analysis was performed to estimate the residual heterogeneity and pooled prevalence of Brucellosis in livestock. Univariate meta-regression revealed that the confounders like region, a test of diagnosis, and species had the highest  $R^2$  values of 17.8, 8.8, and 2.3% respectively, which suggests the presence of heterogeneity leading to further investigation on sensitivity and subgroup analysis. The combined pooled prevalence of brucellosis in both Asia and African countries was estimated as 8%. The pooled prevalence of brucellosis in the Indian livestock population was estimated to be 12%. The findings of our systematic review and meta-analysis indicate that brucellosis continues to be an important animal and public health concern in developing countries of Asia and Africa, as evidenced by the prevalence rate of brucellosis in these regions. Our findings suggested that well-planned surveillance studies in different geographic settings are needed to generate reliable data on disease burden including the economic loss in Asian and African countries.

**Keywords:** Brucellosis, meta-regression, prevalence, systematic review, zoonosis



## DEVELOPMENT OF ENZYME LINKED IMMUNOSORBENT ASSAY USING RECOMBINANT CATHEPSIN B5 ANTIGEN FOR EARLY DIAGNOSIS OF BOVINE TROPICAL FASCIOLOSIS: A NEW APPROACH

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### Abstract

Bovine tropical fasciolosis caused by *Fasciola gigantica* is a major parasitic disease in the tropical countries responsible for significant production losses in animal husbandry practices. In the early stage of the parasite i.e., juveniles cause havoc damage in the bovine host while migrating through liver. Globally the diagnosis of the disease is done by the detection of adult parasite's ova passed in the faeces and unfortunately no test is available to detect the infection at early stage when it causes maximum harm. The cathepsin B5 is a cysteine protease which is present in excretory-secretory product of the fluke predominantly in juvenile stage. The present study is aimed to develop an enzyme linked immunosorbent assay (ELISA) using recombinant cathepsin B5 protein as antigen. The developed ELISA showed 95.3% sensitivity and 92.4% sensitivity with a cut-off of 60% percent positive. It also showed 0.768 (95% CI 0.648 to 0.889) weighted Kappa value when compared with ELISA using native cathepsin antigen. 906 bovine samples collected from different parts of the country were screened and around 40 per cent seroprevalence was recorded. The developed assay can be exploited as a potential tool in the diagnosis of bovine tropical fasciolosis.

**Keywords:** Bovine; fasciolosis; Cathepsin; ELISA.



## DEVELOPMENT AND PROCESS OPTIMIZATION OF DOODHPAK USING RESPONSE SURFACE METHODOLOGY

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Doodhpak is an indigenous milk product popular in Gujarat and other neighbouring states. The product is basically a milk dessert prepared using milk, rice, sugar and flavouring materials. As its manufacturing is mostly confined to cottage scale by hawais or homemakers, an attempt for process optimisation of the product was done. A new concept of in-container manufacturing was adopted using retort process to enhance the shelf life of the product. Doodhpak was prepared using different varieties of rice and it was found that basmati long grain rice was best suited for the production of in container doodhpak. Pre-soaking of rice at 50°C for 30 min followed by pre-cooking at 90°C for 10 min resulted in good cooking characteristics for the preparation of the product. The proportion of various ingredients of Doodhpak was standardized by using Response Surface Methodology. RSM suggested 1.6 times concentration of milk, 2.19% rice and 10.69% sugar as the best suited combination based on the sensory scores obtained through the trials. The time temperature combination of retort processing was standardised as 121°C for 15 min by analysing both the aerobic spore count and sensory attributes of the product.

Key words; Doodhpak, Retort Process, RSM



## **PASSION FRUIT (*PASSIFLORA EDULIS*) LEAF EXTRACT AS A FUNCTIONAL INGREDIENT FOR THE DEVELOPMENT OF ANTIDIABETIC WHEY JELLY**

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### **ABSTRACT**

Whey is one of the main by-products of dairy industry, which for years was thought to be insignificant and was either used as animal feed or disposed as waste. Discarding of whey contributes a significant loss of potential nutrients like proteins, lactose and minerals. The desire for new methods to utilize whey can be appreciated. The objective of present study was to assess the antioxidant and antidiabetic potential of the passion fruit leaf extract (PFLE) and the development of antidiabetic whey jelly by the incorporation of the potential plant extract. Development of whey jelly incorporated with herbal antidiabetic isolates will deliver antidiabetic product which can be consumed by all age groups. The antioxidant potential of PFLE incorporated whey jelly was evaluated by DPPH Radical Scavenging Activity and was found to be 39.7%. The antidiabetic potential was assessed by  $\alpha$ - amylase inhibition assay and the IC50 value calculated was 102.4 $\mu$ g/mL. The sensory evaluation of whey jelly incorporated with extract was carried out in different concentration ranging from 0.1 to 0.25%, in which 0.25% extract incorporated jelly was more perceptible. From this evaluation it was concluded that PFLE incorporated whey jelly possess good antidiabetic and antioxidant properties with excellent sensory attributes. Furthermore, preparation of whey jelly is a better option for the complete utilization of whey at its production point itself.

**Keywords: whey, jelly, passion fruit leaf, antidiabetic, antioxidant**



## SCOPE OF RECYCLED MANURE SOLIDS AS GREEN BEDDING MATERIAL FOR DAIRY COWS

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### ABSTRACT

The material used for bedding has a substantial effect on the welfare, health, and performance of dairy cows. The advancements in biogas production and slurry utilization techniques along with associated environmental benefits like reduction in greenhouse gases make the installation of biogas plants a good investment for large dairy units in India. A by-product of the biogas production system is recycled manure solids which is also known as dairy waste solids, separated manure solids, or green bedding. The interest in recycled manure solids as a substitute animal bedding material has increased as it is soft, easily deformed, and non-abrasive, perceived to be comfortable for cows, and has high on-farm availability. The use of large amounts of recycled manure solids bedding in stalls can improve comfort, reduce lameness and hock lesions, and increase cow longevity if udder health is maintained. Notwithstanding various advantages, there are apprehensions like bacterial proliferation and its effect on mammary health due to the usage of recycled manure solids. Therefore, there is a need to evaluate the utility of recycled manure solids under Indian conditions. If found effective, the recycled manure solids has can provide comfortable bedding to dairy cows without compromising health and economic benefit to dairy farmers.

**Keywords:** Recycled manure solids, cow bedding, welfare





## GREEN SOLVENT ASSISTED EXTRACTION OF GHEE RESIDUE FOR PHOSPHOLIPIDS

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### ABSTRACT

Ghee residue, a lipid rich by-product of dairy processing, is obtained substantially in the process of ghee making. It is reported to have considerable amount of phospholipids (PL) which possess good nutritional and emulsifying properties. A green technology for extraction of PL was standardized using microwave heating coupled with distilled water as solvent. The parameters of microwave power, time and solvent to solid ratio were optimized for the yield of phospholipids. Through Taguchi designed T9 orthogonal array, the parameters were optimized to 540 W power, 60s of treatment time and solvents to solid ratio of 10, for maximum phospholipids yield. Under optimal operating conditions, phospholipid yield was estimated to be 21.84%. The experimental data reported  $R^2$  value of 97.04% with time and power playing significant effect in phospholipids extraction ( $p < 0.01$ ). Through solid phase extraction (SPE) technique, PL quantification by spectrophotometric method was also evaluated. Spectrophotometric method reported 0.8-1.3 times more PL compared to SPE. With short extraction time, the study proved the potential of microwave to assist the extraction process. Also, water as solvent has advantage of an eco-friendly technique to extract valuable compound from ghee residue.

**Keywords:** *Phospholipids, ghee residue, green technology, microwave*



## DRY-CRYSTALLIZATION: A NOVEL APPROACH FOR DEVELOPMENT OF CONVENIENCE MIXES

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### ABSTRACT

Convenience mixes are products that have great potential and possess huge demand owing to its ability to reconstitute easily and quickly. Dry-crystallization approach was developed to prepare ready-to-reconstitute mixes of indigenous dairy puddings. The process basically involves the slow-stirred concentration of the formulation, comprising of the cooked particulates alongwith milk and sugar, till the mix crystallizes out. To ease the drudgery involved in the process, a batch mode mechanical unit was also developed in-house. The technology was standardised for four product variants, namely *Palada payasam*, *Gasagase payasam*, *Kheer* and *Phirni*. Process parameters, namely, steam pressure, scrapper speed and time were optimized in the range of 1.2-1.6 kg/cm<sup>2</sup>, 40-50 rpm and 25-50 minutes, respectively, depending on the product. Reconstituted product from the dry-crystallized mix were found to be highly acceptable during sensory evaluation. Crystallinity of the mix was validated through XRD analysis. Evaluation of engineering properties revealed that the samples prepared using mechanized unit and manual stirring to be at par. Type III sorption isotherms, characteristic of sugar-rich products, were established for the mixes. Storage stability was evaluated for physico-chemical and microbial quality at 30°C for 3 months, for the product packed in Al-laminate pouches, establishing it as a shelf stable product.

**Keywords:** Dry-crystallization, indigenous dairy puddings, engineering properties, sorption, XRD



## “BIOGENIC SILVER NANOPARTICLES ACQUIRE ANTIBACTERIAL ACTIVITY AGAINST CALF DIARRHEAL PATHOGENS”

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### ABSTRACT

Calf diarrhea, one of the most serious problems faced by livestock is attributed to both infectious and non-infectious factors. *E.coli* and *salmonella* are major culprits causing calf diarrhea and great economic losses in the dairy industry. Antibiotics are considered as the most preferable choice for treatment of diarrhea. However, widespread use of antibiotics has led to the emergence of multidrug-resistant bacterial strains. Currently, the growth and development of effective and novel materials with superior antimicrobial properties have been the most active research area. Green and biogenic synthesis of nanoparticles is nontoxic, eco-friendly and cost effective that utilize plant extracts, microorganisms, animal products for bio-reduction, stabilization, and capping of nanoparticles. In our study, panchgavya was used for the synthesis of silver nanoparticles (AgNPs). The synthesized AgNPs were initially observed through visual color change from yellow to reddish brown and further confirmed by surface plasmonic resonance (SPR) band at 410nm using UV-Visible spectroscopy. Morphology and size of AgNPs were determined by SEM and the size of AgNPs mediated by Panchgavya was in the range of 30-60nm with spherical shape. The zeta potential observed by DLS was -56.0Mv. X-ray diffraction (XRD) study revealed the crystalline nature of AgNPs. The stability of AgNPs was due to the capping of proteins which was established by Fourier transform infrared spectroscopy (FTIR). *E.coli spp.* and *Salmonella spp.* bacteria were isolated from fecal samples of calves (n=9) suffering from diarrhea. *In vitro* antimicrobial activity of silver nanoparticles against isolated bacteria was evaluated by agar diffusion assay. Using synthesized AgNPs in a concentration of 400µg for antibacterial activity, the zone of inhibition for *E.coli and salmonella* for 100µg was recorded at 13mm and 14mm respectively. These *in vitro* results indicate that the AgNPs have a significant antimicrobial activity against *E.coli and Salmonella spp.* of diarrheal origin.

Keywords: silver nanoparticles, calf diarrhea, antimicrobial, E. coli, Salmonella



## “BIOGENIC ZNO NANOPARTICLES AS ANTIMICROBIAL AGENTS AGAINST MASTITIC PATHOGENS”

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### ABSTRACT

The study aimed to investigate evaluation of the antibacterial activity of zinc oxide nanoparticles synthesized using panchgavya as a fuel. This biogenic synthesis is nontoxic and economical method. In this method, panchgavya was used as the biological reducing agent for the synthesis of zinc oxide nanoparticles from zinc acetate dihydrate. The size and morphology of zinc oxide nanoparticles was significantly dependent on parameters like temperature and pH during nanoparticles synthesis. Synthesized zinc oxide nanoparticles were characterized using XRD, FTIR, DLS, and SEM. The XRD revealed their hexagonal pattern with crystallite size 13nm. SEM showed their size in the range of 13-72 nm. The hydrodynamic size of synthesized ZnO-NPs was characterized using DLS technique. Polydispersity index was found to be 25.4% with zeta potential of -43.8 mV. The antibacterial potential of zinc oxide nanoparticles was observed by agar well diffusion method against two pathogenic bacteria *Staphylococcus aureus* and *Streptococcus spp.* isolated from mastitic milk samples. It was observed that the panchgavya mediated, biogenic zinc oxide nanoparticles showed strong antimicrobial activity against clinical pathogens, suggesting that biogenic synthesis of nanoparticles can be an excellent strategy to develop antimicrobials for the treatment of bovine mastitis.

Key words: ZnO nanoparticles, biogenic synthesis, antimicrobial, mastitis



## **EVALUATION OF FIELD LEVEL FMD VACCINE EFFICACY AND FACTORS EFFECTING THE VACCINE EFFECTIVENESS IN KARNATAKA: ACROSS SECTIONAL STUDY**

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Foot and Mouth Disease (FMD) control in India largely relies on mass vaccination of target population. In spite of regular vaccination FMD outbreaks are reported annually from different parts of the country including Karnataka. Hence, the current study aims at evaluating the FMD vaccine efficacy during antibody declining phase under field conditions and to identify the factors that affect vaccine performance. A cross sectional study design with a multistage stratified sampling plan was adopted with random selection of three villages from each randomly selected district from each agroclimatic zones in Karnataka. A systematic random sampling was carried out at village level to sample up to 12 cattle. A total of 378 cattle were sampled across 10 districts of 10 Agro-climatic zones. A questionnaire comprising details of animal, FMD outbreaks, vaccine and vaccination was used to collect the survey data. The FMD serotype (O, A, Asia-1) specific antibody titre was measured using LPB ELISA kit. The sampled cattle were categorized as having protective or non-protective antibody titre based on the cut-off antibody titre value. The factors affecting the vaccine efficacy were also identified. The results of the study show that, overall, the immune proportion of cattle in the study area was 75.3%, 77.2% and 82.7% for serotype O, Asia-1 and A respectively. The immune proportions against Serotype 'O' in different sub-populations (Age, Breed) were assessed. The age group <24 month was having 42% immune population which was significantly ( $p < 0.0001$ ) less compared to the age group >24 months with 83.28%. The exotic versus indigenous cattle showed no statistically significant difference with level of immune population. In conclusion the study suggests that there is need to improve the immune proportion in the target population and age is an important host factor which influences the population immunity.



## **MOLECULAR DIAGNOSIS AND EPIDEMIOLOGY OF RECENTLY EMERGED LUMPY SKIN DISEASE IN INDIA**

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### **ABSTRACT**

India is one of the highest milk producing country in the world and having largest cattle population of 192.5 million and buffalo population of 109.85 million (DAHD, 2019) contributing significantly to the national economy and provides livelihoods to millions of small and marginal dairy farmers. Recently an emerging, exotic and transboundary notifiable viral disease called Lumpy skin disease (LSD) was reported in cattle and buffalo for the first time in India causing severe economic losses. For effective prevention and control of the disease accurate and rapid diagnosis is necessary. Therefore, in the present study, we have developed a polymerase chain reaction (PCR) assay for detecting the LSD virus. Using the newly developed PCR, we screened 394 clinical samples (blood, nasal swabs, tissues/scab and vectors) collected from cattle and buffaloes. Out of 394 samples, 336 were found positive for LSDV. Representative PCR positive samples were subjected for sequencing to confirm and to understand the origin of the virus. The sequence analysis also confirmed the etiology as lumpy skin disease virus and the sequences were highly conserved among the isolates even though they are from different geographical regions of country. In conclusion, the newly developed PCR assay can be used for providing quick and reliable diagnosis for initiating rapid disease control measures in the field. The LSDV isolates circulating in the country are genetically similar indicating the common source of origin of disease in the country. There is an urgent need for proper epidemiological studies to identify the risk factors and to develop diagnostics and vaccines for prevention and control of the disease in the country.

Key Words: Cattle, Diagnosis, Epidemiology, LSDV and Phylogeny



## RECOMBINANT OUTER MEMBRANE PROTEINS (OMPS) BASED LATEX AGGLUTINATION TEST (LAT) FOR SERODIAGNOSIS OF LEPTOSPIROSIS IN LIVESTOCK AND HUMAN

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### ABSTRACT

Leptospirosis is an emerging and re-emerging zoonotic disease with public health importance worldwide. Diagnosis of the leptospirosis is challenging due to multiple circulating pathogenic serovars, confusion of the disease to other febrile-causing illness and lack of reliable diagnostic tools. The objective of the present study was to develop and evaluate a recombinant *Leptospira* OMPs based latex agglutination test (LAT) for rapid screening of samples and providing diagnosis of human and animal leptospirosis in an endemic area. The important OMPs protein-coding gene sequences of proteins (Lsa, OmpL, LipL, etc.) was amplified by PCR individually and initially cloned in pGMT-easy vector and subsequently sub-cloned into pET expression vector for expression in *E. coli*. The expressed recombinant protein (s) with His-tag was purified through NiNTA column and characterization using SDS-PAGE and Western blot, which showed the expected expressed band size, of target cloned gene with fusion tag, respectively. Using purified, dialyzed, and concentrated recombinants OMPs, coated latex beads were prepared individually for sero-diagnosis of leptospirosis by LAT. A total of 130 samples (Cattle-40; Human-40; Canine-40; swine -20) were tested for leptospirosis by both microscopic agglutination test (MAT)-serological WHO/OIE reference test and the rOMPs of different proteins coated latex beads. The optimized rLAT can be performed easily and had desirable diagnostic sensitivity and specificity with a high negative predictive value compared to MAT. It can be applied as an initial screening test for diagnosing leptospirosis in humans and animals in endemic areas.

**Keywords:** Leptospirosis, Serodiagnosis, Latex Agglutination Test (LAT), Recombinant OMPs, Livestock, Human



## CURRENT SCENARIO OF PESTE DES PETITS RUMINANTS AND ERADICATION STRATEGIC PLAN IN INDIA

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### ABSTRACT

PPR is enzootic in India as number of outbreaks have occurred in the past and now being occurring regularly, round the year and most frequently during the lean period throughout the country in sheep and goats. On analysis of the outbreaks/cases reports in sheep and goats in National Animal Diseases Referral Expert System (NADRES) database since 1995, it was observed that PPR features among the top ten diseases and stands first among viral diseases, and among reported deaths, PPR accounts for 36% of mortality in sheep and goats. PPR outbreaks occur around the year in all the seasons but are encountered most frequently during the lean period especially, in the winter season (January to February) in different regions/zones. On state-wise analysis, the PPR risk-areas showed wide variations with different levels of endemicity. Andhra Pradesh, West Bengal, and Karnataka were the top three reported states in 1995–2010, whereas Jharkhand and West Bengal states reported more outbreaks during 2011–2015 and 2016–2019 periods. India practices, focus vaccinations in the outbreak places since 2002 and the reported outbreaks have been progressively declined in most of the states in India due to the implementation of a mass vaccination strategic program since 2011. In some Indian states, the PPR outbreaks in sheep and goats have declined after implementing the strategic mass vaccination control programme. At present, the disease has been brought under control in goats and sheep by available effective and safe live attenuated cell culture PPR vaccine. Further a declining trend in reported PPR outbreaks in some states during the past five years due to the implementation of strategic vaccination and control measures under the ongoing national PPR control programme. The epidemiology of PPR has changed due to vaccination as the disease occurs more severely only in the young naïve population. The temporal and spatial distribution of PPR in India provides valuable information on the hotspot areas/zones to take appropriate policy decisions towards its prevention and control in different regions/zones of India. It also identifies when and where intensive surveillance and vaccination along with biosecurity measures need to be implemented to control and eradicate the disease from India in consonance with the PPR Global Control and Eradication Strategy under PPR GEP 2030. The mass vaccination in pulse polio model covering the entire population initially, followed by annual vaccination in a predesignated stipulated period, covering the naïve young population of sheep and goats at least three years will have a tremendous impact on the control of PPR. Followed by vaccination on the migratory population at the check post or border regions of the states or inter-state border or in the place of entry or place of trade market of the animal through transport from other states are to be targeted for mass vaccination as and when required. Sharing the experiences on the PPR vaccination strategies adopted by some of the states in India may motivate other Indian states or other countries of similar socio-economic and small ruminant rearing patterns to vaccinate and control PPR. Recently DAHD Department, Ministry of Animal fisheries and husbandry, Govt. of India planned the National strategic Plan for PPR Control and Eradication 2025 with the hope that PPR in the direction of RP will be eradicated in India within a decade or even earlier.

**Keywords:** PPR status, Strategies, Vaccination, Control, Eradication, India





## STANDARDIZATION OF DRYING METHODOLOGY FOR INTACT WHOLE BUFFALO OFFALS FOR PET FOOD USE

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### ABSTRACT

From the total meat production of 6215 thousand metric ton, about 529 thousand metric ton offals are obtained in India (FAO Stat, 2014) but they are underutilized because of lack of technology although there is huge export demand for dried buffalo offals for pet food use. A suitable technology was developed to dry the whole buffalo offals such as heart, liver and lungs by pretreating these offals. Pretreatment consisted of immersion of the offals in salt (4%) and sugar (3%) solution for 3 h in the ratio of 1:3 (w/v) at room temperature. Offals were partially sliced and treated with microwaves for 4 min (Treatment 1; T1). Treatment 2 (T2) offals were partially sliced, punctured with the help of wire mesh brush and then treated with microwave for 4 min. Controls offals were neither pretreated, partially sliced nor microwaved. The offals were dried at 60 °C for 36 h (heart), 40 h (liver) and 42 h (lungs) in hot air oven. The moisture content of the dried liver for the control, T1 and T2 was found to be 28.38%±1.49, 17.68%±1.59 and 14.13%±1.36, respectively. Dried heart showed moisture percentage of 57.61%±2.57, 35.165%±2.06 and 27.46%±2.15 for the control, T1 and T2, respectively. Corresponding values for the dried lung for the control, T1 and T2 were 32.40%±2.15, 21.58%±2.15 and 8.10%±2.15, respectively. Moisture loss percentage was found to be 66.57%±3.25, 68.98±3.29 and 72.38±2.94 for liver for control, T1 and T2, respectively. L\*, a\* and b\* of fresh and dried control lung and fresh and dried T1 lung were recorded to be 26.03±2.39, 8.71±0.89 and 11.61±1.15 and 17.06±1.26, 3.46±0.85 and 6.95±0.32 and 20.21±1.08, 11.51±0.43 and 10.20±0.56 and 15.25±0.94, 3.47±0.34 and 6.22±0.65, respectively. Thiobarbituric acid reactive substances (TBARS) for T1 heart increased from 0.21±0.08 at 0 day to 0.98± 0.15 at day 60 under 4 °C. Aerobic plate count (APC expressed as Log<sub>10</sub> CFU/ml) revealed that the T2 heart APC count increased from APC 3.02± 0.15 at 0 day and 6.25±0.11 at day 60 stored at 4 °C. Based on above results, it can be concluded that the T1 and T2 are comparatively better dried offals having extended shelf life of two months for liver and lung and one month for heart at 4 °C and hence, pretreated buffalo heart could be dried for 36 h, liver for 40 h and lungs for 42 h at 60 °C in hot air oven in conjugation with 4 min of microwaving.

Keywords: Drying, buffalo offals, liver, heart, lungs, microwave



## HYPOGLYCEMIC EFFECT OF BETA CASEIN HYDROLYSATES EXTRACTED FROM MILK OF *GIR* COWS

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### ABSTRACT

Recent advances in food and nutrition sciences have been exploring milk peptides for their nutraceutical and therapeutic benefits. In this study, an attempt has been made to assess the hypoglycemic effect of  $\beta$ -casein ( $\beta$ -CSN) isolated from milk of *Gir* cows through dipeptidyl peptidase – IV (DPP-IV) inhibition pathway. The enzymatic hydrolysis of extracted  $\beta$ -CSN was carried out using Flavourzyme, pepsin, trypsin and proteinase-k individually at 1%, 2% and 4% enzyme-substrate (E-S) ratio for a period of 2 - 12 hours. The hydrolysate obtained from Flavourzyme treatment for a period of 10 h at 4% E-S ratio showed maximum DPP-IV inhibition ( $50.41 \pm 1.44\%$ ). This hydrolysate was ultrafiltered through 10 and 3 kDa cut off membranes in order to obtain low molecular weight peptides. Permeate of 3 kDa showed  $90.37 \pm 3.57\%$  DPP-IV inhibition, RP-HPLC and LC-MS/MS analysis identified 75 unique peptides in it. Furthermore, the efficacy assay using Min6 cell line (pancreatic beta cells) at different peptides concentrations revealed significantly ( $p < 0.05$ ) enhanced insulin production (51.4% more) and reduction in the cell apoptosis (27.9% less) compared to control group at 30 mg/mL. The genes associated with pro-apoptosis such as CASP3, Bax and BAK were down regulated.

**Keywords:** beta casein, diabetes, DPP-IV inhibition, Min6 cells, hypoglycemic peptides, gene expression



**ADVANCES IN DAIRY AND VETERINARY SECTOR TOWARDS SUSTAINABLE  
DEVELOPMENT GOALS SIGNIFICANT ADVANCEMENT IN DAIRY CATTLE  
HEALTH MANAGEMENT**

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**ABSTRACT**

This paper describes some of the major points of progress and challenges in health management of dairy cattle in the last 25 yr. A selection of the leading contributors in the field is acknowledged. Specific advances in the areas of transition cow management, epidemiology, udder health, applied immunology, housing design, calf health, and health-monitoring tools are described. The greatest advances in dairy health in the last 25 yr have been the shifts to disease prevention, rather than treatment, as well as from focus on individual animals to groups and herds. A fundamental advancement has been recognition of the multifactorial nature of almost all diseases of importance in dairy cattle. Epidemiology has been a critical new tool used to describe and quantify the interconnected risk factors that produce disease. Another major advance has been redefining disease more broadly, to include subclinical conditions (e.g., subclinical mastitis, ketosis, rumen acidosis, and endometritis).

Notable successes are decreases in the incidence of milk fever, clinical respiratory disease in adults, contagious mastitis, and clinical parasitism. There has also been improved protection through vaccination against coliform mastitis and bovine virus diarrhea. Since 1980, average herd size and milk production per cow have increased dramatically. Despite these increased demands on cows' metabolism and humans' management skills, the incidence of most common and important diseases has remained stable.

**Keywords** – Udder health , Immunology , Cow Comfort , Calf Health , Tools For Monitoring



## PRODUCTION AND CHARACTERIZATION OF PROTEIN ISOLATES FROM CHICKEN LIVER

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### ABSTRACT

The study was conducted to isolate protein from chicken liver and characterization of its techno-functional properties. Prior to protein isolation, protein solubility test was carried out to determine the highest solubility at a particular pH. Isolates prepared through acidic and alkali solubilization technique was freeze dried and subjected for different quality evaluation. In protein solubility test, highest solubility was observed at pH 1.5 ( $26.54 \pm 0.04$ mg/ml) and at pH 2.0 ( $27.01 \pm 0.08$ mg/ml) while under alkaline condition, highest solubility was observed at pH 11.0 ( $31.23 \pm 0.05$ mg/ml) and at pH 11.5 ( $27.76 \pm 0.01$ mg/ml). At pH 1.5, 2.0, 11.0 and 11.5, the recovery yield of proteins in isolate was 42.9%, 45.83%, 61.13% and 56.99%, respectively. The total protein content in isolates were  $70 \pm 0.054$ ,  $73.5 \pm 0.045$ ,  $74.5 \pm 0.045$  and  $70 \pm 0.052$  at pH 1.5, 2.0, 11.0 and 11.5, respectively. The total pigment (ppm) was  $150.96 \pm 0.86$ ,  $172.04 \pm 0.65$ ,  $93.84 \pm 0.39$  and  $121.04 \pm 0.65$  at pH 1.5, 2.0, 11.0 and 11.5, respectively. The bulk density (g/ml) of protein isolates was  $0.33 \pm 0.001$ ,  $0.32 \pm 0.001$ ,  $0.26 \pm 0.006$ , and  $0.27 \pm 0.008$  at pH 1.5, 2.0, 11.0 and 11.5, respectively. Fat Absorption capacity (ml/g) was  $3.77 \pm 0.101$ ,  $4.21 \pm 0.084$ ,  $3.76 \pm 0.117$  and  $5.07 \pm 0.066$  at pH 1.5, 2.0, 11.0 and 11.5, respectively. The water absorption capacity (ml/g) was  $2.45 \pm 0.080$ ,  $2.54 \pm 0.085$ ,  $2.79 \pm 0.077$  and  $3.34 \pm 0.041$  at pH 1.5, 2.0, 11.0 and 11.5, respectively. Except bulk density and total pigment, it was observed that values for all recorded parameters were significantly higher for protein isolates at different pH as compared to whole liver powder. From this study it can be concluded that protein isolation could be one of the ways to utilize poultry liver for production of high protein food ingredient.

**Keywords:** Chicken liver, Protein isolate, Functional food ingredient, pH-Shift method, Protein solubility test



## **STUDY OF SUITABLE PHASE CHANGE MATERIAL FOR IMPROVING THE EFFICIENCY OF MILK COOLING SYSTEM**

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### **ABSTRACT**

Improving the energy efficiency of refrigeration system is an important issue regarding energy savings and global warming reduction. Thermal energy storage with phase change materials (PCM) is a promising technology based on the principle of latent heat thermal energy storage (LHTES) and using this technology could be a new option for performance improvement by enhancing heat transfer of the evaporator and reducing efficiency losses of a conventional compressor. A PCM is a substance with a high heat of fusion (melting) and solidifying at a certain temperature, which is capable of storing and releasing large amounts of heat energy.. The research is to be conducted in order to optimize the suitable PCM for improving the energy efficiency of milk cooling system. The dimensionless temp of milk during cooling from 37°C to 4°C by PCM is decreased in very smooth rate in milk cooling system (MCS) which shows better preservation of milk quality because PCM behaves as a temperature controller and minimize the temperature fluctuation. The lowest cooling time for 40 lit and 80 lit milk in MCS is 121 min and 193 min respectively in case of 1:10 (PG:RO water) with 5% NaCl PCM.

Keywords: cooling, milk, phase change material, thermal energy



## THE SIGNIFICANCE OF BIOACTIVE COMPOUNDS IN BOVINE MILK AND COLOSTRUM

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### Abstract

Bovine milk and colostrum are abundant sources of bioactive compounds such as proteins, oligosaccharides, lipids, vitamins, minerals, hormones, Immuno-regulatory peptides, Immunoglobulins, and several growth factors. Bovine milk fat consists of conjugated linoleic acid having anti-carcinogenic properties. The local control of mammary cells is significantly influenced by autocrine factors i.e. Hormones (such as steroid hormones, thyroid and parathyroid hormones, hypothalamic hormones, pituitary hormones, gastrointestinal hormones, growth factors and others). Whereas concerns have been raised regarding the relationship between steroid hormones in bovine milk and the emergence of breast, uterine, and ovarian malignancies, as well as male reproductive abnormalities, adolescent obesity, and teenage acne, but have not been scientifically proven yet. The peptides, amino acids, and proteins present in bovine milk possess anti-oxidative, anti-inflammatory, and immune-stimulatory properties. Lactoperoxidase, lysozyme, lactoferrin, immunoglobulins, and some peptides possess antimicrobial characteristics while bovine lactoferrin also shows immune-stimulatory effects by enhancing the production of IgA and IgG antibodies and has anti-carcinogenic properties against highly metastatic forms of prostate cancer, lung cancer, osteosarcoma, breast cancer, and the gastric adenocarcinoma cell line. Immuno-regulatory peptides modulate immune function with regard to immune competency and avoid unfavourable immune reactions (e.g. tolerance, and hypersensitivity to nutrients) to regulate the bovine GI immune system. Oligosaccharides were earlier assumed to be indigestible by human enzymes, later found to be partially absorbed in the intestines resulting in the prebiotic effect. Bovine colostrum is useful in treating ulcerative colitis, necrotizing enterocolitis, traveller's diarrhoea, etc. Bovine colostrum-based immune milk products that have been prophylactically treated for a variety of infectious illnesses in humans have shown to be successful.

**Keywords:** Bovine milk, Colostrum, Anti carcinogens, conjugated linoleic acid.



## SPATIAL RISK MAP FOR BLACK QUARTER (BQ) IN KARNATAKA USING REMOTE SENSING VARIABLES AND STATISTICAL MODEL

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### ABSTRACT

Black quarter (BQ) caused by *Clostridium chauvoei* is an important bacterial disease that affects cattle and sheep with high mortality. It is a soil borne infection and exerts immense detrimental effects on the overall productive frugality of bovines. The disease having a seasonal occurrence, commonly occurring every year immediately after the onset of monsoon rains where in there will be a sudden change in weather leading to stress and outbreaks to occur. The present study was aimed to identify the influence of climatic and host factors on occurrence of BQ in Karnataka state of India. Village level occurrence of BQ outbreaks were obtained from Department of Animal Husbandry and Veterinary Services, Karnataka. Remote sensed variables along with population of cattle and buffalo were used in the analysis. The model was fit with all the variables Machine learning algorithm. Further, risk map for occurrence of Black quarter in Karnataka was developed using the significant risk factors. In Karnataka, during the period from April 2013 to January 2022 there were 280 outbreaks of BQ were reported. High population of cattle, buffalo and maximum land surface temperature, Enhanced Vegetation Index (EVI) were identified as important risk factors for occurrence of black quarter in Karnataka. The risk map developed showed high risk of the disease in Southern and Central parts of Karnataka. The risk map developed will be useful for the policy makers to focus on systematic vaccination in high-risk areas to reduce the burden Black quarter in Karnataka.

**Key Words:** *Black quarter, Climate, host, Risk map, Surveillance, Vaccination.*

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## ANTIMICROBIAL RESISTANCE PATTERN AMONG CIRCULATING *PASTEURELLA MULTOCIDA* STRAINS

### AND ITS CORRELATION WITH BIOFILMS FORMING CAPACITY

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#### ABSTRACT

*Pasteurella multocida* is a Gram-negative bacterium responsible for various fatal diseases in livestock. Drug-resistant *Pasteurella multocida* may compromise the efficacy of therapies used to prevent and treat infection. This study was conducted to examine the prevalence of drug resistance among *Pasteurella multocida* strains isolated from clinical cases of bovine, sheep, and pig and rabbits. A total 41 *Pasteurella multocida* strains were isolated from the 345 clinical samples collected from different states of India. All the strains were tested for antimicrobial sensitivity against 11 antibiotics as per CLSI guideline and biofilm forming capacity in four different culture conditions with microtitre plate assay. The result indicated that 95% strains (39/41) were resistant to at least one antibiotic and resistance in a decreasing order was: erythromycin (73%), ceftriaxone (49%), ampicillin (39%), amoxicillin/ clavulanic acid (41%), co-trimoxazole (22%), enrofloxacin (17%), doxycycline (10%), chloramphenicol (2%), penicillin-G (2%), and azithromycin (2%). A total of 17 strains were found to be multidrug resistant (MDR) strains. All the strains were categorized into four groups as strong (22%), moderate (19%), weak (51%), and non-adherent (7%) based on biofilm forming ability of strains. Correlation between diverse factors as well as antimicrobial susceptibility in biofilm production were analyzed by Joint-distribution models, and showed that enrofloxacin and azithromycin resistant strains were positively correlated with strong biofilm production.

**Key words:** Antimicrobial resistance, biofilms, *Pasteurella multocida*

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## COMPARATIVE ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES OF PANCHAGAVYA FROM INDIGENOUS AND CROSS BRED COW

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### ABSTRACT

Panchagavya is an organic, fermented product which is prepared by mixing five ingredients obtained from desi cow viz. milk, urine, dung, curd, and ghee. At present, many panchagavya products available in the market with various health claims lack scientific shreds of evidence. Furthermore, limited research work has been done related to the physico-chemical properties of panchagavya prepared from indigenous and crossbred cows under identical conditions. Therefore, the present work aimed to evaluate the physico-chemical properties of panchagavya prepared from both lactating heifer animals of three desi cows viz, Sahiwal, Gir and Tharparkar and one cross bred cow Karan Fries. The panchagavya was prepared by mixing all the five components (Milk, Urine, Dung, Curd and Ghee) in equal ratio and fermented for 20 days at 37°C. Panchagavya at 0 day (raw) and after 20<sup>th</sup> day of fermentation (fermented) were analyzed for physico-chemical parameters viz, pH, total solids, reducing sugar, total nitrogen, ash, urea, uric acid, creatinine, minerals (Ca, Na, K, Fe & Zn) and fatty acid profile. The results showed that after fermentation there was significant (P<0.05) decrease in pH, reducing sugar, sodium, potassium and zinc content. Also, significant (P<0.05) increase was observed in ash, calcium, urea, uric acid and fatty acid profile of panchagavya. However, no significant (P>0.05) change was observed in total nitrogen, crude lipid, total solids, creatinine and ash content after the fermentation.



## THERMALLY STERILIZED VALUE-ADDED *GILOY*-GOAT MILK BEVERAGE: DEVELOPMENT, CHARACTERIZATION AND STORAGE-STABILITY

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### ABSTRACT

In view of the 'green milk' concept, therapeutic benefits of herbs could be conveyed via certain plants as carriers and milk is considered as an ideal delivery/carrier system for bioactive molecules. Increased demand of goat milk in recent years has intrigued researchers to explore the potential of the co-addition of goat milk with herb such as *giloy* (*Tinospora cordifolia*). Therefore, the present study was aimed to develop sterilized *giloy*-goat beverage with the aim of providing functional beverage incorporated with natural bioactives and addressing certain technological challenges. Sterilized functional beverage was developed using goat milk and debittered *giloy* juice in 90:10 ratio along with artificial sweeteners, flavour, stabilizers and analysed for changes in biochemical parameters, anti-oxidant activity for a period of 120 days. Storage study revealed decreased pH and 6.3 after 90 days of storage while, no significant ( $P>0.05$ ) difference in anti-oxidants (DPPH,  $\beta$ -Carotene activity), total phenolics and total flavonoids was observed up to 45-60 days of storage. Principal Component Analysis revealed that flavor attributes (goaty, bitter and sweet after taste), thermal stability, acceptability and astringency could strongly influence the sensory quality of beverage. Presence of *giloy* juice in beverage was confirmed with scanning electron microscopy. Further, inter-molecular interactions (polyphenols-protein) were recorded with fluorescent microscopy and FT-IR analysis wherein alkene and carbonyl bonds showed significance variations with the incorporation of debittered *giloy* juice in goat milk.

Keywords: Goat milk beverage; *Giloy* (*Tinospora cordifolia*); Thermal treatment; Bioactive compounds; FT-IR; Scanning Electron Microscopy



## HEAT INDUCED INTERACTION BETWEEN MILK AND SORGHUM PROTEINS TOWARDS DEVELOPMENT OF A SUSTAINABLE PROTEIN SOURCE

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### ABSTRACT

In the present study, the heat induced interaction between sorghum (*Sorghum bicolor*) and milk proteins was explored. To determine the interaction between sorghum protein isolate (SPI) and milk proteins, a SPI-skim milk composite protein matrix was prepared such that both sources contribute equal protein content. Skim milk alone was used as control. All samples were heated at four different temperatures viz. 30° C, 70° C, 80° C and 90° C for 30 minutes each to induce protein-protein interactions. The pH of skim milk-SPI composite was lower than skim milk. Particle size showed that at each heat treatment, size of composite protein matrix was higher than skim milk protein. Zeta potential also indicated some signs of interaction. Flow curve displayed low viscosity values for composite protein compared to milk protein at each level of heat treatment. Instrumental colour values also showed that L\*, a\* & b\* values were lower in composite protein matrix compared to the milk protein. The interacted form present in the composite protein blend is hypothesized to possess better functional and nutritional quality as compared to the qualities of the individual proteins. More studies are required to investigate milk and sorghum protein interactions and the functionality of composite protein.

**Keywords:** sorghum protein isolate, skim milk, heat treatment, protein-protein interaction



## IDENTIFICATION OF MANAGERIAL RISK FACTORS FOR OCCURRENCE OF FMD IN KARNATAKA USING STATISTICAL METHODS.

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### ABSTRACT

Foot and Mouth Disease (FMD) is a highly contagious viral disease of domestic and wild cloven-hoofed animals. The disease is caused by Foot and Mouth Virus (FMDV) belongs to the family Picornaviridae and the genus Aphthovirus. The livestock population of Karnataka continues to face a significant threat from FMD. The present study aimed to identify the influence of village-level risk factors on the occurrence of Foot and Mouth Disease in Karnataka. FMD outbreak data for the year 2021 (September – December) was obtained from the Department of Animal husbandry and veterinary services. Epidemiological data was collected from four villages affected with FMD using a questionnaire. A binomial logistic regression model was used with all the significant variables. Out of 432 households, 61 households reported FMD during the period. We found that the presence of middlemen in buying and selling of animals ( $P < 0.01$ ), animals that are closely tied together ( $P < 0.01$ ), source of water ( $P < 0.01$ ), and history of FMD ( $P < 0.01$ ), was significant. We conclude that animals affected with FMD should be segregated and treated. Clean water should be provided to animals. Mixing of animals at a common source of water can be avoided to prevent the spread of FMD in villages.

**Keywords:** Foot and Mouth disease, Risk factors, Binomial logistic regression.



## IMPLEMENTATION OF DISEASE PREDICTION MODEL TO ANTICIPATE THE RISK FACTORS OF THEILERIOSIS ASSOCIATED WITH THE ENVIRONMENT AND REMOTE SENSING IN LIVESTOCK OF KERALA, INDIA

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### Abstract

Theileriosis is a tick-borne disease caused by various protozoan parasites of the Theileria genus that causes acute disease among the Livestock, resulting in high levels of mortality. In the current study, the trend of disease occurrence was studied across a 21-year period i.e., from 2001 to 2021 and different machine learning algorithm viz., GLM, GAM, MARS, FDA, CT, SVM, NB, ADA, RF, GBM and ANN have been incorporated to determining the future outbreak sensitive areas and the factors that significantly contribute to the disease outbreak by using disease incidence data, livestock population data, and environment parameters. The information on the disease outbreak is provided by the Department of Animal Husbandry, Kerala. The SaTScan software v9.6 is used to detect the temporal, spatial, and space-time clusters of Theileriosis in Kerala across a 21-year period utilising Poisson based clustering models with space-time scan data. The virulence of theileriosis is projected by producing a risk map for Kerala state, applying climate-disease association modelling, which forecasts the spatial onset of the disease based on changes in precipitation levels. The Receiver Operating Characteristic (ROC) curve, Cohen's Kappa (Heildke Skill Score), Skill Statistics (TSS) and Accuracy are used to analyse discriminating power of the fitted models. The reproduction number  $R_0$  ranged from 0.9 to 2.08 in two districts viz., Kannur and Malappuram, demonstrating the transmissibility of theileriosis potential in the selected risk region. Raster Stack was used to aggregate the results of many model approaches' distinct predictions. Instead of relying on a single best model, it is recommended to integrate the prediction results of multiple models that range from 0 to 1. The findings of the study will aid in focusing on high-risk locations of theileriosis in livestock in order to adopt available control measures and improve livestock productivity.

Keywords: - Theileriosis; Disease prediction; Kerala; Livestock; Machine Learning; Outbreak; Basic reproduction number



**RICOTTA CHEESE FROM CHEDDAR CHEESE WHEY AND SKIM MILK:  
EFFECT OF WHEY PROTEIN TO CASEIN RATIO AND HEAT TREATMENTS ON  
PROTEIN RECOVERY AND TEXTURAL, SENSORIAL, MICROSTRUCTURAL  
AND RHEOLOGICAL PROPERTIES**

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**Abstract**

The effect of whey protein (WP) to casein ratio (0.79, 0.92 and 1.74) of cheese whey-skimmed milk system (70:30; 80:20 and 90:10) and heat-treatment (85, 90 and 95 °C for 10 min) were investigated on quality of Ricotta cheese. Results of RP-HPLC and SDS-PAGE showed that 1.74 WP:casein and heat-treatment at 95°C/10 min lead to maximum denaturation and interaction of WP with casein micelles in the system. The resultant Ricotta cheese had significantly higher protein recovery, spreadability and sensory acceptability, which were also corroborated by principal component analysis. Ricotta cheese matrices also had a greater number of small pores as compared to other treatments, which increased hydration and decreased compactness, eventually decreasing elasticity and viscosity of cheeses. The optimised Ricotta cheese contained 20.06% total solids, 11.87% proteins, 3.17% fat, 1.26% ash, 3.38% lactose and 64.56% of whey proteins (of total protein) and was able to recover 90.48% proteins from the whey-milk system. This study demonstrated that rheological properties are dependent on microstructural features of matrices and protein recovery and that sensory properties and rheological properties of Ricotta cheese can be improved by increasing WP:casein of the system and applying appropriate heat treatment.

**Keywords:** Ricotta cheese, whey protein to casein ratio, heat treatment, protein recovery, rheology, microstructure



## **FEEDING EFFECT OF ENVIRONMENT FRIENDLY GALACTOGOGUE (FENUGREEK SEEDS) ON MILK PRODUCTION, MILK COMPOSITION AND BODY CONDITIONS IN PATANWADI SHEEP**

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### **ABSTRACT**

The present study was conducted to evaluate the feeding effect of Fenugreek seed powder (FSP) on milk production, milk composition and body condition in Patanwadi Sheep at ICAR-Central Sheep and Wool Research Institute, Avikanagar, Malpura. 21 lactating ewes were selected for experiment which were classified in three groups in such a way that parity and last season's lactation yield were kept almost similar in three groups. Group 1(G1) was Control (400 gm Concentrate + 0 gm FSP), group 2(G2) was denoted as Treatment 1(400 gm Concentrate + 10 gm FSP) and group 3 (G3) was Treatment 2(400 gm Concentrate + 20 gm FSP). Feeding trial was conducted for 90 days and milk production data were collected at 1st, 5th, 9th and 13th week of lactation. Body weight of ewes at parturition and 90th day of lactation were recorded. Average daily milk yield/ewe and total lactation yield/ewe were 626.07±51.59, 694.64±65.07 and 716.07±56.87 gm and 56.34, 62.51 and 64.44 litres/lactation in G1, G2 and G3 respectively. Average fat percent and Solid but not fat (SNF) were 7.73±0.57, 6.93±0.47 and 5.76±0.48 percent fat and 9.21±0.32, 10.05±0.28 and 10.08±0.27 percent SNF in G1, G2 and G3 respectively. The lactose and milk protein were 5.01±0.17, 5.54±0.15 and 5.55±0.15 percent and 3.33±0.12, 3.64±0.11 and 3.61±0.09 percent in G1, G2 and G3, respectively. Body weight at lambing and end of experiment were 41.62±1.06, 41.04±1.13 and 40.85±1.95 kg and 42.13±0.87, 41.23±0.89 and 41.62±2.05 kg in G1, G2 and G3, respectively. Above results revealed that FSP have positive effect on lactation. Effect of FSP on fat is negatively correlated and SNF is positively correlated. FSP had no negative effect on body condition. B: C ratio in G2 and G3 was 3.4 : 2:1 and 1.75:1, respectively. So, it may be concluded that FSP have galactagogue property in sheep and 10 gm FSP is economical for milk augmentation in sheep.

Key words: FSP, Sheep, Galactagogue, Milk production, Milk composition



## ANTI-ALZHEIMER POTENTIAL OF LACTOBACILLI IN RAT MODEL

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### ABSTRACT

Alzheimer's is a neurodegenerative problem cause mental deterioration, cognitive decline, and impedance of neurons. As probiotics are a notable preventive measure against the mental deterioration happen in Alzheimer's disorder. Thus, probiotics were evaluated for Anti-Alzheimer properties i.e., production of Gamma aminobutyric acid (GABA) neurotransmitter, SCFA, antioxidant potential, and vitamin B<sub>12</sub>. To begin, probiotic cultures were evaluated for GABA utilizing PCR and TLC, followed by HPLC measurement. PCR was utilized to check for vitamin-B<sub>12</sub> gene expression, and HPLC was utilized to evaluate it. The antioxidant activity of screened GABA cultures was additionally researched utilizing ABTS, DPPH, Hydroxyl Free Radical Activity and SOD. Furthermore, Gas Liquid Chromatography was utilized for estimation of SCFA produce by probiotics lactobacilli. The total of 15 probiotic cultures were collected from NCDC, of which 10 cultures found positive for GABA followed by 7 for vitamin-B<sub>12</sub> production. At last, the lactobacilli culture *Limosilactobacillus fermentum* NCDC 701 was chosen best for anti-Alzheimer properties like SCFA production, neurotransmitter production i.e., GABA and having incredible antioxidant potential. Furthermore, this culture utilized for the anti-Alzheimer treatment in Alzheimer induced rat model. Rat model of Alzheimer finished at the 7 days by the intraperitoneally injection of aluminium chloride and D-galactose. The confirmation of Alzheimer done by the observation of plaque formation in model as compared to control rat by ELISA kit. The NCDC 701 probiotic culture fed to Alzheimer induced rat model and observe the behavioural activity, biochemical analysis and gene expression. The *Limosilactobacillus fermentum* NCDC 701 probiotic culture could be the best solution to mitigate the pathophysiology of Alzheimer.

**Keywords:** GABA, SCFA, Probiotics, Alzheimer, Lactobacilli





## **DAIRY COOPERATIVE SOCIETY : A DRIVER FOR SOCIAL AND ECONOMIC SUSTAINABILITY OF INDIAN WOMEN**

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### **ABSTRACT**

Milk is one of the most produced liquid commodities in India. A journey from milk deficit to surplus is being achieved in last few decades. This transformation has been possible due to growing number of organised dairy sector as cooperatives. A study on various roles played by organised dairy sectors on the livelihood of women was made at Niali block of Cuttack, Odisha, India. About 60 women dairy farmers were interviewed who were the members of dairy cooperatives. Majority of them had control over dairy cows as they received it as a gift from their parents at the time of their marriage. Majority of them generally do not consume liquid milk; rather they take it in the form of tea, dahi, and ghee. It was reported that before the establishment of dairy cooperative society in their area, they used to sell milk to the vendors at minimal price. As vendors were not reliable, they used to set back the money after several months of milk being sold. Women were not able to sell milk at the time of rainy season, cyclones or floods. Cooperative is more reliable as it collects milk twice daily. It is also more flexible as it collects all the surplus milk and also provides support in the form of subsidised feed, required trainings and payment at 10 days interval. Cooperatives are more accessible and approachable as their own village member is a secretary who collects the milk. Cooperative societies have made dairy a profitable venture for women. Linking Odisha women to organised dairy can help in achieving gender equality, bringing sustainable livelihood, improving household health, and nutrition. It speaks about social integration through upliftment of marginalised categories by equity and empowerment.

Keywords: Organised Dairy; Odisha; Sustainability; Women



## COW URINE: LOW-COST MEDIUM FOR MICROALGAE *Chlorella* sp. BIOMASS PRODUCTION

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### ABSTRACT

Microalgae is used as fertilizer in agriculture, dietary supplement in aquaculture, feedstock for biofuel. The cost of nutrient medium for microalgae culture on a commercial scale is high. Therefore, this study was conducted to reduce the cost of culture medium and the effective usage of cow urine. *Chlorella* sp. was cultured in control (Bold Basal Medium) and at a concentration of 2 %, 4 %, 6 %, 8 %, and 10 % of cow urine. The culture was continued for 12 days. At 2 % and 4% concentration of cow urine the biomass production was 0.56 g/L and 1.26 g/L. At 4 % the cell density ( $4.4 \times 10^6$  cells/mL) was more than double when compare to control ( $1.7 \times 10^6$  cells/mL). More than 6 % of cow urine was found to be inhibitive to *Chlorella* sp. culture. From this study, it could be interred that 2 % and 4 % of cow urine could be replacement for the nutrient medium in microalgae culture.

Key words: Cow urine, *Chlorella* sp., Replacement

### TECHNOLOGY FOR RAPID WHEY REMOVAL FOR PRODUCTION OF CHAKKA

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### Abstract

*Chakka* is the semi-solid intermediate traditional Indian dairy product obtained by draining off the whey from the curd mass. Traditional gravity method of whey removal from curd mass is a time consuming process and during summer it sometimes results in quality deterioration. A rapid whey removal system was designed and fabricated for *chakka* production. Special cud holder partition with 120° angle was designed and integrated to ensure faster and uniform whey removal from the curd mass. The performance of the developed whey dewatering mechanism was evaluated with different process variables spin time (30 to 90 min), curd temperature (5 to 15°C) and quantity of curd (2- 6 kg). The measured responses were yield, moisture content, total solids and total solid loss. The numerical optimized process parameters were: quantity of milk: 2-6 kg, spin time: 60 min, curd temperature: 5°C. Whey draining time reduced from 600-720 min to 60 min (90-92 % time reduction) was observed in case of mechanized production of *chakka*. The developed equipment is suitable for small-entrepreneurs for the mechanized production of *chakka*.

**Keywords:** Chakka, traditional, Indian dairy product, rapid, whey removal, curd



## PERFORMANCE OF SOVIET CHINCHILLA RABBIT ON DIET SUPPLEMENTED WITH INDIAN CORAL PLANT (*ERYTHRINA STRICTA*)

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### ABSTRACT

The study was conducted to study the beneficial effects of supplementing Indian coral plant (*Erythrina stricta*) on the productive and reproductive performance of Soviet Chinchilla rabbit. A total of twenty four weaned bunnies were divided into four dietary treatment groups supplemented with Indian coral plant (*Erythrina stricta*) at levels of 0 per cent, 33 per cent, 66 per cent and 100 per cent. Statistical analysis indicated 66 per cent and 100 per cent supplemented groups to have improved performance ( $P=0.05$ ) in average body weight, average daily gain (ADG) and average daily feed intake. Number of litter size at birth was recorded to be significantly ( $P=0.05$ ) larger in 66 per cent and 100 per cent supplemented groups. Statistical analysis indicated significant ( $P=0.05$ ) heavier litter weight in  $T_4$  and  $T_3$  groups, respectively. Mortality rate recorded during the reproductive period in the treatment groups was 5.97 per cent, 3.96 per cent, 3.24 per cent and 2.85 per cent, respectively. The Indian coral plant (*Erythrina stricta*) has potential as an alternative feed resource that could improve the performance of rabbits in the farming community.

**Keywords:** Productive performance, reproductive performance, Soviet Chinchilla rabbits, Indian coral plant (*Erythrina stricta*).



## ECONOMICS OF ANIMAL DISEASES: A SYSTEMATIC REVIEW IN SMALL RUMINANTS

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### Key words: Small Ruminants, Disease and Economic loss

**Abstract:** Small ruminants, such as Sheep and Goats serve as all-time money (ATM) for rearers and important source of income for livelihood to the landless, small and marginal farmers. A comprehensive economic assessment of animal diseases is of utmost importance before formulating the various livestock health intervention efforts. Measurement of economic losses caused by this important disease would provide information useful in determining research priorities and in drawing attention to the effects of diseases in small ruminants. Estimation of losses is necessary to understand the depth of the problem and design preventive measures for this purpose. An attempt was made to review the economic loss estimation in small ruminants. Economic impact of Bluetongue serotype 8 epidemic in Germany estimated at 74 Euros in sheep. At the national level, the impact of the BTV-8 epidemic ranged between 157 and 203 million Euros. Peste des petits ruminants (PPR) is a highly contagious viral disease in small ruminants causing huge loss to farmers. An attempt was made by Govindraj (2016) to estimate the economic losses based on the annual incidence, morbidity, mortality levels etc. derived from literature, discussion with experts, and based upon scientific facts. The results revealed that at the annual 10 per cent (%) incidence level, the estimated total loss due to PPR in sheep and goats was INR 5041.5 million (77% was mortality loss and 23% was morbidity loss) and INR 11074.6 million (73% mortality loss and 27% morbidity loss), respectively. Further, sensitivity analysis under *Ceteris paribus*, revealed a loss of INR 8058.8 million and INR 24174.1 million at the minimum (5%) and maximum (15%) incidence levels, respectively. V. Senthil Kumar and M. Thirunavukkarasu investigated the losses caused by Sheep Pox in the state of Tamil Nadu (2010), estimated the loss was Rs. 1048.81, Rs. 744.26, and Rs. 200.22 in ram, ewe, and lamb, respectively. N.N. Thombare and Mukesh Kumar Sinha (2009) studied the economic losses caused by PPR in sheep and goats in Pune, Maharashtra, and found that the estimated loss was Rs. 918 in sheep and Rs. 945 in goats. Disease-related losses in goat farms were studied by B Singh and Shiv Prasad in 2008, and the estimated loss in India was RS. 264.8 lakh.



## EPIDEMIOLOGICAL INVESTIGATION OF PNEUMONIC PASTEURELLOSIS INDICATE POSSIBLE CARRIER STATUS OF *PASTEURELLA MULTOCIDA* IN SHEEP FARMS IN KARNATAKA

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### ABSTRACT

Pneumonic pasteurellosis is an important disease of small ruminant caused by *Pasteurella multocida*, a gram-negative bacteria. Disease is commonly manifested as a fulminating, fatal lobar pneumonia, septicemia and even death in complicated case. In the present study, epidemiological investigation of pneumonic pasteurellosis among sheep farms located in and around Dodaballapur taluk of Bengaluru rural district was studied. A total of five sheep farms were investigated and 85 nasal swabs and serum collected from the suspected pneumonic animals having with or without nasal discharge. Animals were not vaccinated against Hemorrhagic Septicaemia. All the samples were subjected to culture and confirmation by *Pasteurella multocida* specific PCR amplification. Further, IHA test was standardized and performed for determination of anti-pasteurella antibodies in the serum. Study revealed 18 samples were positive in PCR amplification (~460bp) indicating the 21% prevalence of pneumonic pasteurellosis in the study area. A total of 30 serum samples (35%) recorded with IHA titre more than 1:160 indicated recent infection. A total of 12 animals (14%) were found to be negative in PCR but had high titre of anti-*Pasteurella multocida* antibodies indicating carrier stage for *Pasteurella multocida*. In conclusion. *Pasteurella multocida* infection was highly prevalent among sheep farms and presence of carrier animals indicated that they could act as potential source for infection /disease transmission to other susceptible animals.

Key Words: *Pasteurella multocida*, sheep, pneumonia



**COMPARATIVE INFORMATICS STUDY OF CODON USAGE PATTERN,  
EVOLUTIONARY RATE AND PHYLOGEOGRAPHIC RECONSTRUCTION IN FOOT  
AND MOUTH DISEASE (FMD) SEROTYPES (A, ASIA 1 AND O) OF SIX MAJOR  
CLIMATIC ZONES OF INDIA**

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**Abstract**

Foot and mouth disease (FMD) is a major economically important viral-induced livestock disease globally. The FMD virus spreads widely in a confined, cool and humid climates conditions. RNA viruses are genetically instable, and highly influenced by the mutational pressure. Likewise, the mutational pressure is majorly determined by the climatic/environmental factors. The present study is a primary effort to have the comprehensive relationship between climatic factors and molecular evolutionary pattern of serotypes FMD virus in India. In study, three serotypes (A, Asia 1 and O) were selected with six major climatic zones of India (Montane, Humid sub-tropical, tropical wet and dry, tropical wet, semi-arid and arid). Based on the publically available nucleotide sequence data the codon usage bias, evolutionary and phylogeographic reconstruction was carried out. The study revealed the presence of significant variation between the codon usage bias indices in the selected serotype with respect to the climatic zones. Implying that the codon usage pattern indices (eNC, CAI, RCDI, GRAVY, Aromo) are seriously affected by selection and mutational pressure, taking a supremacy in shaping the codon usage bias of FMD viral gene. Indicating that the viral co-evolution and adaptation in different climatic zones in India. Further, the tMRCA age was 1947, 1993 and 1961 for serotype-A, Asia 1 and O respectively, for FMD virus. The integrated analysis of codon usage bias, evolutionary rate and phylogeography analysis signifies the major role of mutational and selection pressure, implying that the in FMD virus co-evolution and adaptations are highly influenced by the climatic/environmental factors.

**Keywords:** Foot and mouth disease (FMD), serotypes, Indian climatic zones, Codon usage bias, Evolutionary rate, Phylogeography analysis, Positive selection, tMRCA.



## **MODERN RETAILERS LINKED FIGS BASED SHEEP AND GOAT FATTENING MODEL: DEVELOPING ENTREPRENEURSHIP FOR SELF-EMPLOYMENT IN RURAL INDIA**

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### **ABSTRACT**

Out of the 138 million Indian rural households, 33.01 million (24%) are maintaining sheep and goats. The Meat and Seafood business have become a lucrative venture for start-ups in India. According to a report, the Indian meat industry is estimated at US\$ 31 billion and is growing at a CAGR of 20% and is expected to reach US\$ 65 billion by the year 2022. The value of the global meat sector was estimated to value at 838.3 billion USD in 2020, and was expected it is to increase to 1157.6 billion USD by 2025. India's meat market was Rs. 3300 crores in 2019, likely to be Rs. 4600 crores by 2024. Raising animals that are in good health is essential for the production of good quality meat. Farmers in fragmented rural markets rely on middlemen to sell their sheep and goat. The persistent exploitation is very much like 'predator-prey relationships. When you take the middle man out of services, you take away discrimination of the customer and differential service. The higher productivity and profitability in sheep and goat farming can be achieved by primarily focusing on organizing traditional farming to economically viable commercial sheep and goat fattening farms by organizing individual farmers into Farmers Interest Groups (FIGs) linked with Modern Retailers while focusing on the productivity improving aspects of nutrition, prevention of diseases and equipping them with modern ICT tools to face the climatic risks, market ambiguity and constraints to achieve higher productivity and profitability in given time. To make that to happen in rural settings, group based rural entrepreneurship approach is need of the hour. This transformatory approach is making theory into practical where development agents make them to adopt new way of doing, to be executed in the field in collaboration with all possible stakeholders, though in small scale but aimed at workable, sustainable and commercially viable sheep and goat fattening model.

The group approach can adopt good production practices with less cost. Further, they have better buying power, that can command higher price, if the quality of the product is maintained. They can also encourage backward integration/contract farming. Above all, if the Indian meat industry wants to achieve global recognition, the maintenance of food safety at all stages of production, processing, packing, storage, and marketing of meat and meat-derived products while adhering to the standards prescribed by the importing countries shall make a significant impact. The cost benefit of this approach in terms of productivity gain and profitability made by the beneficiary farmers would provide evidences to the policy makers for replicating and upscaling the programme as well as evaluating the efficiency of each stakeholder. Further, the sustainability analysis helps one to identify the hindrances in implementing the programme and thus, refine the implementing strategies in order to reap more benefits to various stakeholders in the livestock sector, particularly the small and marginal farmers. This approach has the potential to fulfil the expectations of the modern retailers and consumers for quality product. The sustainability assessment of the



programme on a regular basis would give a better idea about different stakeholder's contribution and required mid-course corrections and value addition for doubling the farmers income in a time bound manner.

This approach is a significant improvement over earlier days traditional approach where everything organized loosely without fixing responsibility to anyone for the services required for an economically viable sheep and goat farming model. The traditional way of sheep and goat farming is an isolated approach which is a weak link for strengthening the aspiration for achieving farmers income double, in short span of time. But this commercial modern retailer linkage group-based sheep and goat fattening model with institutions developed lead farmer who operated on real time data where there is possibility of mid-term course corrections. It is these communities that have the least power in our markets who are the quickest to recognize the value of information-rich IT systems. The project aim is to transform the unorganized sheep and goat in rural areas into a self-sustaining organized Farmers Interest Groups resulting in substantial improvement in the livelihood of the farmers making them 'Atma Nirbhar'.

**Keywords:** Modern Meat Retailers, FIGs, Sheep and Goat, Fattening Model, Entrepreneurship, Self-employment

**Title: Effect of heat treatment on sorghum-whey protein interactions**

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**ABSTRACT**

Though several cereal-dairy composite foods have been developed in order to supplement and complement each other, research on interaction between milk proteins and cereal proteins is scanty. The present work aims to isolate and characterize sorghum protein isolate (SPI) from sorghum flour and investigate its interaction with whey proteins. The flour showed an increasing solubility with increasing pH while the SPI (77.88% protein w/w) showed solubility to be minimum at pH 4 and maximum at pH 10. Whey-SPI matrix containing 0.8% protein (w/w), where each of the components supplied half of the total protein, was subjected to four different temperatures, i.e. 60°C, 70°C, 80°C and 90°C for 30 minutes each. Sediment and supernatant fractions, obtained upon centrifugation, were analyzed separately. Particle size, zeta potential and viscosity of supernatants were similar to those of the control whey indicating no protein-protein interaction. Fourier Transform Infrared Spectroscopy (FTIR) analysis of sediment showed shifting of peaks, disappearance of old and appearance of new peaks indicating protein-protein interaction. Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE) analysis discovered disulphide linkages between kafirin and  $\beta$ -lactoglobulin and kafirin and  $\alpha$ -lactalbumin. Further research is needed to explore the molecular interactions and functional properties of sorghum-whey protein composite.

**Keywords:** kafirins, whey, FTIR, SDS-PAGE, interaction





## BLACK SOLDIER FLY- AN ALTERNATIVE WASTE MANAGEMENT & FEED

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### ABSTRACT

Urban solid waste management is regarded as one of the most pressing and significant environmental issues confronting cities in low- and middle-income countries. Global livestock production is increasing, but high feed costs impede the livestock business from growing and meeting rising demand. Given the patterns of rapid urbanization and expansion in urban population, as well as shifts in nutrition preferences, the severity of this dilemma will worsen in the future. Due to growing public pressure and environmental concerns, waste experts worldwide are being called upon to develop more sustainable methods of dealing with municipal waste management. A novel strategy to biowaste conversion by insect larvae, using the Black Soldier Fly (BSF), *Hermetia illucens*, has received a lot of interest in the last decade. Because of their high nutrient content and ability to be raised on organic side streams, insects have been recognized as viable replacements to traditionally utilized protein sources in cattle feed (Nguyen et al., 2015). Which is capable of converting a wide range of organic resources, from food waste to manure, into insect biomass efficiently. In modern society, BSF offers a solution to solve challenges to the lack of global waste management, unemployment in urban areas, and increased demand for sustainable animal feed.

Key words: Black soldier fly, *Hermetia illucens*, insect bioconversion, alternative feed, waste management.

### Selected Reference:

Nguyen, T. T., Tomberlin, J. K., & Vanlaerhoven, S. (2015). Ability of black soldier fly (Diptera: Stratiomyidae) larvae to recycle food waste. *Environmental entomology*, 44(2), 406-410.



## MICROBES INHABITING UPPER RESPIRATORY TRACT OF SMALL RUMINANTS FROM KARNATAKA

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### ABSTRACT

Respiratory tract is one of the important pathway for existence of highly developed lifeforms. This pathway apart from being an air supplier, also harbours various microbial communities at initial entry point to certain extent of tract. Apart from so-called commensals, pathogens which relish on the nutrients of mammals overcome defense mechanisms of the body and causes various diseases in animals, humans, birds. There are identified list of pathogens and opportunistic pathogens available, but because of different lifestyle, mechanizations, farming practices, microbial communities harbouring the tract keeps on increasing. Objectives: To investigate the prevailing microbiome and/ or pathobiome in upper respiratory tract of sheep and goats of Karnataka. Methodology: In this study, during the year 2019-20, 280 nasal swabs were collected from apparently healthy and ill sheep and goats from different districts of Karnataka, processed by conventional methods of enrichment/selective media isolation on Blood agar, MacConkey Agar, BHI Agar. Crude DNA was extracted from haemolytic/nonhaemolytic greyish/whitish pure colonies were subjected to rpoB PCR. Those isolates amplified product size of 560 bp were sequenced by Sanger dideoxy sequencing. A total of 46 isolates revealed detection of following microbiome belonging to mainly three families Pasteurellaceae (15 *Pasteurella multocida*, 20 *Mannheimia* sp.), followed by Enterobacteriaceae (5 *Enterobacter* spp., 1 *Leclercia* sp., 2 *Klebsiella* spp., 3 *E. coli* and 2 *Salmonella* sp.) followed by Moraxellaceae (9 *Moraxella* sp.) and Erwiniaceae (1 *Pantoea* sp.). In conclusion, this study indicated habitation of both pathogens and commensals in the upper respiratory tract of Small ruminants.

**Keywords:** Microbiome, small ruminants, rpoB PCR, Respiratory tract



## **SPECTRUM OF AGRI-BUSINESS PROPOSALS AT NAAVIC AGRI-BUSINESS INCUBATOR (ABI)**

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### **Abstract**

The agriculture sector, a backbone of Indian economy, employs over 52% of Indian population and contributes 17-18% to country's GDP. Agri-business incubators (ABIs) are hub of promoting agri-entrepreneurs and innovation. Agritech-startups can provide solutions to farmers to cope with unreliable climate change, pest attacks, water scarcity, and hikes in price, and other issues. Govt. of India has initiated funding opportunities for the Agri-startups and one such scheme for supporting Agri-startups is RKVY-RAFTAAR under Ministry of Agriculture and Farmers Welfare which resulted in establishment of 28 ABIs across India. One such ABI is NaaViC, at ICAR-NIVEDI, Bengaluru. In the current study, we analysed pattern/distribution of business proposal which were received for Grant-in-aid support.

In past three years 2019-2022, six cohorts for business proposals were invited which resulted in receipt of 1512 applications under Pre-seed and seed-stage startups under the scheme. The analysis of applications indicated that major sector was IT & IoT in Agriculture with 25% of applications. Of which, 32% of applicants had at least one woman as founder/co-founder, Majority of applications received for Grant-in-aid were from Karnataka state and the average age of the applicant being 27 years. Upon mentoring and selection through a set of evaluation criteria's, finally, a total of 34 startups have received a 3.1 Cr Grant-in-aid. Our analysis of proposals reflected That IT & IoT in Agriculture sector is booming and most of the Agri startups are embracing technologies to address the lingering problems. Notably, women's led Agri-startups are on rise in the ecosystem which is significant and could potentially impact the start-up ecosystem.

**Keywords:** Agriculture, Startups, Agri-business, Grant-in-aid, Innovations, IT & IoT



## **SURFACE PROTEINS OF PROBIOTIC LACTOBACILLI EXHIBIT STRAIN SPECIFIC PROTECTIVE ROLE IN COLITIS MICE**

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### **ABSTRACT**

#### **Introduction**

*Lactobacillus plantarum* MTCC5690 and *L. fermentum* MTCC5689 are putative probiotic strains of Indian gut origin that are well known for anti-inflammatory effects; however the effector molecule regulating the underlying mechanisms is not known. The objective of the study was to extract and purify total surface proteins from probiotic *Lactobacillus* strains and to study its protective role in colitis mouse model. A standard probiotic strain *L. acidophilus* NCFM of proven efficacy was used as a control strain. The total surface proteins were extracted from the strains by LiCl, GnCl and lysozyme method. The surface protein preparations (300 µg/100 µl/mice) of the 3 lactobacilli strains were orally gavaged to respective mice groups for the first 7 days alternatively, followed by colitis induction and again alternatively administered with surface proteins for the next 7 days. The extent of colonic damage and inflammation were assessed by histological analysis, determination of Myeloperoxidase (MPO) activity and cytokine levels. Among the three extraction methods tested, the LiCl method was found to be the best method. The administration of surface proteins had visible improvements in the disease parameters (appetite, fur quality, movement etc.) of colitis mice. In the colonic tissue, significant reduction in the MPO levels as well as improvement in the histological score and morphological damage were noted in the NCFM group followed by MTCC5690 and then MTCC5689 compared to colitis control. In terms of cytokines expression, increase in IL-10 and decrease in TNF- $\alpha$  was observed in NCFM treated group followed by MTCC5689 and then MTCC5690. The study signifies that surface proteins from probiotic lactobacilli strains exhibit anti-inflammatory effect in colitis mice in a strain specific manner. Surface proteins/protein from probiotic lactobacilli can be a safer and better therapeutic alternative to live probiotics for combating inflammatory disorders.

**Keywords:** Probiotic, surface protein, mouse, colitis, DSS,



## **GROWTH AND PROSPECTS OF DAIRY SECTOR IN INDIA**

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### **ABSTRACT**

Dairy sector is an imperative part of rural and urban economy. It helps in improving the socio-economic status of the farmers, provide nutrition and employment opportunities to the population. Currently India contributes more than 23% of the world's total milk production. India's milk output is estimated to be 209.96 (GOI, 2020-21). India is vast country and with the increase in the population demand for dairy products has also elevated. Therefore we need constant efforts for sustainable development of dairy sector. The per capita availability of milk has also increased to a level of about 406 grams per day in (GOI 2019-2020), which is higher than the world average and even more than 300ml/day recommended by ICMR. The livestock sector contributes 5.2% of GDP out of total 18.4% GDP contributed by agriculture and allied sector. However the share of livestock sector in agricultural GDP of India has increased from 13.88% in 1980-81 to 25.85% in 2011-12. Moreover the compound growth rate of milk production in India was 5.6% during 1990-91 to 2019-20. Hence dairy sector has emerged as sunrise sector in the economy with the vast networks of dairy cooperatives which will help in fulfilling the ever growing demands of milk products in coming years.

**Keywords:-** Dairy, Growth, Livestock, Socio-economic



## ADVANCES IN DAIRY AND VETERINARY SECTOR TOWARDS SUSTAINABLE DEVELOPMENT GOALS A GLANCE INTO THE COW BASED ECONOMY IN SUSTAINABLE AGRICULTURE

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### Abstract

Human health and food security are likely to be the most important global issues in the light of current population growth. As a result, safeguarding human health and food security has become a key priority for countries at all stages of economic growth. Simultaneously, the livestock industry plays a critical part in any country's economic, environmental, and social management. Since the domestication of cattle, both cows (females) and bulls (males), have played a unique role in human history. The cow (*Bos taurus* or *Bos indicus*) has a high pedestal because of the extensive use of their valuable harvests such as dairy products (colostrum, milk, clarified butter, yoghurt, and so on) and animal waste such as dung and urine. Cow urine-mediated nanomaterials exhibit unique properties and pioneering uses in a range of scientific and technological domains. As a result, the goal of this study is to provide a complete overview of various cow products, including their molecular composition, bioactivities, and applications ranging from human welfare to natural farming leading to agricultural sustainability. This review also aims to highlight the potential for cow products to be used in Zero Budget Natural farming, bioenergy generation and pollution remediation which will lead our country towards sustainable agriculture.

Keywords: Food security, cow, economy, human welfare, natural farming, sustainable.



**“AMELIORATIVE EFFECT OF FOXTAIL MILLET (*SETARIA ITALICA*)  
FORTIFIED FERMENTED PROBIOTIC LASSI ON INDUCED OBESITY AND  
TYPE-2 DIABETES”**

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**ABSTRACT**

Normalized sedentary lifestyle coupled with environmental factors has led to high rising statistical figures of diabetes and obesity evident globally. Foxtail millet has been receiving increasing attention owing to its multitude of health benefits among which hypoglycemic and hypercholesteremic effects are two of the most prominent. Probiotics have proved their efficacy in amelioration and management of metabolic disorders over time, whether alone or with prebiotic additives. A food-based intervention combining foxtail millet and probiotics both is needed to combat the rising pandemic of metabolic syndrome. In this study, we have formulated a novel Foxtail millet fortified probiotic lassi as our symbiotic therapeutic approach towards diet induced obesity and Type-2 Diabetes. C57 mice was the rodent model of choice due to its higher susceptibility to diet induced obesity and diabetes. The morphological and biochemical parameters have collectively proved to have proposed effects on the diabetes and obesity biomarkers. Histopathological examination clearly showed the improvements in the cellular integrity and reduction in the adipocyte hypertrophy. The RT-PCR data analysis showed a marked decline in expression of proinflammatory cytokines. In conclusion, Foxtail millet fortified probiotic lassi could be a possible therapeutic dietary addition for proper management of Type-2 Diabetes and Obesity.

Keywords: Millet, Probiotics, Type-2 Diabetes, Obesity



## SIMULATION APPROACH TO COMPARE DIFFERENT BIOGAS BURNER DESIGNS

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### Abstract

Biogas generated from cattle manure or other biomass can be used as one of the alternative for fuel and can pave way for waste to wealth. Biogas is one of the cheaper and sustainable alternatives for LPG. Biogas stove has become a widely adopted appliance and helps to meet the energy requirement for cooking. Researchers have worked on number of different designs of biogas burners. There is a great potential for advancement and improvement in biogas technology. This study was undertaken to compare various geometries of biogas-fired burners using simulation. The simulation model was developed on Python platform. Various simulation parameters were burner geometry, number and diameter of flame porthole, gas flowrate, and air-gas mixing ratio. The study was found useful to navigate researchable parameters which are crucial for improving thermal efficiency of the biogas burner.

**Keywords:** Biogas, Burner, Design, Stove, Simulation, Thermal Efficiency





## QUALITY ASSESSMENT OF IMPROVED GRASSES FOR LIVESTOCK NUTRITION ON DEGRADED GRASSLAND & UNDER MID HILL CONDITIONS OF H.P.

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### ABSTRACT

A study was carried out to investigate “Quality assessment of improved grasses on degraded grassland under mid hill conditions of H.P. was conducted during July 2016 to October 2017 at the research farm of Agroforestry unit of Department of Horticulture and Agroforestry, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur. The experiment consisted of 7 treatments comprising of *Setaria*, *Brachiaria*, White clover and their 3 combinations viz; *Setaria*+White clover, *Brachiaria*+White clover, *Setaria*+ *Brachiaria*+White clover and control. The experiment was laid out in randomized block design with three replications. Fodder was analyzed for various quality parameters at the time of different cuts of forages. All grasses were analysed for nutritional and anti-nutritional components viz., dry matter, crude protein, crude protein yield, Total Ash, neutral detergent fibre (NDF) and acid detergent fibre (ADF), Oxalate and Lignin. In all grasses, White clover pure recorded significantly the highest crude protein content (20.0%), Pure *Setaria* treatment recorded significantly higher Acid Detergent Fibre (47.68%) and Pure *Brachiaria* treatment recorded significantly maximum neutral detergent fibre content (67.28). *Setaria* and *Brachiaria* grasses when grown in combination with White clover produced significantly higher crude protein content than when planted alone. Lowest neutral detergent fibre and acid detergent fibre content was recorded in White clover treatment. Balanced and complete nutrition is essential to sustain the growth of livestock to maintain optimum productivity and profitability. Grasses have a potential to be a source of energy for animals but have low protein content whereas, contrary to this, legumes are low in energy but rich in protein and other essential nutrients. The results of the study revealed that the fodder quality of the forage was improved through the introduction of the legume component.

**Key words:** *Setaria*, *Brachiaria*, White clover, Grasses, Quality Parameters, NDF, ADF



## HERITABILITY ESTIMATES OF PRODUCTION AND REPRODUCTION TRAITS OF FIRST LACTATION IN CROSSBRED CATTLE

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### ABSTRACT

Data pertaining to 529 crossbred cattle sired by 79 sires maintained at dairy farm of GBPUAT, Uttarakhand between 1990-2019, were collected from the university farm to study their heritability estimates. The heritability estimates for the first lactation production and reproduction traits of the crossbred cattle were calculated using mixed model least-squares and maximum likelihood computer program PC-2 of Harvey (1990). The heritability ( $h^2$ ) estimates under univariate model 2 of Harvey (1990) for all first lactation traits AFC, FSP, FCI, FLP, FLMY, FL305DMY, FLPY and FLDAPY were  $0.18 \pm 0.04$ ,  $0.28 \pm 0.04$ ,  $0.21 \pm 0.10$ ,  $0.40 \pm 0.10$ ,  $0.42 \pm 0.15$ ,  $0.36 \pm 0.09$ ,  $0.41 \pm 0.10$  and  $0.34 \pm 0.20$ . Heritability estimates were low in magnitude for reproduction traits (AFC, FSP and FCI) ranging from  $0.18 \pm 0.04$  to  $0.28 \pm 0.04$ . However, for production traits (FLP, FLMY, FL305DMY, FLPY and FLDAPY) the heritability estimates were reported medium ranging from  $0.34 \pm 0.20$  to  $0.42 \pm 0.15$ . Low heritable reproduction traits do not hold much promise for improving the first lactation traits by direct selection but emphasis should be laid on scientific management practices. Medium heritability indicated that there is a scope for direct selection of animals for faster genetic progress. The variation due to environmental factors is more important in governing the reproduction traits while the production traits are had major influence of additive genetic factors.

**Keywords:** Heritability, Crossbred, Haryana, Holstein Friesian, Jersey, Lactation.



## SOIL ENZYMATIC ACTIVITY AND MICROBIAL COUNT AFFECTED BY DIFFERENT NUTRIENT MANAGEMENT PRACTICES UNDER FODDER PEARL MILLET CULTIVATION

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### ABSTRACT

The present study was undertaken during *khariif* season of 2019-20 at Agronomy research farm, ICAR-NDRI, Karnal (Haryana). The experiment was laid out in Randomized Complete Block Design with eight treatments *viz.* T<sub>1</sub>: Absolute control; T<sub>2</sub>: 100% RDF; T<sub>3</sub>: 100% RDF + Cow urine foliar spray; T<sub>4</sub>: 100% RDF + PGPR; T<sub>5</sub>: 100% RDF + PGPR + Cow urine foliar spray; T<sub>6</sub>: 75% RDF + Cow urine foliar spray; T<sub>7</sub>: 75% RDF + PGPR and T<sub>8</sub>: 75% RDF + PGPR + Cow urine foliar spray with three replications. Study indicated that soil enzymatic activity and microbial count significantly affected by different nutrient management practices under fodder pearl millet cultivation and recorded maximum microbial biomass carbon (163.47 and 192.44 µg/g dry soil), dehydrogenase activities (13.25 and 23.83 µg TPF/g soil/day), alkaline phosphatase activities (84.55 and 106.96 µg PNP/g soil/hr.), bacterial counts (14.46×10<sup>6</sup> and 22.09×10<sup>6</sup> CFU/g soil), actinomycetes counts (26.40×10<sup>5</sup> and 37.15×10<sup>5</sup> CFU/g soil) and fungal counts (14.07×10<sup>4</sup> and 18.85×10<sup>4</sup> CFU/g soil) at 40 DAS and harvest respectively, with application of 100% RDF+PGPR+CU, which was found statistically at par with 100% RDF+PGPR followed by 75% RDF+PGPR+CU and 75% RDF+PGPR at 40 DAS, while, at harvest it was found at par with 100% RDF+PGPR and both were found significantly higher over rest of the treatments. Which, will further sustain soil fertility and crop productivity.

**Key words:** Cow urine, Enzyme, Fodder, Pearl millet and Soil



## EXPLORING THE NUTRITIONAL POTENTIAL OF WILD GRASS FODDER FOR MEGA HERBIVORE (*ELEPHAS MAXIMAS*) IN FOOTHILLS OF WESTERN GHATS

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### ABSTRACT

**Back ground:** During April 2021- April 2022 the study was conducted in Coimbatore reserve forest, Western Ghats. The area falls between 10°37'and 11°31' North latitudes and 76°39'and 77°5' East longitudes.

**Methods:** It was approached in a systematic random sampling method. For that, 1sq.m size bamboo frame was randomly placed and the density of grass species were recorded in percentage. Samples were shade dried for one week and ground to pass through 1mm sieve, grinded and stored in to polythene bags and the samples were chemically analysed to determine their nutritional values.

**Result:** The DM content of various grass fodder was varied from 28.18% to 59.75%. The crude protein content was differing between 5.94% and 11.94%. The highest CP was recorded in *Cyanodon dactylon* (11.94%) and least in *Artistida setacea* (5.94%). Ether extract content was found in the range of 1.00% to 5.00%. The ADF content of *Aristida setacea* (45.74%) was observed as highest whereas the lowest was observed in *Oplismenus burmannii* (26.78%) and it was followed by *Themeda triandra* (26.85%), *Heteropogon contortus* (30.12%) and *Enteropogon monostachyus* (30.31%). The average NDF content of grass fodder was 52.27% with a range of 37.89% (*Oplismenus burmannii*) to 67.87% (*Cymbopogon martinii*). The average TDN content of grass was 77.45%; RFQ exhibited wider variations among the grasses and it ranged between 107.51 and 198.83. This is the pioneer study evaluating nutritional values of native grass fodder for elephant in Western Ghats. This study gives strategies for selection of high nutritive fodder grass for habitat improvement of elephant and also it provide scientific and baseline information for conservation of native grass fodder in Western Ghats.

**Keywords:** Native, Grass fodder, Nutritional character, elephant



## DEVELOPMENT OF CEREBELLUM IN PRENATAL GADDI SHEEP FETUSES

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### Abstract

The present investigation was conducted on the brain of 54 Gaddi sheep fetuses to study the development of cerebellum at different stages of gestation. The prenatal brain samples were divided into four groups viz. Group-I (30-60 days), Group-II (61-90 days), Group-III (91-120 days) and Group-IV (121 days- till full term) based on their age (days) obtained by the formula,  $Y = 2.74X + 30.15$ , where Y is the age of embryos in days and X is the CRL in centimeters. A significant ( $p < 0.05$ ) increase was observed in the weight of the cerebellum from Group I to Group III and further to Group IV. The cerebellum was present as a dumbbell shaped structure as early as 67 days of gestation. The external granular layer was unique to the fetal cerebellum of Group I. Purkinje cells were organized as a distinct layer at 96 days of gestation. In Group IV of Gaddi sheep fetuses, the purkinje cell layer consisted of a single layer of flask-shaped cells which were distributed uniformly along the upper margin of inner granular layer. The length and width of cerebellum increased significantly from Group I to Group IV.

Keywords: Cerebellum, Prenatal, Sheep



## **DOUBLING FARMERS INCOME THROUGH INCREASING MECHANISATION OF DOMESTIC PROCESSING EQUIPMENT AT LARGE SCALE IN DAIRY AND FOOD SECTOR**

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### **ABSTRACT**

Milk production in the country has grown at a compound annual growth rate of about 6.2 per cent to reach 209.96 million tonnes in 2020-21 from 146.31 million tonnes in 2014-15. The scenario gives lots of scope for increasing income of farmer's in the fields of processing of milk. Spoilage of the milk is the major problem facing by rural farmers as they are lacks of modern storage infrastructure such as chilling and processing facilities. For this purpose, highly need of reducing cost of processing equipment and domestication of the processing instruments through mechanisation of dairy and food processing equipment. As per 2<sup>nd</sup> advance estimates for 2021-22, total food grains production in the country is estimated at record 316.06 million tonnes which is higher by 5.32 million tonnes than the production of food grain during 2020-21. The Fruits production is estimated to be 102.9 Million Tonne compared to 102.5 Million Tonne in 2020-21. The production of Vegetables is estimated to be 199.9 Million Tonne, compared to 200.4 Million Tonne in 2020-21. As it may note that fruits and vegetables spoilage of the country varies from 25 to 30 per cent and there is need of improve storage structures in rural areas as well as increase processing facilities for reducing the wastage in agriculture sector. This mechanisation increase the farmer's income and definitely contributes in countries economy.

**Keywords:** Milk, dairy, food, income, grains, farmers, fruits and vegetables



## EFFECT OF ALUMINA DOPING TO BIOGENICALLY SYNTHESISED ZNO NANOPARTICLES FROM COW URINE

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### ABSTRACT

The biogenically synthesis method has proved successful in economical synthesis of pure zinc oxide (ZnO) and alumina-doped zinc oxide (AZO) nanoparticles from cow urine using a co-precipitation method. The vast bio-molecules present in cow urine act effectively in reducing aluminum and zinc ions to alumina-doped zinc oxide and also act as chelating and gelling agents. The UV-Visible spectroscopy, FTIR, and EDS studies confirm the presence and purity of biogenically synthesised nanoparticles. Blue shift in absorption band and enhancement in energy band gap results due to the Al<sup>3+</sup> doping to ZnO nanoparticles. The XRD analysis shows hexagonal wurtzite structure of ZnO and AZO nanoparticles with 67.02 and 72.01% crystallinity and reducing in crystal size from 12.29 to 9.20 nm after doping of ZnO with Al<sup>3+</sup>. SEM study also postulates similar results of reduction in size from 17.40 to 12.43 nm and reduction in agglomeration of nanoparticles. AFM analysis concludes reduction in surface roughness of ZnO from 1.575 to 1.302 nm after doping with Al<sup>3+</sup>.

Keywords: Biogenic synthesis, alumina-doped ZnO nanoparticles, FTIR, SEM, EDS, AFM.

### MANGO FLAVOURED MILK FROM STABILIZED SOUR COW MILK

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### ABSTRACT

Souring of milk is a common problem in tropical countries like India, cause of huge economic losses for farmers as well as dairy entrepreneurs. An attempt was, therefore made to improve the stability of sour cow milk (SCM) to make it suitable for preparation of mango flavoured milk (MFM). Stabilizing salt – tri sodium citrate (TSC) was added @ 0.1-0.5% to milk with acidity ranging from 0.13- 0.23% lactic acid (LA) to enhance the heat stability. However, addition of TSC could not improve the heat stability of milk with > 0.18% LA satisfactorily. The study showed that the addition of 0.3% TSC to SCM with acidity 0.18 % LA gave negative alcohol test at 70% (v/v) alcohol without affecting the flavour of milk. The 0.3% TSC added SCM was mixed with mango pulp (@10-14%), stabilizer (?-carrageenan:guargum:CMC @ 0.2-0.3%) and sugar (@ 7-8%) for preparing MFM. Optimization of the ingredients was done employing face centered design model of response surface methodology. The optimization process suggested that use of mango pulp, stabilizer and sugar @ 12.57%, 0.28% and 7.56%, respectively of the volume of TSC added SCM produced MFM with a highest desirability of 0.88.

**Keywords:** Sour cow milk, Heat stability, Tri sodium citrate, Alcohol test, Mango flavoured milk.



## ROLE OF *ARTEMISIA ANNUA* ESSENTIAL OIL IN METHANE MITIGATION FROM RUMINANTS UNDER *IN VITRO* CONDITIONS

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### Abstract

Methane emission in ruminants has received a lot of attention because of its contribution to greenhouse gases and impact on global warming. Researchers are currently looking for natural products to develop new feed additives that will improve feed efficiency and reduce methane emission from ruminants. This study was conducted to examine the efficacy of *Artemisia annua* essential oil at different level (50-250 ppm) in different roughage (R) and concentrate (C) ratio (50R:50C, 60R:40C and 70R:30C) under *in vitro* conditions. Results revealed that total gas production (mL/g DM), digestibility of DM (%), acetate and propionate level improved significantly ( $P < 0.05$ ) at 50 ppm level in 60R:40C. In contrast, decreased in CH<sub>4</sub> (%) and CH<sub>4</sub> (mL/100mg DM) were noted with 50 and 100 ppm of essential oil incorporation. There was slightly change observed in ammonia N mg/dl and acetate: butyrate (AP) ratio at 50 ppm in 60R:40C. This study concluded that mixing *Artemisia annua* essential oil in feed can be used to reduce methane emission under *in vitro* conditions and it will be used on animals in the future.

**Keywords:** Essential oil, Methane, Ruminants, Digestibility





## EFFECTS OF ORAL LACTOFERRIN AND PROBIOTIC INTERVENTIONS IN EARLY LIFE ON GUT HEALTH AND NEONATAL PIGLET MORTALITY

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### Abstract

The neonatal piglet mortality has emerged as a major hurdle for profitable pig production. Improved management and strategic nutritional intervention in early age have been reported to improve survivability in post-natal life. The objective of the study was to examine whether supplementations of oral lactoferrin (Lf) and swine origin *Pediacoccus acidilactici* FT28 probiotic will improve the gut health and growth performance and prevent mortality of suckling piglets. A total of 80 piglets from 8 sows were randomly assigned into four groups, as group control, where 23 piglets received 2.0 mL NSS once daily orally; group bLf, where 21 piglets received 100 mg bLf once daily orally; group Pb where 18 piglets received *P. acidilactici* FT 28 probiotic at the dose rate of 10<sup>9</sup> colony forming unit (cfu)/ piglet once daily orally and group bLf+Pb where 18 piglets received both 100 mg bLf and *P. acidilactici* FT 28 probiotic at the dose rate of 10<sup>9</sup> cfu once daily orally from day 0 to 7 of birth. The results revealed that bLf supplementation significantly (p<0.05) improved the mean concentrations of iron (Fe), zinc (Zn), transforming growth factor-  $\beta$ 1 (TGF- $\beta$ 1) and immunoglobulin G (IgG) and A (IgA) and reduced the oxidative stress indices. Although probiotic supplementation markedly (p<0.05) increased the TGF- $\beta$ , IgG, IgA concentrations but, it did not produce any significant effect on Fe, Zn and oxidative stress indices. The combined bLf and probiotic supplementations also improved the concentrations of Fe, Zn, TGF- $\beta$ 1, IgG and IgA in serum and ameliorated the oxidative stress of neonatal piglets. The Log-rank (Mantel-Cox) test showed the piglet survivability was significantly higher bLf (100%) and Pb (94.444%) supplemented groups when compared with control (65.217%) group however it was not significant between control and bLf+Pb (88.889%) supplemented group. A significant improvement in ADG and piglet weight at weaning was observed in the Pb group as compared to other groups, with no significant differences in piglet weight at birth among the four groups. The incidence of diarrhoea was 2.485% and 0.680% in control and bLf groups while no diarrhea incidence was recorded in Pb and bLf+Pb groups. Taken together, it is concluded that bLf alone was superior in reducing piglet mortality, whereas probiotic alone was superior in reducing diarrhoea incidence among all the supplementation groups till the age of weaning.

**Keywords:** Lactoferrin; Mortality; Piglet; Probiotic; Diarrhea



## CONVENTIONAL AND COPRO-PCR TECHNIQUES FOR DETECTION OF TAENIID EGGS OF DOGS

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### ABSTRACT

The present study was carried out to determine the prevalence of *Taenia* spp. infection in dogs from various parts of Andhra Pradesh. A total of 418 faecal samples of dogs were screened by direct smear, sedimentation, flotation technique using zinc sulphate flotation and Formalin-ether sedimentation technique. The overall prevalence of taeniid infection in dogs was determined as 10.05%. Formalin- Ether sedimentation technique was regarded as a best among other conventional microscopic techniques. 38 samples out of 50 known positive and known negative were found positive by PCR. Out 38 samples, 23 were found positive for *Echinococcus granulosus* and 15 samples were found positive *Taenia* spp. Higher infection rate was recorded in adult male stray dogs in rural areas during summer season. The PCR based test is used in large scale for detection of Taeniid infection in dogs and it is regarded as a most specific diagnostic method. By using specific primers, Taeniid infection can detected up to species level, with a specificity of 100%.

Keywords: Taeniid eggs, *Taenia* spp, *Echinococcus granulosus* and COPRO-PCR.



**METAGENOMIC INSIGHTS IN RESPONSE TO HOST-SPECIFIC PROBIOTICS  
SUPPLEMENTATION UNDERLYING THE DIFFERENCE IN PERFORMANCE,  
IMMUNITY, AND FECAL MICROBIOTA OF PRE-RUMINANT BUFFALO  
CALVES**

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**ABSTRACT**

Eight Murrah buffalo 3-5 days old calves (average body weight  $32.52 \pm 0.43$  kg) were divided into two groups randomly to evaluate the effects of host-specific probiotics on performance, immunity, and fecal bacterial metagenomics as follows: Group (I) received basal diet alone without probiotics (CON); Group (II) received lyophilized probiotic formulation (PF) having both *Limosilactobacillus reuteri* BF-E7 and *Ligilactobacillus salivarius* BF-17 ( $1 \times 10^9$  CFU/g/calf/day) along with basal diet for 30 days. There was an increased final BW (kg), average daily gain (g/d), average dry matter intake (g/d), and structural growth measurements in PF than in CON. Furthermore, PF group calves showed significant ( $P < 0.05$ ) improvement in fecal biomarkers like lactate and ammonia, immune status, *vis-a-vis* reduced fecal score. Moreover, metagenomics insights of fecal samples revealed that the relative abundance of *Firmicutes* tended to be higher in PF calves than in the CON. However, the relative abundance of *Proteobacteria* was lower for calves of PF group on day 15. A trend was observed in *Bacteroides* and *Lactobacillus* abundance in calves fed PF compared with those of the control calves. It is concluded that administration of probiotic formulation significantly improved performance and gut health via modulating intestinal microbiota of buffalo calves.

**Keywords:** Early-life intervention; *Lactobacillus* spp.; calves; immune status; gut microbiota



## NOVEL POLYMORPHIC VARIANTS IN STEAROYL-COENZYME A DESATURASE 1 (SCD1) GENE ASSOCIATED WITH MILK FAT CONTENT IN EGYPTIAN AND INDIAN BUFFALO BREEDS

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### ABSTRACT

Molecular genetic interventions in modern times are active gears for creating animals with a superior genetic makeup. Stearoyl-Coenzyme A desaturase 1 (SCD1) is a candidate gene for milk fat content. Using polymerase chain reaction single-strand conformation polymorphism (PCR-SSCP) assay and sequencing technologies, we studied genetic variants in the exon four regions of the SCD1 gene in *Bubalus bubalis* and linked them to milk characteristics. Two single nucleotide polymorphisms (SNP) have been identified in the coding region of the bubaline SCD1 gene in Murrah and Bhadawari buffalo breeds. Because of the nucleotide substitution, the amino acid arginine was converted to lysine. The 3D protein structure of the SCD1 gene was estimated using homology modeling, which revealed a wide variation (Root Mean Square Deviation) ranging from 0.458 to 1.391. Further association analysis of these novel variations could reveal punctual effect on fatty acid deposition traits and their utility for marker assisted selection purposes. The role of the SCD1 gene in milk production is demonstrated in this research and how it could be targeted to select outstanding dairy buffaloes.

**Keywords:** *Bubalus bubalis*, SCD1, PCR-SSCP, SNPs, 3D protein structure



**EFFECT OF RICE DISTILLERS DRIED GRAINS WITH SOLUBLE (RDDGS) ON PRODUCTION PERFORMANCES IN LOW INPUT TECHNOLOGY (LIT) MEAT PURPOSE COLOURED CHICKEN IN TRIPURA**

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**Abstract**

The present study was conducted to evaluate the effects of rice distillers dried grains with soluble (rDDGS) on overall growth performance and economic viability in low input technology (LIT) meat purpose coloured chicken in Tripura. Two hundred (200) day old LIT meat purpose coloured chicks were randomly distributed into four experimental groups with 50 birds in each in a completely randomized design. Each group was sub-divided into 5 replicates with 10 birds in each. The experimental groups were: (1) Control (without rDDGS)(2) T<sub>1</sub> (10% rDDGS) (3) T<sub>2</sub> (14% rDDGS) (3) T<sub>3</sub>(18% rDDGS).Supplementation of rDDGS at 14% level significantly ( $P<0.05$ ) decreased average feed intake and body weight compared to control but there was no difference in FCR between control and DDGS supplemented groups. Supplementation of rDDGS at three dose levels, did not show any significant effect on serum biochemical parameters. Supplementation of rDDGS @ 14% level significantly increased ( $P<0.05$ ) dressing %, thigh% and drumstick %. No significant difference ( $P>0.05$ ) was observed in metabolizability of dry matter, crude protein, ether extract, crude fibre, nitrogen free extract and organic matter between the experimental groups. Total expenditure per bird was highest in control group. Dietary supplementation of rDDGS at 14% level was most effective in improving FCR, carcass traits and biochemical parameters but for better economic gain we may recommend 18% inclusion of rDDGS in basal diet of chicken.

Key words: Chicken, DDGS, Performance, Carcass, Economic.



## **ROLE OF VITAL INGREDIENTS IN TECHNOLOGY OPTIMIZATION AND QUALITY EVALUATION OF PIZZA CHEESE (MOZZARELLA)**

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### **ABSTRACT**

Pizza cheese is one of the most liked cheeses for garnishing and sprinkling on a number of food items. The importance and role of omega 3 fatty acids and dietary fibre in fulfilling various health functions to the consumers is scientifically proven. Factually, milk and milk products are devoid of dietary fibre and poor source of omega 3 fatty acids. Keeping in view the above facts, the present investigation was aimed to optimize the technology for the preparation of Pizza Cheese (Mozzarella) with mentioned vital nutraceuticals in the form of emulsion. The Pizza Cheese (Mozzarella) was prepared with varying levels of milk fat i.e 1.5, 3.5, and 4.5 percentages. From the sensory analysis and also the consumer's preference trend towards less fat, it was deduced that 3.5 per cent was fairly acceptable for Pizza cheese (Mozzarella) preparation. Also, sensory analysis revealed that addition of up to 6 per cent levels of emulsion was acceptable by the panellists. Hence these levels were taken further to prepare functional Pizza cheese (Mozzarella). From the research findings, it was found that 40per cent vital ingredients were retained in the Pizza cheese (Mozzarella). The proximate composition of control and experimental Pizza cheese (Mozzarella) were within the limits prescribed by Food Safety Standards Authority of India (FSSAI).

**Key words:** Pizza Cheese (Mozzarella), Omega 3 fatty acids, Dietary Fibre, Emulsion, RDA



**ADVANCES IN DAIRY AND VETERINARY SECTOR TOWARDS SUSTAINABLE DEVELOPMENT GOALS MOLECULAR CHARACTERISATION OF ENTEROBACTER SP. FROM RESPIRATORY INFECTIONS OF ANIMALS.**

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**ABSTRACT**

*Enterobacteriaceae* Organisms like *Enterobacter cloacae* complex are part of natural gastrointestinal flora in mammals but become pathogenic under opportunistic conditions. Detection by PCR and Molecular characterization helps in the identification of an organism and assessing genetic diversity.To identify the presence of *Enterobacter* species, bacterial isolates from field respiratory infections were revived, followed by crude DNA extraction and PCR detection using published OMP gene-specific primers. 6 out of 60 isolates that were screened showed amplification of 385bp product. PCR products were sequenced by Sanger method and BLASTn analysis were carried out.Antimicrobial susceptibility test was carried out by Kirby Bauer Disc Diffusion method to check the antibiotic susceptibility of the isolates for cephalothin, ampicillin, amoxicillin, and chloramphenicol. All the tested isolates were resistant to Cephalothin, Ampicillin, and Amoxicillin and showed susceptibility to chloramphenicol. By partial gene sequencing analysis and phylogenetic tree construction by Neighbour Joining method using MEGA software, three isolates were found to be closely related to *Enterobacter hormaechei* which belongs to *Enterobacter cloacae* complex.

**Keywords :** Enterobacter sp., OMP gene, Phylogenetic tree, Animals,

**DAIRY DEVELOPMENT IN INDIA: INSIGHTS FROM HOUSEHOLD AND DISTRICT LEVEL ANALYSIS**

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**Abstract**

This paper explores the patterns and determinants of bovine demographic structure and dairy development in India. We used district level data from the recent 20<sup>th</sup> Livestock census and household level data from Livestock Holdings Survey conducted by NSSO in 2018-19. The study uses herd efficiency ratio and milk productivity as indicators of dairy development. We find a higher bovine density in the districts of Jharkhand, Bihar, Himachal and Uttarkhand. The eastern and tribal districts of the country were found to have higher share of indigenous cattle, lower herd efficiency ratio and low milk productivity. Districts found in Kerala, Punjab, Tamil Nadu, Haryana, Karnataka are marked by higher share of crossbred cattle, high herd efficiency ratio and milk productivity. Gini coefficients revealed a more equitable bovine ownership than land ownership. Regression analysis showed that households with smaller landholdings had a higher herd efficiency ratio. Unirrigated households have the most efficient bovine herd. The landless households had the highest average milk productivity. Among the land owning households, milk productivity was higher for households with larger land sizes. The study reveals that dairying contributes to a greater share of farm income to marginal and small farmers.

**Keywords:** Bovine density, farm income, herd efficiency, marginal farmers, milk productivity,



## CHARACTERIZATION OF RECYCLED MANURE SOLIDS AS COW BEDDING MATERIAL

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### ABSTRACT

The bedding material has a significant effect on the health, welfare and performance of dairy animals. Increased cost and reduced availability of traditional bedding materials such as sand and straw necessitate exploration more accessible and sustainable options like recycled manure solids (RMS). Therefore, the present study was conducted to characterize the physical, chemical, and bacteriological properties of recycled manure solids. After anaerobic digestion of cow dung in a containerised digester (retention time 30-40 days), slurry collected in the outlet tank was fed to the manure dewatering machine for the removal of excess moisture. The solid portion that remained is recycled manure solids which is subjected to sun drying for 48 hrs to obtain the desired moisture level in the recycled manure solids. The physicochemical and bacteriological properties of RMS were evaluated in-vitro using standard methods. The physical properties of the RMS such as water holding capacity (g water/g dry matter), moisture (%), Bulk density ( $\text{Kg.m}^{-3}$ ), tapped bulk density, coefficient of friction and porosity were  $1.76\pm 0.02$ ,  $45.45\pm 0.17$ ,  $119.48\pm 0.67$ ,  $151.72\pm 1.92$ ,  $0.51\pm 0.02$  and  $90.90\pm 0.06$ , respectively. The chemical properties of the RMS such as pH, total N (g/kg), C (g/kg), C: N, Ash (%), and organic matter in recycled manure solids were  $8.07\pm 0.02$ ,  $1.71\pm 0.1$ ,  $35.91\pm 0.77$ ,  $21.12\pm 1.61$ ,  $28.16\pm 1.557$  and  $1.83\pm 1.55$ , respectively. In recycled manure solids, the total bacterial count, *Coliform* counts, *E. coli*, *Staphylococcus spp.*, and *Streptococcus spp.* counts were  $21.16\pm 2.28$ ,  $8.43\pm 0.33$ ,  $11.85\pm 4.4$ ,  $15.55\pm 1.12$ , and  $16.99\pm 2.37$ , respectively. The physicochemical properties of the RMS are comparable with other bedding materials.

**Keywords:** Recycled manure solids, physicochemical, bacteriological properties





## CAROTENOIDS ENRICHED GHEE AND ITS QUALITY PARAMETERS

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### ABSTRACT

Ghee is chemically complex lipid; during its prolonged storage, it produces objectionable flavour and odour due to autoxidation of fat and thus limits its shelf life. Since, the addition of synthetic antioxidant(s) is prohibited by the Food Safety Standards Authority of India, an attempt was made to prepare ghee enriched with carotenoids as natural sources of antioxidants. The  $\beta$ -carotene is a natural yellow-red coloured carotenoid pigment. It is an important precursor for vitamin A and used as a colorant in the food industry under the numbers E160. In this study, Response surface methodology was used to extract the  $\beta$ -carotene from carrot using ghee as a solvent by Ultrasonication. Frequency, amplitude, extraction time, and Carrot powder to ghee ratio were optimized for optimum extraction of  $\beta$ -carotene. The optimized ghee product was superior in terms of sensory properties, colour parameter, and antioxidant activity (% Inhibition of DPPH) than Control ghee. FFA content of the product was  $0.24 \pm 0.02$  % oleic acid. The physico-chemical quality indicator was found to be unaltered and their values were on par with the specifications given by FSSAI. Thus,  $\beta$ -carotene will be a potential alternative to synthetic antioxidants to extend the shelf life of ghee during storage.

**Keywords:** Ghee, Carrot,  $\beta$ -Carotene, Ultrasonication, Antioxidant



## PREPARATION OF MORINGA POD PULP POWDER AND EVALUATION OF PHYSICOCHEMICAL AND BIO-FUNCTIONAL PROPERTIES

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### ABSTRACT

*Moringa oleifera* is popularly used as medicinal plant, since each and every part of the plant like leaves, fruits/pods, flowers, seeds, stem, and root are having significant importance towards human health and nutrition. Hence, an attempt was made to prepare the moringa pod pulp powder using tray drying method and the powder was analysed for both physicochemical and bio-functional attributes. The moisture, protein, fat, total carbohydrates, crude fiber, ash, and acid insoluble ash content of product was  $5.55 \pm 0.02$ ,  $9.52 \pm 0.08$ ,  $0.62 \pm 0.01$ ,  $69.03 \pm 0.12$ ,  $9.05 \pm 0.09$ ,  $6.23 \pm 0.04$ , and  $0.13 \pm 0.01$  respectively. The powder has got water solubility index of  $69.17 \pm 0.81\%$ , water absorption index of  $7.67 \pm 0.22$  g/g dry weight, and browning index of  $10.99 \pm 0.11$ . The total phenolic content was found to be  $70.63 \pm 0.1761$  mg GAE/g powder. The powder exhibits concentration gradient antioxidant, antidiabetic, ACE inhibitory, and antimicrobial activities. The powder has shown the  $IC_{50}$  value of 4.19, 3.68, and 4.47 mg/mL respectively for DPPH assay,  $\alpha$ -amylase inhibition, and ACE inhibition assay. Since, the moringa pod pulp powder has got better nutritional profile and functional attributes, one can exploit the powder to utilize as an ingredient in the formulation of functional dairy and other food products for value addition.

**Keywords:** Moringa, Tray drying, Nutrition, Functional attributes,



## RESOURCE USE EFFICIENCY OF FARMING SYSTEM IN KORAMANGALA- CHALLAGHATTA VALLEY PROJECT AREA

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### Abstract

The research empirically estimates the resource use efficiency and resource saving target ratio of farmers in KCVP and NKCVP area using Data Envelopment Analysis (DEA). Data for the study was obtained from Kolar district of Karnataka, 120 vegetable growers were randomly selected through random sampling technique, and data collected with the aid of pre-tested questionnaire coupled with interview schedule. Resource efficiency of vegetable farmers was studied and degrees of overall technical efficiency (CRS) and pure technical efficiency (VRS) were determined using a neoclassical non-parametric model called DEA. Additionally, overuse of resources was examined, and resource saving of different resources were estimated. The results on technical efficiency revealed a mean efficiency scores of 0.74 and 0.90 for technical and pure technical efficiency in FS- I, whereas in FS- II (0.70 and 0.80), FS- III, (0.65 and 0.80) and in FS- IV (0.68 and 0.83) KCVP area indicating resources were comparatively more efficiently used in FS-I followed by FS-II, FS-IV and FS-III. While comparing KCVP and NKCVP areas, resources were more efficiently used in NKCVP area than KCVP area. To reduce excessive usage, farmers should be encouraged to follow the recommended package of practices by consulting experts from farm universities or agricultural department.

Key words: Technical efficiency, Non-parametric, Constant returns to scale(CRS), Variable returns to scale(VRS), Farming systems(FS)

**Theme - 7**  
**Role of Agrochemicals,**  
**Biological & Technological Interventions**  
**Towards Safe Food and Nutritional Security**



**Temperature and moisture dependent virulence of the entomopathogenic nematodes against larval and pupal stages of *Spodoptera frugiperda* (Lepidoptera: Noctuidae)**

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**ABSTRACT**

Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), predominantly attacks maize, sorghum, millets and sugarcane in Asia. However, in India it causes considerable economic losses only on maize crop. Virulence of *Heterorhabditis indica* NBAIIH38, and *Steinernema carpocapsae* NBAIRS59, was evaluated at different temperature regimes and soil moisture against the larval and pupal stages of fall armyworm. The tested EPNs species showed a temperature dependent virulence against the larval stages of fall armyworm. Both the EPNs species showed a poor infectivity, penetration and reproduction at the lowest temperature (15 °C) and a high infectivity, penetration and reproduction at the highest temperature (37 °C). At 30 °C, both EPNs species caused the highest mortality of fall armyworm larvae, but *H. indica* performed significantly ( $P < 0.05$ ) better than *S. carpocapsae*. In lowest soil moisture levels (1% and 3%) both the EPNs species showed less virulence against pupal stages of fall armyworm. In this study these two EPNs species not only caused the mortality of pupae, but was also responsible for the emergence of malformed adult moths from nematode infected pupae. The EPNs infectivity increased with increasing the temperature and soil moisture. In overall, *H. indica* performed the best against the fall armyworm larvae and pupae at all temperature degrees and soil moisture.

**Keywords:** Entomopathogenic nematodes, fall armyworm, temperature, moisture, virulence



## Effect of organic manure and nitrogenous fertilizers on jassid population and yield in brinjal

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### ABSTRACT

Organic manures and fertilizers play a major role in growth of plant. They replace the nutrient that crops remove from the soil and also provide supplement to soil nutrient stock and act as a readily available form for absorption. The most crucial nutrient for increasing brinjal plant growth, canopy area expansion, photosynthesis and productivity is nitrogen, resulting in higher vegetative growth and crop yield. But, indiscriminate use of nitrogen fertiliser raises the quantum of some amino-nitrogen concentrations in the plant system, making it more conducive to insect pest's growth and development. It also leads to degradation of soil and water quality which draws attention toward alternate use of organic manures. In this regard, an experiment was conducted on brinjal crop during Kharif season in 2019-20 at CCS Haryana Agricultural University, Hisar, Haryana. The comparison was made between two different doses of nitrogenous fertilizers and one dose of organic manure in form of FYM (N<sub>1</sub>- 100 kg N/ha, N<sub>2</sub>- 150 kg N/ha and N<sub>3</sub>- FYM) on BR-112 variety of brinjal in term of their effect on jassid population and benefit-cost ratio (BCR). It was found that the maximum average jassid adult and nymph population was recorded at N<sub>2</sub> followed by N<sub>1</sub> and minimum in treatment N<sub>3</sub>. The highest fruit yield was recorded in treatment N<sub>2</sub> @ 21.49 q/ha followed by N<sub>3</sub> and N<sub>1</sub> @ 17.91 and 16.66 q/ha respectively. The highest BCR was recorded in N<sub>2</sub> @ 1.96 followed by N<sub>3</sub> @ 1.61 and minimum BCR was recorded in N<sub>1</sub> treated plots i.e. 1.53. Therefore, optimizing the N-fertilization greatly affects the sucking pest population and it can be an integral part of integrated pest management in brinjal crop.

**Keywords:** Benefit cost ratio, Fertilizers, FYM (farm yard manure), Jassid, Nitrogen

**Pesticide residue deposits in Unmanned Aerial Vehicle spray system in maize and rice crop**

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**ABSTRACT**

The use of Unmanned Aerial Vehicles for agricultural operations is gaining momentum in India. The spray deposits on the target crop and drift during spray is one of the major concerns in UAV spraying. A study was conducted to assess the pesticide deposit in maize and rice crop, field soil and water using Liquid Chromatography- Mass Spectrometry/ Mass Spectrometry technique. The deposition of emamectin benzoate 5 % SG @ 250 g/ha and chlorantraniliprole 18.5 % SC @ 150 ml/ha applied through UAV spray system (atomizer and jet nozzle) for fall armyworm management was compared with knapsack sprayer and control droplet applicator in maize crop, while UAV application of fipronil 5 SC @ 650 ml/ha was compared with knapsack sprayer and power sprayer application in rice crop against borer pests. The results revealed that initial deposits vary with different spray systems. Residue deposit was higher in UAV spraying than high volume spraying. Also, in UAV spray system, application through atomizer nozzle resulted in more initial deposit than jet nozzle. Residues of chlorantraniliprole, emamectin benzoate and fipronil were below detectable limit ( $0.020 \mu\text{g g}^{-1}$ ) in soil while detectable residues of chlorantraniliprole was found in water samples placed near maize field.



**Reaction of cowpea genotypes for resistance against legume pod borer, *Maruca vitrata*  
(Fabricius)**

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**ABSTRACT**

Among the pests infesting cowpea, the legume pod borer, *Maruca vitrata* (Fabricius) is a serious threat, which ultimately reduces the value of the economic produce. Indiscriminate use of insecticides to manage this pest leads to unwanted repercussions in the environment. It prompted to turn the focus on eco friendly methods to manage this pest. Use of tolerant and/or resistant genotypes is the first line of defense against insect pests. In the light of this consideration, 280 cowpea genotypes were screened against *M. vitrata* during *Rabi*, 2020 and *Kharif*, 2021 seasons at Vallampadugai Village, Cuddalore district, Tamil Nadu state, India. The pod infestation was noted at different days after sowing. The results revealed that, minimum and maximum per cent pod infestation was noted on IC-39870 (15.00% in *rabi* and 10.00% in *kharif*) and EC-161916 (100% in *rabi* and 93.33% in *kharif*) in both seasons. Based on per cent pod damage, 30 genotypes were found highly resistant, 52 were moderately resistant, while 81 genotypes were susceptible and 38 were highly susceptible in *rabi* season. In *kharif*, 18 genotypes were highly resistant and 86 genotypes were moderately resistant in contrast to 13 genotypes recording highly susceptible ratings.

**Keywords:** Cowpea, genotypes, field screening, *Maruca vitrata*, resistance





**Susceptibility of whitegrub, *Melolontha cuprescens* Blanchard infesting apple to local strain of *Beauveria brongniartii* (Saccardo) in Himachal Pradesh**

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**ABSTRACT**

*Melolontha* sp. is a polyphagous pest of numerous crops in north-western Himalayan regions. The adults are leaf defoliators while grubs feed on roots. In Kullu valley of Himachal Pradesh, the third instar grubs of *Melolontha cuprescens* showing fungal mycelial growth over their body were found to be infected with the entomopathogenic fungus, *Beauveria brongniartii*. The fungus was extracted from infected grubs and identified based on hyphal structure and spore shape and size. The branches of conidiophores were smaller and conidia were ellipsoidal in shape. The conidia were  $2.80\text{-}2.92 \times 1.9\text{-}2.2 \mu\text{m}$  long. The isolate, *B. brongniartii* thus obtained, was coded as CH I. The efficacy of local isolate of *B. brongniartii* (CH I) was evaluated against *M. cuprescens* grubs by dip treatment and oral feeding methods. Against first instar grubs, CH I isolate of *B. brongniartii* in dip treatment proved to be highly effective, whereas for second and third instar grubs, CH I through oral feeding showed higher virulence. In dip treatment and oral feeding methods, the  $LC_{50}$  value of *B. brongniartii* (CH I) was  $5.45 \times 10^5$  and  $5.47 \times 10^5$  conidia/ml,  $5.98 \times 10^5$  and  $5.52 \times 10^5$  conidia/ml, and  $6.27 \times 10^5$  and  $5.56 \times 10^5$  conidia/ml for first, second and third instar grubs of *M. cuprescens*.

**Keywords:** *Melolontha cuprescens*, *Beauveria brongniartii*, dip treatment, oral feeding,  $LC_{50}$

## Management of *P. xylostella* on cauliflower crop through novel group of insecticides

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### ABSTRACT

The use of insecticides on cruciferous vegetables is one of the major control measures used by farmers. Due to short life cycle of Diamondback Moth (DBM) *P. xylostella*, it has developed resistance to many insecticides. To test the efficacy of insecticides on DBM on cauliflower crop, ten insecticides were evaluated against in *rabi*, 2017-18 and 2018-19. The cumulative (2017-18 and 2018-19) mean per cent *P. xylostella* larval control was highest in plots treated with tolfenpyrad (91.61%) followed by spinetoram (91.41%). The bifenthrin (71.49%) and acephate (69.57%) treated plots shown least per cent efficacy. The results revealed the lesser sensitivity and efficacy of older insecticides to DBM. Regular monitoring, efficacy trials, renewal and recommendation of new molecules is the need of the hour as a part of chemical management.

Keywords: DBM, New insecticides, Bioefficacy, Cauliflower

## A new class of dual-purpose nanoparticles for detection *vis-à-vis* photocatalytic degradation of pesticide residues in water

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### ABSTRACT

Major sources of pesticide contamination in surface and groundwater are chemical spills, industrial effluents, agricultural runoffs, and leaching. Furthermore, reliance on detection techniques such as gas chromatography-mass spectroscopy (GC-MS), liquid chromatography-mass spectroscopy (LC-MS), LC-MS/MS, GC-MS/MS makes monitoring rather expensive. Advanced oxidation process (photocatalysis) coupled with robust fluorimetric detection has the potential to overcome both these problems. Thus, the quest for dual-purpose nano-probes for both pesticide detection and degradation (by photolysis) led to the discovery of a new facile synthesis strategy for nano-TiO<sub>2</sub> and a superior photolytic hybrid nano-composite, TiO<sub>2</sub>-ZnO, utilizing a simple and inexpensive sol-gel method. The same procedure was followed for all the levels of zinc (0.75, and 1 M) and titanium oxide (1, 1.5, and 2 M) precursors. The nanomaterials were characterized by spectroscopic and other techniques. The prepared nano-detection linearity was in the range of 0.1 ppm~40 ppm. Photocatalytic removal of imidacloprid and glyphosate residues by UV/ZnO, UV/TiO<sub>2</sub>, and UV/ZnO/TiO<sub>2</sub> process was evaluated at pH 7, photocatalyst dosage of 0.5 g/L, and 10 ppm imidacloprid concentration. The photocatalytic degradation efficiency of imidacloprid by UV/ZnO/TiO<sub>2</sub> process was about 84.2% > UV/TiO<sub>2</sub> (64.9%) > UV/ZnO (33.3%). Whereas, the photocatalytic degradation efficiency of glyphosate was found to be significantly higher (88.5%). Further point of zero charge pH was identified for the hybrid material to understand the mechanism of photocatalysis of glyphosate and imidacloprid residues in aqueous condition. Further a response surface design study was conducted to optimize the photocatalytic efficiency parameters for the same. The synthesized sensor probe materials performed admirably in terms of high sensitivity, increased photocatalytic activity, strong stability, wide linearity over the response range, and comparatively quick response time. The

## Identification of Sources and Mechanism of Resistance in Jute Germplasm against Lepidopteron Pest Complex

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### ABSTRACT

Jute is the golden fibre crop and belongs to the family Malvaceae. The lepidopteron pests viz., jute hairy caterpillar and indigo caterpillar are emerging as major pests which cause considerable economic loss to jute crop under favorable climatic conditions. The different jute species significantly affected larval survival from neonate to pupation and adult emergence. The survival of *S. obliqua* after 5 days of feeding varied from 46.60% in WCIN-179 (*C. aestuans*) to 100% in accessions of *C. capsularis* and JRO 204. The larvae failed to survive at 10 days after feeding (DAF) in *C. aestuans* and *C. pseudo-olitorius*. The survival of larvae was low (0-6.66%) in wild accessions except in *C. trilocularis*. The survival was 90-100% in cultivated species, JRO-204. Among the accession, OIN-154 recorded least growth index of 2.91 compared to susceptible JRC 412 (4.12). This indicates high degree of antibiosis in *C. aestuans* and *C. pseudo-olitorius*. Similarly, the larval weight of *S. litura*, 20 DAF on different host species varied from 150.25 mg (*C. fascicularis*) to 164.74 (*C. aestuans*). Cultivated varieties supported larval growth to extent and recorded the weight, 307.11 and 242.49 mg in JRC 212 and JRO 204 respectively. The least larval weight and survival was seen in *C. fascicularis* and showed maximum antibiosis on larval development. The wild accessions that caused significant antibiosis can further be explored based on their crossability with the cultivated jute species for developing resistant jute varieties against hairy caterpillar and indigo caterpillar.

**Keywords:** Jute, Mechanism of resistance, Lepidopteran pests, Wild and cultivated jute sp.



**Confirmation of the presence of chitinase gene in native *Beauveria bassiana* isolates causing the mortality of cassava mite, *Tetranychus truncatus* Ehara (Acari: Tetranychidae)**

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**ABSTRACT**

The chitinase gene has been extensively researched as a pest control agent because of its characteristic activity of degrading chitin in insects, worms, fungus, certain algae, and yeast. *Beauveria bassiana* is an insect pathogenic fungus that has been effectively utilised to control insect pests all over the world. Thirty isolates of *B. bassiana* were isolated from soil samples and insect cadavers collected from 8 distinct locations of India for this investigation. DNA from *B. bassiana* isolates was isolated using the CTAB technique. Using (Internal Transcribed Spacer) ITS1 and ITS4 primers, 30 isolates were tested for amplification of the ITS1 and ITS2 regions and all of them showed amplified products with a size of 580bp, indicating that they all belong to *B. bassiana*. PCR was used to amplify a chitinase gene (1047bp) from *B. bassiana* genomic DNA isolates using forward primer 523ChitEcoRI and reverse primer 325ChitHindIII. Later, the pathogenicity of 30 *B. bassiana* isolates from different hosts, as well as one commercial formulation (Beveroz), was tested in vitro against *Tetranychus truncatus*. The results showed that the Bb6, Bb15, and Bb12 isolates caused much higher *T. truncatus* mortality i.e., 97.73 %, 96.73 %, and 94.50 %, respectively than the other isolates. This work established the role of chitinase for pathogenicity and their bio-efficacy against *T. truncatus*.

**Keywords:** *Beauveria bassiana*, bio-efficacy, chitinase, mycosis, *Tetranychus truncatus*,



**Life fertility studies of different populations of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee)**

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**ABSTRACT**

Eggplant (*Solanum melongena* L.) member of *Solanaceae* family is known as brinjal in India and worldwide known as guinea squash. It is economically important vegetable crop having high nutritive value. In India, there are approximately 2500 varieties of brinjal of various shapes. Insect pests are the major causes which are responsible for reduction in yield and quality of the crop. Among these, the brinjal shoot and fruit borer, *Leucinodes orbonalis* has been reported to be the serious pest which reduces the yield up to 60-70 per cent. The samples of *L. orbonalis* were collected from three locations of Himachal Pradesh viz., Shimla, Solan and Una, two locations from Punjab viz., Jalandhar and Ferozpur and two locations from Haryana viz., Karnal and Bhiwani. Biological and life fertility studies of the *L. orbonalis* revealed that the maximum duration of pre-adult period was for Shimla population and least for Karnal population, whereas the intrinsic rate of increase was maximum for population from Ferozpur and least was from Jalandhar population. The results indicated the difference in the host utilization pattern and it can be used for developing effective pest management strategies.

**Keywords:** Brinjal, yield, *Leucinodes orbonalis*, locations, life fertility.

## Field evaluation of integrated pest management modules against sucking insect-pests in okra under mid hills of Himachal Pradesh

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### ABSTRACT

The investigations were carried out to evaluate various IPM modules against sucking insect pests viz., leafhoppers (*Amrasca biguttula biguttula*), aphids (*Aphis gossypii*), whiteflies (*Trialeurodes vaporariorum*) in okra during the Kharif season of 2021 at the Experimental Farm of Department of Vegetable Science, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan Himachal Pradesh. There were three modules viz., T<sub>1</sub>- Integrated module (Installation of yellow sticky traps and pheromones traps + spraying of Azadirachtin @ 3-5 ml/l after 30 DAT + spraying of Flonicamid 50WG @ 0.4 g/l 10 DAFS + spraying of Thiacloprid 21.7 SC @ 0.6 ml/l 10 DASS + spraying of Rynaxypyr @ 0.3 ml/l 10 DASS + spraying of Spiromesifen @ 1 ml/l 10 DATS), T<sub>2</sub>- Bio-intensive module (Spraying of Neem soap @ 10g/l after appearance of pest + spraying of Pongamia soap @ 10 g/l 10DAFS + Spraying of NSKE @ 40 g/l 10 DASS + spraying of *Verticillium lecani* @ 5 g/l + spraying of *Beauveria bassiana* @ 5g/l), T<sub>3</sub>- Chemical module (Spraying of Flonicamid 50 WG @ 0.4 g/l + spraying of Difenthiuron @ 1g/l 10 DAFS + spraying of Spiromesifen 22.9 SC @ 1.25 ml/l 10 DASS + spraying of Thiacloprid 21.7 SC @ 0.6 ml/l 10 DATS), T<sub>4</sub>- Control (water only). Each module was replicated five times in a randomized block design. The study revealed that the minimum numbers of leafhoppers and aphids per plant were observed in Integrated module (2.30) and (2.14), respectively. Whereas, the minimum numbers of whitefly were noticed in Chemical module (2.25) followed by Integrated module (2.97) and Bio-intensive module (4.94). The maximum number of leafhoppers, aphids and whiteflies per plant were observed in Control (20.16, 19.83 & 24.16), respectively. The maximum yield was observed in Integrated module (106.50 q/ha) and the minimum yield per plant was observed in Control (50.40 q/ha).

**Keywords:** Okra, Pheromone traps, Yellow sticky traps, Flonicamid



**Evaluation of different sex pheromone trap designs against shoot and fruit borer, *L. orbonalis* in brinjal**

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**ABSTRACT**

Investigations on different types of sex pheromone trap designs for monitoring shoot and fruit borer, *L. orbonalis* in brinjal were carried out at Main Vegetable Research Station, AAU, Anand during *khariif*, 2021-22. Soon after transplanting the seedling into the field, different designs of traps *viz.*, water trap, sleeve trap, delta trap, locally prepared bottle with sleeve trap and bottle trap were installed in the field. The number of shoot and fruit borer moth catches was recorded at weekly intervals. Results revealed that among the different sex pheromone trap designs, sleeve traps gave the best results in trapping the highest number of moths. On average, the highest no. of moths trapped were observed in the sleeve trap followed by the delta trap, water trap, bottle with sleeve trap, and bottle trap. These options will prove to be cheaper plant protection options for the and safer on the environment..

**Keywords:** Brinjal, Shoot and fruit borer, Sex pheromone, Trap designs



## **Development of sustained release encapsulations of pesticides using biopolymers as suitable carriers: A review**

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### **ABSTRACT**

The use of lower concentrations and fewer applications of agrochemicals is one of the prime objectives of sustainable agriculture as it decreases the toxicity to non-target organisms and the risk of wider environmental contamination. Lowering the pesticide load in the environment with no effect on the crop yield leads to the thought of their modification. The pesticides are formulated or encapsulated in a suitable carrier from which these get released on the target pest and affect it in a more sustained and prolonged manner. Slow and sustained release of pesticides from the carrier also makes it less or non-toxic to the environment and associated non-target organisms. Many biopolymers are being employed for this purpose. For instance, chitosan, alginate, guar-gum, pectin, cellulose, lignin etc. have been mostly used for controlled release pesticidal nano or micro-sized formulations. The advantages of nano-formulations are that they prevent the active ingredient from premature degradation, help in target-oriented release, increase its solubility. Therefore, the encapsulation of the pesticides improved their mode of action thereby reducing their toxicity, strengthening their candidature for use in future practical applications.

**Keywords:** Pesticide formulations, encapsulated formulations, regulated release



**Population growth parameters of *Aphelinus asychis* Walker on *Myzus persicae* (Sulzer)  
in bell pepper**

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**ABSTRACT**

The parasitoid, *Aphelinus asychis* Walker (Aphelinidae: Hymenoptera), is an important naturally occurring solitary koinobiont endoparasitoid of green peach aphid, *Myzus persicae* (Sulzer) (Aphididae: Hemiptera). Among all the nymphal stages of the aphid, second instar was preferred. The population growth parameters of the *A. asychis* viz. total development, pre-oviposition, oviposition, post-oviposition periods, sex ratio (F:M), and fecundity were  $16.95 \pm 0.45$ ,  $1 \pm 0.00$ ,  $6.6 \pm 0.40$ ,  $1.6 \pm 0.40$  days, 1:0.97, and  $54.50 \pm 10.44$  eggs/female, respectively. The true generation time (T), the true intrinsic rate of increase ( $r_m$ ), doubling time, finite rate of increase ( $\lambda$ ), and the net reproductive rate of *A. asychis* with *M. persicae* was 21.39 days, 0.16 females/female/day, 2.52 days, 1.17 females/day and 36.98 females/female, respectively. The parasitoid has a potential for supplementing the augmentative and/or conservation biocontrol of the pest. The study also underscores the scope of optimizing the aphid for mass production of the parasitoid.

**Keywords:** *Aphelinus asychis*, *Myzus persicae*, Insect population, Endo parasitoid

**Evaluation of biopesticides against *Callosobruchus maculatus* Fabricius in chickpea under stored conditions**

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**ABSTRACT**

By realizing the significant losses caused by pulse beetles in storage and the importance of biopesticides, present investigation was carried out to evaluate eco-friendly biopesticidal approaches for management of *Callosobruchus maculatus* in chickpea. Four biopesticides viz., *Beauveria bassiana*, *Metarhizium anisopliae*, *Lecanicillium lecanii* and *Bacillus thuringiensis* with wettable powder and oil formulations with wettable powder and oil formulations were evaluated as grain protectant against *Callosobruchus maculatus* Fabricius in stored chickpea. Among the various biopesticides tested, *B. bassiana* WP was found to be superior treatment with the highest half-life value (197.81), gross persistency value (7115). Significantly lower number of adults emerged in *B. bassiana* WP during six months of storage period. These affirmations can be considered for better storage of chickpea in large scale for long period of time and for sowing purpose.

**Keywords:** Biopesticides, Chickpea, *Callosobruchus maculatus*, Grain protectant, sustainable management



***Plumeria alba*, an attractive alternate host for the mass multiplication of papaya mealy bug parasitoid, *Acerophagus papayae***

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**ABSTRACT**

The papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink (Hemiptera: Pseudococcidae) is native to Mexico and Central America. Between 2008 and 2009 it was detected in South India, Indonesia, Malaysia, Sri Lanka and Thailand. *Acerophagus papayae*, *Anagrycus loeckii* and *Pseudleptomastix mexicana* are three parasitoid species that are currently used in the biological control of papaya mealybug. Of these *Acerophagus papayae* was found to be more efficient and is under commercial distribution for control of papaya mealybug in India. The mass multiplication requires potato tubers and regulated environment for the multiplication of papaya mealy bug and was unsuccessful due to high temperature at Trichy. Hence a study was undertaken to find the feasibility of rearing of *A. papaya* in *Plumeria*. The *Plumeria* plant was chosen for the study as it is hardy, the leaves have numerous lateral veins, needs zero maintenance, easily infested by papaya mealybug, can withstand heavy population of papaya mealy bug, can recover after a heavy infestation and acts as a natural mass multiplication source for the parasitoid, *Acerophagus papayae*. The results revealed that the egg period was 7.2 days, while 1. 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> instar was 5.3, 3.5, 2.3, 3.9, days respectively. The total duration of male and female were 23.4 days and 33 days, respectively on *Plumeria alba*. The fecundity was observed to be 370.4 eggs per female. The parasitization of mealybug by *Acerophagus papayae* was noticed during the 2<sup>nd</sup>, 3<sup>rd</sup> and adult stages. The highest parasitisation was in the 2<sup>nd</sup> instar (81.2 %) which is in accordance with Meyerdirk *et al.* (2004), Muniappan *et al.* (2006) and reduced in the 3<sup>rd</sup> instars and the adults. The mean per cent parasitization in the third instar was comparatively lesser (42.4 %). The adult was parasitization was 14.8 per cent.

**Keywords:** Papaya mealybug, *Plumeria*, *Acerophagus papaya*, Parasitisation potential



***Rhizopertha dominica* (Coleoptera: Bostrychidae): Studies on screening techniques of wheat genotypes/varieties for resistance**

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**ABSTRACT**

Lesser grain borer, *R. dominica* (Coleoptera: Bostrychidae) is a notorious insect pest of wheat and it can cause both quantitative and qualitative losses and also decrease the sustenance of stored wheat. The host preference of *R. dominica* was studied in twenty-five wheat genotypes/varieties with both free and force choice test. Free choice screening provided prefatory information which was antixenosis usually measured. In force choices per cent weight loss, F<sub>1</sub> adult emergence and susceptibility index demonstrated the rapid increases in the *R. dominica* population in wheat variety GW 190 compared to wheat genotypes/varieties VD18-12, VD18-13, VD18-14 and LOK1. Based on per cent weight loss, the genotype/varieties were graded by arbitrary categorization as resistant (9), moderately resistant (6), less susceptible (5), moderately susceptible (3), and susceptible (2). Correlation done between the weight loss and all other growth parameters revealed that the weight loss has positive and significant correlation with mean developmental period and highly significant and positive correlation with F<sub>1</sub> adult emergence and susceptibility index. The wheat genotypes/varieties resistant to *R. dominica* VD18-12, VD18-13, VD18-14 and LOK1 have the potential to reducing the loss of wheat during storage condition and it can also be used as donor lines for future breeding purpose.

**Keywords:** Antixenosis, growth index, lesser grain borer, oriental, susceptibility.



**Bioefficacy of enhancement brown algal seaweed with organic inputs against rice leaf folder, *Cnaphalocrocis medinalis* Guenee (Lepidoptera: Crambidae)**

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**ABSTRACT**

The experiment was conducted to evaluate the insecticidal and IGR activity of solvent extract (Acetone) of *Sargassum wightii* in combination of with organic inputs (neem leaf extracts 3% and 5%) against rice leaf folder *Cnaphalocrocis medinalis* was conducted in the Department of Entomology, Faculty of Agriculture, Annamalai University, India during 2021-2022. The seaweed extracts @ 6,7 8 percent alone and combination of seaweed 6,7,8 percent with neem leaf extract 3 and 5 per cent concentrations were investigated for their toxicity (larvicidal and IGR activity) against rice leaf folder were compared with standard checks neem leaf extract 3 and 5 per cent. Highest mortality (66.66%) was observed in the combination treatment *S. wightii* seaweed extract 8 per cent + neem leaf extract 5% and followed by *S. wightii* seaweed extract 8% with neem leaf extract 3% revealed 60.00% mortality. The larva to adult conversion ratio of 1: 0.13 in *S. wightii* seaweed extract 8% with neem leaf extract 5% was the least when compared with other treatment. Whereas, *S. wightii* seaweed extract 8% with neem leaf extract 3% was the second experiment with a larval and adult conversion ratio of 1:0.20. Meanwhile, there was no mortality observed in both controls in both the experiments.

Keywords: *Sargassum wightii*, *Cnaphalocrocis medinalis*, neem leaf extract.



## **Efficacy of various organic pesticides against *Leucinodes orbonalis* in brinjal crop**

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### **ABSTRACT**

Studies were undertaken during Rabi 2021 at MPUAT, Udaipur to investigate the efficacy of various organic pesticides against *Leucinodes orbonalis*, which is a major pest affecting brinjal production throughout the world. Seven organic formulations viz. Dashparni at 5%, Dashparni at 7.5%, Dashparni at 10%, Teekha sat at 5%, Teekha sat at 7.5%, Teekha sat at 10% were evaluated against standard check Spinosad. Two sprays at an interval of 15 days were scheduled for each treatment on the onset of ETL. The results of the present study reveals that comprising both sprays the application of Dashparni @ 10% and Teekha sat @ 10% were at par with Spinosad treated plots (79.35%) with overall mean percent reduction of 76.50 and 72.02 in the brinjal fruit and shoot borer population. Among the other different organic treatments, Teekha sat at 5% was proved to be least effective with mean per cent reduction of 64.69 per cent. It was followed by Dashparni at 5% which was at par with Dashparni at 7.5%. Other treatments moderately reduced the pest density with mean per cent reduction in the range of 64-67 per cent. The results also revealed that Spinosad treated plots recorded the minimum incidence of brinjal fruit and shoot borer. But the organic pesticides have also proved effective in reducing the fruit and shoot borer incidence and can be used as an alternate for chemical control.

**Keywords:** Brinjal, Fruit and shoot borer, Dashparni, Teekha Sat

## Characterization of fatty acid composition from wax secreted by grapevine mealybug, *Maconellicoccus hirsutus* (Green)

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### ABSTRACT

Pink mealy bug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae) is considered as one of the most important and difficult to manage pests of grapevines. Wax secreted by mealybugs provide them protection from natural enemies, insecticides and desiccation. This study was aimed to find out the fatty acid composition of the wax secreted by *M. hirsutus*. *M. hirsutus* were reared on grapevines under insect net house and sprouted potatoes in the laboratory. Waxy covering of mealybugs and their egg masses were collected using hand brush dipped in hexane. Gas Chromatography-Flame Ionization Detector (GC-FID) was used for wax composition analysis. The mealybugs reared on different hosts showed different fatty acid composition. The eggmass wax from mealybugs reared on grapevine had higher amount of Gamma-linolenic acid (42.24%) in comparison with mealybugs reared on sprouted potato (27.35%). Waxy covering of mealybugs reared on grapevine had higher Gamma-linolenic acid (36.79%) than mealybugs reared on potato (23.33%). Capric acid were absent in wax of eggmass and mealybug from grapevine and present in potato 12.86% and 25.12%, respectively. It can be concluded that the host has effect on the composition of fatty acids in the wax of mealybugs. The information about fatty acids present in the wax secreted by *M. hirsutus* can help in devising management strategies to break this protective layer.

Keyword - Mealybug, fatty acid, wax, eggmass, butyric acid, capric acid



## CRISPR-Cas9 mediated genome editing: a novel tool for Insect Pest Management

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### ABSTRACT

Genome editing is an eco-friendly biotechnological strategy for managing insect pests of various crops. The CRISPR-Cas system, which consists of clustered regularly interspaced short palindromic repeats (CRISPR) is an adaptive immune system in bacteria and archaea that protect them from invading bacteriophages and plasmids. The development of CRISPR-Cas9 as the newest gene editing technology and a potent tool in the biotechnology sector in recent years has sparked a cascade of research into its potential applications in managing agricultural insect pests, protecting plants and controlling insects that transmit diseases to humans. Globally, numerous research groups are using plants to demonstrate the effectiveness of RNA interference (RNAi) and CRISPR-based genome editing techniques. CRISPR has been applied to a variety of non-model insects, such as other species of flies, mosquitos, moths, butterflies, and other non-insect arthropods. The capability of gene knock-out (KO), knock-in (KI), and/or knock-down (KD) in non-model systems has recently been made possible by genome editing techniques.

**Keywords:** CRISPR-Cas9, genome editing, insects, entomology

## Morphological and molecular screening of different wild *Ipomoea* sp. and sweet potato

### (*Ipomoea batatas* (L.) Lamarck for sweet potato weevil resistance

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### ABSTRACT

Sweet potato (*Ipomoea batatas* (L.) Lamarck) was ranked as the seventh most important crop in the world. Despite of the high economic significance, the cultivation of sweet potato is mostly affected due to the sweet potato weevil (*Cylas formicarius* (Fabricius)) infestation. It is the major pest of sweet potato, causing tuber yield loss up to 80%. Hence identification of host plant resistance genes against sweet potato weevil is one of the alternative pest control strategies and these genes have an important role in the management of pest. The present work deals with morphological screening of different *Ipomoea* sp. viz (*Ipomoea batatas*, *I. obscura*, *I. palmata*, *I. triloba* and *I. mauritiana*) using choice and no choice assay method for insect preference/feeding. Among the different *Ipomoea* sp. the sweet potato weevil preference for *Ipomoea mauritiana* was significantly less compared to *I. batatas*, *I. triloba*, *I. obscura*, *I. palmata*. Mortality of weevils were also observed during choice assay test by feeding of leaves, vines and tubers of *Ipomoea mauritiana* by third day. Further the methanol extract of the tubers of sweet potato and *I. mauritiana* was prepared for the bioassay study and the weevils showed repellent effect for the solvent extract from *I. mauritiana* compared to sweet potato root extract which shows the difference in the semiochemical composition. The root extract were used for GC-MS analysis for the identification of compounds responsible for the repellent effect of weevils. Cysteine protease inhibitor, proteinase inhibitor, kunitz trypsin inhibitor genes specific primers were used for the molecular screening of wild *Ipomoea* sp. The PCR conditions of all the gene specific primers were standardized for all the *Ipomoea* sp. The results of the study showed *I. mauritiana* as a resistance source of genes against sweet potato weevil.

**Key words:** *Ipomoea*, sweet potato weevil, proteinase inhibitor, screening

## **Jute stick activated carbon (NINFET-JAC) as an alternative clean-up agent to graphitised carbon black for pesticide residue analysis in food materials**

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### **ABSTRACT**

Pesticide residue analysis in agricultural and food commodities produces has become a mandatory practice across the world for consumers' safety. The analysis of pesticide residues in agricultural and food commodities often suffers from matrix effects/interferences, leading to inaccurate estimation of residues. A cleanup step is therefore necessary not only to remove the co-extracted, matrix-derived compounds but also minimise the effects on signal enhancement or suppression of a target pesticide. To overcome this matrix interference, graphitised carbon black (GCB), a petroleum-derived imported product, is the commonly used adsorbent in clean-up processes adopted by the national and international food testing laboratories. However, owing to the high cost, the application of GCB in pesticide residue analysis contributes a lot to the sample testing cost. Hence, search for an effective and efficient clean-up material continues. For the first time, this work reports the application of activated carbon derived from jute stick (JAC), a by-product of the jute industry, for its cleanup efficiency during 181 pesticide multi-residue analysis in four commercial agricultural crops namely okra (*Abelmoschus esculentus*), spinach (*Spinacia oleracea* L.), pomegranate (*Punica granatum* L.) and tea (*Camellia sinensis* L.), using gas chromatography-tandem mass spectrometry (GC-MS/MS). Production of JAC was standardised, and developed carbon was characterised with CHNS, BET surface area, FTIR, XRD, and SEM-EDX. It was found that a new clean-up protocol consisting of JAC (5mg/ml sample extract) was superior than GCB in terms of pesticide recovery along with low matrix interference. Addition of 5 mg of GCB or JAC along with PSA (25 mg) to said solvent extract exhibit reduction of the residues to 16.3-20% for GCB, and 40-46.7% for JAC by gravimetric analysis and pesticide recoveries in the range of: 63.2-120% and 69-127.5% in okra, 62-117.9% and 60.4-117% in pomegranate, 68.6-126.8% and 61-114.6% in spinach and 69.3-117.4% and 59.8-113.9% in tea for JAC and GCB respectively. Unlike the petroleum-based GCB (costing approximately 11-12 USD per gram), JAC can be easily produced from low-cost agro-residue of jute stick with a tentative production cost of USD 10 per kg (i.e USD 0.01 per gram). Our estimate indicated that JAC will be 1100-1200 times cheaper than GCB. Therefore, the application of JAC will reduce the food testing cost, which will directly boost a large number of testing of food products. Hence, JAC holds immense potential as a new indigenous product under the banner of 'Make in India' and may help the Indian food testing laboratories to perform food analysis at a lower cost, leading towards the 'Atmanirbhar Bharat'.

**Keywords:** Jute stick carbon, Graphitised carbon black, Pesticide residues, Food testing

## **Persistence and residue dissipation behavior of dimethoate and malathion in tomato fruits**

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### **ABSTRACT**

Persistence and dissipation behavior of dimethoate and malathion was worked out on tomato fruits at the experimental farm of the Department of Entomology, Dr. Yashwant Singh Parmar University of Horticulture and Forestry Nauni, Solan (HP) using good agricultural practices (GAP). Two foliar applications of dimethoate at the recommended (X) @ 200 g a.i. ha<sup>-1</sup> and double the recommended dose (2X) @ 400 g a.i ha<sup>-1</sup> and malathion @ 750 g a.i. ha<sup>-1</sup> (X) and 1500 g a.i. ha<sup>-1</sup> (2X) each were given at 10 days interval with a Knapsack sprayer with the first application at the fruit initiation stage. Initial deposits of dimethoate in tomato fruits from the two treatments were 1.507 and 3.017 mg kg<sup>-1</sup> with the half life of 1.2 and 1.8 days respectively, whereas the initial deposits of malathion in tomato fruits from the two treatments were 2.800 and 5.706 mg kg<sup>-1</sup> which reduced to half in 1.5 and 1.7 days. Based on the persistence studies waiting period of 8 and 7 days has been suggested for dimethoate and malathion, respectively on tomato from consumer's safety point of view.

**Keywords:** Tomato, Persistence, Residues, Dimethoate, Malathion, Half-life, Waiting Period

***Survey and surveillance of spotted pod borer (*Maruca vitrata*) as potential pest of yard long bean (*Vigna unguiculata* sub spp. *sesquipedalis*) in Southern Karnataka***

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**ABSTRACT**

*Spotted pod borer, Maruca vitrata* is the tropical pest of increasing importance on food legumes including yard long bean (*Vigna unguiculata* subspp. *sesquipedalis*). However, there is a dearth of information on its damage potential, distribution, population dynamics and management in yard long beans. The present study was conducted on survey and surveillance of *Maruca vitrata* on yard long bean in different growing regions of southern Karnataka viz., Shivamogga and Udupi districts during 2018 to 2019. During survey, the highest incidence of pod borer population was observed in Shivamogga district (5.27 larvae/ plant) as compared to Udupi district (4.07 larvae/ plant). The data on seasonal incidence of pod borer, the larval population was first observed during 4<sup>th</sup> standard week with an initial population of 0.30 larvae/ plant. The maximum larval population of borer (12.02 larvae/plant) was recorded during 9<sup>th</sup> standard week. Thereafter, the pod borer population decreased till 17<sup>th</sup> standard week up to 4.04 larvae. A highly significant positive correlation was existed between maximum temperature and larval density, positively significant correlation with minimum temperature, significantly negative correlation with maximum and relative humidity. Non-significant negative correlation with rainfall and significant positive correlation with wind speed were recorded. The regression analysis indicated that all the weather parameters together were responsible for a significant variation of 62.40 per cent.

Keywords: Survey, Surveillance, spotted pod borer, Yard long bean

## **Agricultural Chemical Waste Management**

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### **ABSTRACT**

An Agricultural Waste Management System (AWMS) is a planned system in which all necessary components are installed and managed to control agricultural production by-products and used in a way that maintains or enhances the quality of air, water, soil, flora, fauna and energy resources. Many agricultural enterprises use large quantities of agrochemicals viz., fertilizers, fungicide and weedicide etc. With the indiscriminate use of these agrochemicals the risk of contamination of surface and groundwater has increased resulting from improper storage of chemical residues, rinse water, unused chemicals and improper disposal of empty containers. Water can be collected in pits below the ground. This liquid can be used as a part of the make-up water when the chemical is needed again. Different chemicals need to be stored in separate storage containers. Purchase the amount/quantity of material only that you need, and do not use more than necessary. This process requires accurate determination of the amount of agrochemical solution needed, careful calibration of application equipment, and proper use of the material. This reduces the amount of waste to be processed. A chemical container can be disposed off in one of the two ways: by throwing it in the trash or by recycling it. Those can be turned over to authorities or businesses that have the responsibility of handling them, or they can be buried, as per the regulations.

**Keywords:** Agriculture Waste Management, Resources, Chemical, Contamination



## Decontamination studies of fenvalerate, imidacloprid and profenofos residues on cabbage using household products

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### ABSTRACT

The present investigation was conducted in the Department of Entomology, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan (Nauli), Himachal Pradesh during the year 2020-2021 to evaluate the efficiency of different decontaminants in mitigating the residues of fenvalerate, imidacloprid and profenofos from the cabbage heads from consumption point of view. Among the different decontaminants, removing the outer leaves from the cabbage head proven to be most efficient treatment (63-70 per cent). The 1% saline water, 5% NaHCO<sub>3</sub>, 2% Acetic acid and 0.01 % KMnO<sub>4</sub> washing provided upto 68.01, 62.73, 61.55 and 57.21 per cent relief, respectively from insecticide residues. Popularly marketed products like Arka herbiwash (IIHR, Bangalore), Nim wash (from ITC), Veggie Clean (from Marico) didn't make much difference as they mitigated only 32- 50 per cent residues. The tap water washing and luke warm water washing of cabbage heads turned out to be least effective.

**Keywords:** Cabbage, Insecticide Residues, Decontamination, Washing



## Effect of intercropping with biopesticide application on incidence of major insect pest of cauliflower

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### ABSTRACT

The present investigation was carried out at Horticulture farm, Rajasthan College of Agriculture, Udaipur during *Rabi*, 2020 to evaluate the effect of intercropping with biopesticide application on incidence of major insect pest of cauliflower viz., *Plutella xylostella*, *Spodoptera litura* and *Brevicoryne brassicae*. The different treatments viz., T<sub>1</sub> (Cauliflower + Garlic + Bio-pesticide spray), T<sub>2</sub> (Cauliflower r + Onion + Bio-pesticide spray), T<sub>3</sub> (Cauliflower + Mustard + Bio-pesticide spray), T<sub>4</sub> (Cauliflower + Lucern + Bio-pesticide spray), T<sub>5</sub> (Cauliflower + Berseem + Bio-pesticide spray), T<sub>6</sub> (Cauliflower + Tomato + Bio-pesticide spray) and T<sub>7</sub> (Cauliflower + Bio-pesticide spray) were evaluated against major insect pests. The results revealed that among the different treatments, T<sub>6</sub> (Cauliflower + Tomato + Bio-pesticide spray) was found to be most effective which caused highest reduction of DBM larvae, *S. litura* larvae and aphid population in cauliflower at 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> days after both sprays. It was followed by T<sub>1</sub> (Cauliflower + Garlic + Bio-pesticide spray) and T<sub>2</sub> (Cauliflower r + Onion + Bio-pesticide spray), all these treatments found at par with each other. Next effective treatments were T<sub>4</sub> (Cauliflower + Lucern + Bio-pesticide spray), T<sub>5</sub> (Cauliflower + Berseem + Bio-pesticide spray) and T<sub>3</sub> (Cauliflower + Mustard + Bio-pesticide spray) against DBM, *S. litura* and aphid. The least effective treatment was T<sub>7</sub> (Cauliflower + Bio-pesticide spray) with minimum reduction of pest population.

**Keywords:** Cauliflower, Insect Pests, Intercropping, Biopesticides



## Studies on residues and dissipation of fluensulfone and fluopyram in/on tomato

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### ABSTRACT

Fluensulfone and Fluopyram were applied in tomato field (*PAN 1286 Hybrid*) to investigate their residue and dissipation status. Fluensulfone was sprayed @ 3.84 Kg a.i./ha ( $T_1$ ) and 7.68 Kg a.i./ha ( $T_2$ ). Fluopyram was applied at 10 days interval as soil drench @625 ml/ha ( $T_1$ ) and @ 1250 ml/ha ( $T_2$ ). Residue and dissipation of Fluensulfone and Fluopyram in tomato were analysed through Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS). Acetonitrile was the extracting solvent and PSA and C18 were used for cleanup. Under optimized conditions, Fluensulfone gave respective recoveries of  $103.93 \pm 4.79$ ,  $99.62 \pm 0.101$  and  $98.07 \pm 2.29$  in tomato at fortification @LOQ, 5xLOQ and 10xLOQ level. In case of tomato cropped soil, the same pesticide showed respective recoveries of  $100.72 \pm 5.79$ ,  $94.68 \pm 3.27$  and  $90.90 \pm 5.19$ . Fluopyram gave the least recovery of  $90.14 \pm 4.80$  and the highest recovery of  $101.56 \pm 9.39$  irrespective of substrate and fortification level. Half-life of Fluopyram was 1.92 days ( $T_1$ ) and 2.03 days ( $T_2$ ). Fluensulfone persisted upto 15 and 20 days in tomato cropped soil respectively having respective half-lives of 3.46 ( $T_1$ ) and 3.86 days ( $T_2$ ). On the other hand, fluopyram showed residues upto 10 and 15 days, respectively for having respective calculated half-lives of 1.94 ( $T_1$ ) and 2.22 days ( $T_2$ ).

Keywords: Tomato, Fluensulfone, Fluopyram, Method Development



**Assessment of resistance in greengram genotypes against spotted pod borer, *Maruca vitrata* (Fabricius)**

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**ABSTRACT**

Greengram is a popular pulse and is an excellent source of dietary protein. Cultivation of greengram is hampered by biotic and abiotic stresses. Among the biotic stresses, infestation of the spotted pod borer, *Maruca vitrata* (Fabricius) inflicts extensive damage. Considering the need for ecofriendly management of this insect pest, 333 greengram genotypes were gathered and screened under field condition to identify resistance sources against spotted pod borer during *Rabi* 2020 and *Kharif* 2021 at Sivapuri village, Chidambaram, Tamil Nadu, and India. For each genotype, the per cent pod damage was worked out after harvest. The results of this study revealed that, the per cent pod damage was the least on IC-39301-1 followed by IC-311451 during *Rabi* 2020 and IC-39301-1 followed by IC-103207 during *Kharif* 2021. In both seasons, the percent pod damage was higher in the genotype IC-39317, followed by IC-103981. Based on per cent pod damage, 4 and 10 genotypes were found resistant, while 182 and 175 genotypes were moderately resistant, 70 and 78 genotypes were tolerant, 56 and 63 genotypes moderately susceptible, 21 and 7 genotypes were highly susceptible in *Rabi* 2020 and *Kharif* 2021, respectively. The genotypes which were grouped under resistant and tolerant category in both the seasons were selected for further evaluation to develop desirable varieties.

**Keywords** Greengram (*Vigna radiata*), Genotypes, Pod borer, Resistance.

## Development of novel molecules through bioinformatics approaches for the eco-friendly pest management strategy

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### ABSTRACT

The new era of genomics has seen the emergence of Next Generation Sequencing (NGS) technologies which have made it possible to sequence the genomes of non-model organisms. The breakthrough in the data sequences made the advancement in application of bioinformatics to address the major biological problems. The molecular dynamics is one such approaches, could be useful to understand the function of the target protein and also simulation model can help to develop molecules which are highly specific to the target proteins can be further used for eco-friendly pest management. Study on structures of insecticide resistance proteins will throw light on the understanding of the factors responsible for the differential interaction of resistance against susceptible. These interaction studies will lead us to develop various ligand structures which can be potential future insecticide molecules. In this study we have done couple of studies using *Plutella xylostella* and *Pectinophora gossypiella* transcriptome information. The RYR gene sequence was mined from DBM transcriptome data and the 3-D structure was predicted using Modeller & iTasser later validated with Ramachandran plot technique. This structure has been used for molecular dynamic studies using simulation model to find out the best fit small molecules, which are resembling the parental amide group of insecticide via virtual screening of Chembridge database. Upon searching 5 lakhs compounds, finally 2 molecules have been identified as effective against RYR- target genes and could be useful to develop novel insecticide. In another example, using molecular simulation studies, an attempt has been made for the development of fusion protein using molecular docking studies yielded the hybrid fusion protein Cry1Ac-Vip3AcAa- combining VIP protein , Cry1Ac and Cry2Ab, which can be used further to develop products against the Bt resistant populations.

**Keywords:** Molecular Docking, Bioinformatics, *Plutella xylostella*, *Pectinophora gossypiella*, Molecular Simulation

## Physicochemical aspects of vermiwash obtained from neem leaves and its potential use as biopesticide

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### ABSTRACT

The tree *Azadirachta indica* is native to parts of South Asia where it has been used for many things. Of primary interest to research scientists is its activity as an insecticide. Many of the tree's secondary metabolites have biological activity, but azadirachtin is considered to be of the most ecological importance. Studies have shown a wide spectrum of activity and species affected. Research has increased in the past few years as the desire for safe pest control methods increases and it becomes apparent that this tree will be able to play a role in integrated pest management systems. Vermitechnology is the use of surface and sub-surface local varieties of earthworms in composting and management of soil. Earthworms along with other animals have played an important role in regulating soil processes, maintaining soil fertility and in bringing about nutrient cycling. Vermiwash is a liquid that is collected after the passage of water through a column of worm action and is very useful as a foliar spray. It is a collection of excretory products and mucus secretion of earthworms along with the micronutrients from the soil organic molecules. Vermiwash, if collected properly is a clear and transparent, pale yellow coloured fluid. The effect of vermiwash produced by decomposing neem leaves by earthworm action was tested against the neem leaf extract for bio-pesticidal effects. They were tested on the Acridid Short Horned Grasshoppers (Orthoptera: Acrididae) by applying these samples directly to the insects without dilution. No direct negative effect was recorded on the longevity of these species. However, activities seem to have decreased to some extent in the vermiwash using neem leaves as compared to the extract using neem leaves.

**Keywords:** Biopesticide, earthworms, vermiwash, micronutrients, composting



**The effect of attract and reward strategy in enhancing biological control of brown plant hopper, *Nilaparvatha lugens* in rice**

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**ABSTRACT**

A field experiment was conducted to evaluate the combined effect of exogenously applied synthetic HIPV elicitor, Methyl Salicylate (MESA) @ 100mg L<sup>-1</sup> and French marigold, *Tagetes patula* flowering border on parasitism by egg parasitoids of bph, *N. lugens* during February – April, 2022. Parasitism on BPH eggs by two egg parasitoid species namely, *Anagrus* sp. and *Oligasita* sp. was observed. The total mean per cent parasitism by both the egg parasitoid species observed, BPH pre baited plants with MESA near flowering border (63.16 %), BPH pre baited plants without MESA near flowering border (44.97 %), BPH pre baited plants with MESA without flowering border (34.65%) and BPH pre baited plants without MESA without flowering border (15.52 %) were significantly different from each other. The significant difference in per cent parasitism between BPH pre baited plants with MESA near flowering border and BPH pre baited plants without MESA without flowering border was 47.64 %. Presence of nectar producing flowering border alone contributed to 44.97 per cent parasitism. And a significant increase of 18.19 % of parasitism was observed by combining MESA application in rice field with nectar producing flowering bund crop. The parasitoids were attracted towards MESA and got nectar as a reward from the flowering bund crop. Therefore, the attract and reward strategy has a potential role in increasing beneficial insect populations there by leading to sustainable pest management in rice fields.

**Keywords:** Brown planthopper, egg parasitoids, synthetic HIPVs, MESA, bund crop



**Bio-efficacy of different acaricides against two spotted spider mite, *Tetranychus urticae*  
Koch infesting okra under field condition**

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**ABSTRACT**

Field study was conducted to evaluate bio-efficacy of nine acaricides against two spotted spider mite, *T. urticae* at Department of Entomology, BACA, AAU, Anand during *summer*, 2021. Each treatment consisted of two sprays applied at an interval of 15 days. The number of nymph and adults were recorded at 1, 3, 7, 10 and 14 days after each spray. The pooled data over periods clearly indicated that the treatment of spiromesifen 22.9 SC 0.02%, abamectin 1.9 EC 0.00057% and fenazaquin 10 EC 0.012% were found significantly superior over all the evaluated acaricides. Also, propargite 57 EC 0.014%, ethion 50 EC 0.05%, diafenthiuron 50 WP 0.06% and etoxazole 10 SC 0.008% were found moderately effective and furthermore, in contrast to this, chlorfenapyr 10 SC 0.015% and dimethoate 30 EC 0.03% were noticed as least effective acaricides against two spotted spider mite infesting okra.

**Keywords:** Okra, Two spotted spider mite, Management, Bio-efficacy, Acaricides



**Incidence level, nature of damage and management of *Celosterna scabrator* (Coleoptera: Cerambycidae) infesting grapevines**

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**ABSTRACT**

Grapevine stem borer, *Celosterna scabrator* is one of most important pests of vineyards and causes significant vine damage and yield loss. An attempt was made to study the incidence level, behavioural aspects and management of the pest. Total 25 *C. scabrator* infested vineyards were surveyed during 2021-22 and 1.25-29.66 % of grapevines were found having active infestation. The age of vineyard and infestation level were found moderately correlated (correlation coefficient 0.507). The study on nature of damage showed that the grubs fed on main trunk, cordons and roots. Yield loss of 3.36 kg per vine was recorded due to infestation of *C. scabrator* where mean yield per vine was 11.16 kg in healthy and 7.80 kg in infested vine. The adults were found scraping bark of immature canes. In the experiment on management of *C. scabrator*, effect of mechanical removal and soil drenching of different insecticides were evaluated. Mechanical removal was found superior over insecticides providing cent percent guaranteed control.

**Keywords:** Grape, *Celosterna scabrator*, incidence, nature of damage, management



**Demonstration of effective concentration of *Isaria fumosorosea* against Rugose Spiraling Whitefly in coconut**

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**ABSTRACT**

The entomopathogenic effect of *Isaria fumosorosea* against Rugose Spiralling Whitefly in infested coconut palm leaves was studied at an effective concentration. We collected the young infested leaves from open field condition by following randomize block design method. The RSW infested young leaves were collected from infested palms and stored at the proper room temperature at 24<sup>0</sup>C for clean observation of whitefly surveillance. The experiment was carried out by particular formulation of *Isaria fumosorosea* @ 6ml and 8 ml /lit concentration. It was sprayed on infested leaves and maintained under insect rearing petri plates. The instar to adult stages was monitored in all respective treatments consisting of 2ml, 4ml, 6ml and 8ml. The Nymphs was controlled under 6ml and 8ml concentration, and also entomopathogenic effect was marked on nymphs followed by adults. The Nymphs which affected by entomopathogenic fungus were placed on a PDA medium followed by three replication. The creamy white growth was observed after five days on medium at 28<sup>0</sup>C ± in BOD Incubator and observed the sporulation under an electronic Microscope.

**Keywords:** Coconut, Entomopathogenic, *Isaria fumosorosea*, Rugose Spiralling Whitefly



## Biopesticides: an organic approach for pest management in cabbage

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<sup>2</sup>Department of Agricultural Entomology, B. A. College of Agriculture, Anand Agricultural University, Anand-388110, Gujarat, India.

### ABSTRACT

The current study was undertaken at Anand Agricultural University, Anand, Gujarat during *Rabi*, 2019-20 to investigate the bioefficacy of various biopesticides against the insect pests of cabbage under laboratory conditions. For the purpose, nine biopesticides *viz*: *Neemastra* 100%, *Brahmastra* 0.03%, *Agnistra* 0.025%, *Dashparni Ark* 0.03%, *Bacillus thuringiensis* WG, *Metarhizium anisopliae* 1.15% WS, *Beauveria bassiana* 5% WS, Azadirachtin 0.15% EC and Neem Seed Kernel Extract 5% were tested against diamondback moth, *Plutella xylostella* and cabbage aphid, *Lipaphis erysimi*. Biopesticides were assessed employing leaf dip techniques replicated thrice. For each treatment, twenty aphids and ten second instar larvae of diamondback moth were taken in Petri plates. An assessment on mortality of aphid(s) and larva(e) of diamondback moth was made after 24, 48 and 72 hours of their exposition to treatments. The present study revealed that among the different biopesticides, Neem Seed Kernel Extract 5% (96.27%) and *Agnistra* 0.025% (94.88%) were best in reducing *L. erysimi* population. Further, in *P. xylostella*, highest larval mortality was obtained from *Bacillus thuringiensis* WG (95.25%), *Dashparni Ark* 0.03% (92.68%) and Azadirachtin 0.15% EC (92.68%).

**Keywords:** *Plutella xylostella*, *Lipaphis erysimi*, *Bacillus thuringiensis*, *Dashparni Ark*, *Agnistra*, Neem Seed Kernel Extract



**Sustainability of Italian honeybee, *Apis mellifera* L. in an innovative flow hive under Bengaluru conditions**

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**ABSTRACT**

Performance of Italian honeybee, *Apis mellifera* L. in the imported flow hive was compared with that in the conventional Langstroth hive, at Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru during 2019-2020. At both locations, 3-way ANOVA interaction between type of hive (A), type of bee foragers (B) and time of observation on foraging activity (C) proved the superiority of Langstroth hive over flow hive during December, 2019-January, 2020. Pooled Colony Performance Index (CPI) values showed superiority of Langstroth hive over flow hive. However, during June – July, 2020, pooled data revealed that flow hive was superior than Langstroth hive w.r.t. mean worker cell area, mean honey filled area and mean comb weight, whereas Langstroth hive was superior than flow hive w.r.t. mean pollen filled area and mean drone cell area. The overall findings proved that Langstroth hive was relatively more suitable under GKVK conditions to maintain *A. mellifera*, which may need further confirmation in bee flora-rich locations like western ghats of Karnataka for longer periods to prove the practical and economic feasibility of using flow hive for *A. mellifera* in our state, considering the expensiveness of flow hive over the standardised Langstroth hive.

**Keywords:** Flow hive, Langstroth hive, *Apis mellifera*, Bee colony performance



**Traditional ways of seed treatment with botanicals to control storage insects and to increase seed germinability in field conditions of Sesame**  
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**ABSTRACT**

Seed is the most essential element and the quality seed plays a vital part in agriculture production as well as in the national economy. To achieve the targets of agriculture production, the availability of good quality seeds at planting time is of utmost importance. Therefore, to prevent the quantitative and qualitative loss due to the several biotic and abiotic factors during storage several methods are being used such as seed treatments with suitable chemicals or plant products. Over the past few years, attempts have been made to switch from a synthetic (inorganic) seed treatment with eco-friendly materials of plant origin being cheaper and safer. Keeping in view the present study was conducted from 2017 to 2019 in the laboratories of the Department of Seed Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The impact of seed treatments with botanicals on seed quality and control of storage insect (*Corcyra cephalonica*) was studied in two varieties of sesame during the 18 months of storage period. It was found that the seed treatment with turmeric rhizome powder significantly reduced the insect damage and also increased the field establishment followed by marua leaf powder. Guar gum showed a negative effect on field emergence as compared to control.

**Keywords:** Seed treatment, Botanicals, Seed Quality, Seed storage, Field establishment.

**Traditional ways of seed treatment with botanicals to control storage insects and to increase seed germinability in field conditions of Sesame**  
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### ABSTRACT

Seed is the most essential element and the quality seed plays a vital part in agriculture production as well as in the national economy. To achieve the targets of agriculture production, the availability of good quality seeds at planting time is of utmost importance. Therefore, to prevent the quantitative and qualitative loss due to the several biotic and abiotic factors during storage several methods are being used such as seed treatments with suitable chemicals or plant products. Over the past few years, attempts have been made to switch from a synthetic (inorganic) seed treatment with eco-friendly materials of plant origin being cheaper and safer. Keeping in view the present study was conducted from 2017 to 2019 in the laboratories of the Department of Seed Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The impact of seed treatments with botanicals on seed quality and control of storage insect (*Corcyra cephalonica*) was studied in two varieties of sesame during the 18 months of storage period. It was found that the seed treatment with turmeric rhizome powder significantly reduced the insect damage and also increased the field establishment followed by marua leaf powder. Guar gum showed a negative effect on field emergence as compared to control.

**Keywords:** Seed treatment, Botanicals, Seed Quality, Seed storage, Field establishment.



**Bio-efficacy of organic treatments on the population of major insect pests infesting  
cabbage and cauliflower**

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**ABSTRACT**

In reference to the growing awareness and demand for organically produced consumable crops in recent years, an experiment was undertaken to evaluate the bio-efficacy of different organic treatments viz. sole application of Dashparni @ 10% (T<sub>1</sub>), combined application of Dashparni @10% and Tricoderma @ 10% (T<sub>2</sub>) and application of Dashparni @10%, Tricoderma @ 10% and Vermiwash @1% (T<sub>3</sub>) at 30, 45 and 60 DAS for the management of major insect pests viz. *Plutella xylostella*, *Spodoptera litura* and *Brevicoryne brassicae* infesting cabbage and cauliflower during Rabi 2020-21 at MPUAT, Udaipur. The results of the experimentation revealed that the combined application of Dashparni (10%), Vermiwash (10%) and Tricoderma (1%) proved to be superior with 52.50, 51.29 and 57.53 mean per cent reduction in population of DBM, tobacco cutworm and aphid, respectively in cabbage. It was followed by the combined application of Dashparni @10% and Tricoderma @ 10% (42.13, 47.64 and 45.56 mean per cent reduction, respectively). Sole application of Dashparni @10% in cabbage found to be least effective (40.68, 44.33 and 44.72 mean per cent reduction, respectively). All the treatments were significantly superior over control. Similar trend of efficacy was observed in cauliflower also, where the treatment T<sub>3</sub> was recorded as most effective in reducing the population of the major insect pests viz. *Plutella xylostella*, *Spodoptera litura* and *Brevicoryne brassicae* (53.28, 51.50 and 51.21 mean per cent reduction, respectively). It was followed by the application of T<sub>2</sub> (45.28, 43.09 and 45.28 mean per cent reduction, respectively) and T<sub>1</sub> (44.65, 41.45 and 41.29 mean per cent reduction, respectively).

**Keywords:** Cabbage, Cauliflower, Insect Pests, Dashparni, Tricoderma, Vermiwash

**Characterization of fatty acid composition from wax secreted by grapevine mealybug,  
*Maconellicoccus hirsutus* (Green)**

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**ABSTRACT**

Pink mealy bug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae) is considered as one of the most important and difficult to manage pests of grapevines. Wax secreted by mealybugs provide them protection from natural enemies, insecticides and desiccation. This study was aimed to find out the fatty acid composition of the wax secreted by *M. hirsutus*. *M. hirsutus* was reared on grapevines under insect net house and sprouted potatoes in the laboratory. Waxy covering of mealybugs and their egg masses were collected using hand brush dipped in hexane. Gas Chromatography-Flame Ionization Detector (GC-FID) was used for wax composition analysis. The mealybugs reared on different hosts showed different fatty acid composition. The egg mass wax from mealybugs reared on grapevine had higher amount of Gamma-linolenic acid (42.24%) in comparison with mealybugs reared on sprouted potato (27.35%). Waxy covering of mealybugs reared on grapevine had higher Gamma-linolenic acid (36.79%) than mealybugs reared on potato (23.33%). Capric acid were absent in wax of egg mass and mealybug from grapevine and present in potato 12.86% and 25.12%, respectively. It can be concluded that the host has effect on the composition of fatty acids in the wax of mealybugs. The information about fatty acids present in the wax secreted by *M. hirsutus* can help in devising management strategies to break this protective layer.

**Keywords:** Mealybug, fatty acid, wax, egg mass, butyric acid, capric acid

## **Insect pests and parasitoids in the rice fauna's ecosystem**

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### **ABSTRACT**

Rice is the cereal grain that feeds half the planet. Rice fields are economically important as well as ecologically valuable. A wide range of plant and animal species exist in rice fields. Rice fields are one of the biggest ecosystems that can be found in the tropics, including diverse insect pests and their natural enemies. In this view, CR Dhan 200, CR Dhan 201, CR Dhan 202, CR Dhan 203, CR Dhan 204, CR Dhan 205, CR Dhan 206, CR Dhan 207, CR Dhan 209 rice varieties were sown in experimental plots of Faculty of Agriculture, Annamalai University, Chidambaram. The experiment was laid out in Randomized block design with three replications. To monitor the pest and natural enemies net sweeping and yellow pan trap method was used. The results showed that the maximum number of yellow stem borer were observed in the direct-seeded rice variety of CR Dhan 209 (5.33) and the leaf folder population was maximum in the direct-seeded rice variety of CR Dhan 204 and 209 (4.33). The peak population of grasshopper and green leafhopper was recorded in the transplanted rice variety of CR Dhan 209 (15.00), CR Dhan 209 (5.33). The maximum number of Braconidae was observed in transplanted rice variety of CR Dhan 205 (3.00) and Ichneumonidae was recorded the highest number of direct-seeded and transplanted rice in the variety of CR Dhan 202 (3.00). Among parasitoids maximum population of family chalcididae was collected in direct seeded rice variety of CR Dhan 207 (3.00). The peak population of Trichogrammatidae was recorded in direct-seeded rice of CR Dhan 207 (3.33). The presence of Platygasteridae was high in the transplanted rice variety of CR Dhan 205 (8.66). The presence of Eulophidae was high in the direct-seeded and transplanted rice variety of CR Dhan 201 (8.00) and the parasitoid family Pteromalidae was collected maximum numbers in the direct-seeded rice variety of CR Dhan 200 (8.00), respectively. Among the rice ecosystems more insect pests and crop damage were noticed in direct-seeded rice more than the transplanted rice.

**Keywords:** Rice, Net sweeping, Yellow Pan Trap, Insect Pests, Parasitoids.

**Field evolved resistance to insecticides and the biochemical mechanism involved in pink bollworm, *Pectinophora gossypiella*, (Lepidoptera: Gelechiidae)**

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**ABSTRACT**

Pink bollworm (*Pectinophora gossypiella*), is one of the most destructive pests of cotton. The indiscriminate use of synthetic insecticides has affected the reliability insecticides against PBW and has led to the evolution of resistance. We tested the sensitivity of ten field populations of PBW to commonly used insecticides such as emamectin benzoate, spinosad, spinetoram, quinalphos, fenvalerate, firponil and chlorantraniliprole. In addition, the activity of carboxyl esterase, GSTs and cytochrome 450s were also investigated. Further, determined the baseline susceptibility of *P. gossypiella* for broflanilide and fluxametamide. The results showed that, resistance levels of PBW varied among ten field populations. Fenvelarate, chlorantraniliprole and spinosad were least effective and showed moderate to high level of resistance in all populations of PBW. However, emamectin benzoate displayed higher efficacy and the resistance ratio ranged from 5.78 to 19.09. Furthermore, the activity of detoxifying enzymes ranged from  $84.76 \pm 1.91$  to  $158.92 \pm 2.34$  in esterase;  $15.94 \pm 0.96$  to  $38.89 \pm 1.68$  in GSTs and  $1.39 \pm 0.19$  to  $5.06 \pm 0.22$  nmol/min/mg protein in cytochrome P450s, which resulted in increase of 1.88 fold, 2.43 fold and 3.64 folds, respectively. Further, baseline susceptibility values for broflonilide and fluxametamide ranged from 136.10 to 343.39 mg/L; 47.52 to 273.29 mg/L among field populations of *P. gossypiella*. In conclusion, emamectin benzoate and spinetoram can be utilized for the effective management of PBW.

**Keywords:** *Pectinophora gossypiella*; insecticides; insecticide resistance; detoxifying enzymes; baseline susceptibility



## Development and validation of management modules for rugose spiralling whitefly

### *Aleurodicus rugioperculatus* Martin in coconut

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#### ABSTRACT

Two on farm trials to evaluate the management modules for rugose spiralling whitefly in coconut were conducted in the eight-year-old coconut plantation at Krishnapuram village, J.N. Palayam, Udumalpet block, Tiruppur District (10.522093N; 77.150417 E) and Vadipatti village, Palani Block, Dindigul district (10.452193 N; 77.41714 E) during October 2021 to March 2022. Four modules were developed for evaluation viz., Module 1 (yellow sticky traps @ 10/acre + Release of *Encarsia guadeloupeae* @100 adults /ac + Release of *Mallada sp* eggs @ 400/ac + Neem oil 0.5% spray), Module 2 (yellow sticky traps @ 10/acre + Release of *E. guadeloupeae* @100 adults /ac + Release of *Mallada sp.* eggs @ 400 /ac + Spraying of *Isaria fumosorosea* ( $2 \times 10^8$  CFU/ml) 5 gram/ litre of water), Module 3 (yellow sticky traps @ 8/acre + Release of *E. guadeloupeae* @ 10 leaf bits / ac + Release of *Mallada sp.* eggs @ 400/ac + + Neem oil 0.5% spray), Module 4 (Untreated control - Conservation biological control). Trials were laid out in the RBD design with four treatments and seven replications (5 palms in each replication). The treatments (Setting up of yellow sticky sheets release of *E. guadeloupeae* and *Mallada sp* eggs) in the modules were given at the time of initiation of the trial except neem oil spray in the module 1 & 3, *Isaria fumosorosea* spray in the module 2 which were given a month after the trial initiation and second spray of *I. fumosorosea* spray was given 14 days after first spray at module 2. Observations were recorded on monthly interval. Per cent reduction was calculated using pre-treatment count and the last observation (6 month after imposing the treatment). Results revealed that, after imposing the management module, 25 to 29; 47 to 50 and 79 to 82 percent reduction of RSW population was observed after two, four and six months, respectively and Modules 1, 2 and 3 were superior over untreated control and performed no-par with each other in both trials. Parasitisation of *E. guadeloupeae* on RSW before implementing the management module observed as 35.61 to 37.55 per cent. Six months after imposing the management module percent parasitisation was increased to 65.34 - 67.60 percent in the modules 1, 2 and 3 where as in untreated control plot, parasitisation of *E. guadeloupeae* increased to 18.50 and 20.10 percent. Precount population of *Mallada sp* was 5.67 to 6.94 grubs per ten leaflets and it was increased to 50.72 to 53.18 per cent in the treatments at six months after imposing the management module. In untreated control plot 38.93 percent population increase was observed. To conclude, all the management modules (Module 1, 2 and 3) were superior over untreated control and performed no-par with each other in controlling RSW in coconut.

**Keywords:** Coconut, RSW, Management, Modules, *Encarsia*, *Mallada sp.*,



**Nature of damage and spatial distribution pattern of stem borer, *Stromatium barbatum*  
(Cerambycidae: Coleoptera) infesting grapes**

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**ABSTRACT**

*Stromatium barbatum* is one of the most destructive and difficult to manage wood boring pest of grapes. Present study was carried out to investigate nature of damage and spatial distribution pattern of *S. barbatum*. Investigations on the nature of damage of *S. barbatum* were carried out in 15 grapevines of three grape varieties, viz., Thompson Seedless, Fantasy Seedless and Manjari Naveen each grafted on Dogridge rootstock. These grapevines were more than 10 years old and were being uprooted because of reduced productivity due to *S. barbatum* infestation. The grapevine roots, rootstock stem, scion stem, cordons and canes were observed for damage. The main damage was seen on scion stem comprising of main trunk and cordons. *S. barbatum* grubs formed irregular tunnels and many galleries tightly packed with very fine powdery frass. *S. barbatum* was not found to cause any damage to the roots, rootstock stem and scion canes. This information is useful for rejuvenation of vineyards as rootstocks are healthy and need not be replanted saving on cost. Spatial distribution pattern of *S. barbatum* on the basis of exit holes was investigated in other vineyards of three grape varieties, viz., Manjari Naveen, Manjari Shyama and Manjari Medika. Variance mean ratio were 1.77, 2.63 & 2.84 and the negative binomial parameter k were 0.16, 0.15 & 0.15 for Manjari Naveen, Manjari Shyama and Manjari Medika, respectively showing clumped distribution.

**Key Words:** - Grape, *Stromatium barbatum*, rootstock, scion, clumped distribution



## Effect of surface and seed treatment on rice seed storage pest

### *Sitotroga cerealella* (Olivier)

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### ABSTRACT

The process involved in the production of genetically pure seeds needs more attention unlike grains. Protecting the seeds from the vulnerability of storage pests is also very important. Angoumois grain moth, *Sitotroga cerealella* (Olivier) is one of the most destructive internal feeders of stored rice seeds. Proper storage of the seeds plays a major role in preserving the viability and vigour of the seeds. Certified seed bags once tagged should not be opened until it completes the validity period of nine months. So, the possibility of drying, reprocessing and treating the seed lots in the mid of validity period is impossible. Hence, protecting the seeds without insect damage and maintaining the minimum seed germination percentage is challenging. With this background a study was conducted to evaluate the effect of surface treatment of storage bags in seed storability. The containers were surface treated with Azadirachtin 0.03% EC @ 5ml/L and Dichlorvos (DDVP) 76 EC @ 7 ml/L at monthly interval for 12 months. Surface treatment was effective in maintaining the insect damage only upto third month of storage. When surface treatment was carried with seed treatment using thiamethoxam 30 FS @ 5 ml/kg of seeds, the insect damage was less than 3 % until nine months and the seed germination percentage was also above the acceptable criteria. Surface treatment did not influence the moisture content of the stored seed.

**Keywords:** Seed treatment, surface treatment, seed storability, *Sitotroga cerealella*



**Effect of seed treatment and botanicals on the damage caused by *Atherigona soccata* on sorghum**

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**ABSTRACT**

The sorghum shoot fly, *Atherigona soccata* (Rondani) is a serious pest of sorghum attacking between 7 and 28 days after seedling emergence, causing the development of dead hearts and, in extreme infestations, crop failure. Several components involving the use of organics and chemicals can be evaluated for effective and easy control of the shoot fly. In this regard, an experiment was conducted on sorghum crop during *Kharif* season in 2019-20 at CCS Haryana Agricultural University, Hisar, and Haryana. A comparative study was done between the seed treatment and botanicals on the dead heart caused by sorghum shoot fly at 14, 21 and 28 days after emergence (DAE). Out of all the treatments, the combination with thiamethoxam 30FS @ 10ml/kg + neem oil @ 2% showed the minimum plants showing dead heart formation at 14 DAE (11.07 %), 21 DAE (14.44 %) and 28 DAE (19.98 %) while, the maximum numbers of mean plants with dead heart formation were observed in karanj oil @ 2% at 14 DAE (18.26 %), 21 DAE (22.53 %) and 28 DAE (33.08 %). The maximum mean green fodder yield of 309.60 q/ha was recorded from thiamethoxam 30FS @ 10ml/kg + neem oil @ 2%.

**Keywords:** Botanicals, Dead heart, Green fodder yield, Shoot fly

## Development of a multiresidue method for analysis of multiclass pesticides in vegetable by gas and liquid chromatography with triple quadrupole tandem mass spectrometry

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### ABSTRACT

A multiresidue method has been developed and validated for the determination of 69 multiclass pesticide residues in bitter gourd by gas and liquid chromatography coupled to triple quadrupole mass spectrometry in a single run of 34.857 min. and 16 min. respectively. The extraction was employed by using QuEChERS method. Three methods *viz.* Method I, Method II and Method III based on different combinations of extracting solvent *i.e.* ethyl acetate, acetonitrile and buffered acetonitrile respectively, with clean up involving 50 mg PSA, 30 mg GCB and 150 mg MgSO<sub>4</sub> for GC-MS/MS analysis and 50 mg PSA + 30mg GCB for LC-MS/MS analysis, were evaluated. Due to better mean recovery percentage of all test pesticides at two fortification levels *viz.* 10 ppb and 50 ppb, Method-I was selected for validation according to SANTE guideline (SANTE/11813/2017). Following Method-I, the average mean recovery percentage were in the range 70-120%, the precision values (RSD<sub>r</sub>) were below 20% along with the matrix effect  $\pm 20\%$ . The lowest fortification level at which all the analytes showed acceptable trueness was 10 ppb which also satisfies their respective Maximum Residue Limits (MRLs) as proposed by the U.S. Department of Agriculture, proving that 10 ppb fortification level is the LOQ level.

**Keywords:** Bitter gourd; Multiresidue method development; GC-MS/MS; LC-MS/MS



### **Strategies to improve RNAi efficiency for insect pest management**

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#### **ABSTRACT**

RNA interference (RNAi) is a powerful tool for gene silencing in different organisms, including plants. The extensive use of RNA interference (RNAi) for the management of insect pests has been severely constrained by the low efficacy of this technique in many insect pests. Numerous studies are being conducted to develop various strategies so as to boost RNAi efficiency, such as target gene selection and double-stranded RNA (dsRNA) delivery technologies. Genome-wide or extensive screening techniques have been utilised to find the target genes that are most amenable to RNA interference. To increase the RNA efficiency for a target gene, additional tactics include designing dsRNA constructs and modifying the dsRNA structure. Much recent research on dsRNA delivery systems has been on the utilisation of complexed or encapsulated dsRNA utilising different agents, polymers, or peptides to improve dsRNA stability and cellular uptake. Other dsRNA delivery methods involve genetically modifying plants and microorganisms (for example, fungi, bacteria and viruses) to create insect-specific dsRNA. The target insect pests will become toxic or die after ingesting the dsRNA-producing organisms or tissues.

**Keywords:** RNA interference, gene silencing, dsRNA, insect pest management

**Antifeedant activity and biochemical effects of essential oils and their major constituents on rice moth, *Corcyra cephalonica***

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**ABSTRACT**

Rice moth, *Corcyra cephalonica* is a serious pest in storage commodities. Chemical pesticides are primarily used to manage *C. cephalonica*. Insecticide resistance and the effect on non-targets have led to the need for compounds that are clean, green and derived from plant sources. Essential oils *Trachyspermum ammi* (Ajowan) and *Piper betle* (betel) and their major constituents thymol,  $\alpha$ -terpinene, eugenol, eugenol acetate and  $\beta$ -caryophyllene were evaluated for antifeedant and nutritional index activities against 3<sup>rd</sup> instar larvae of *C. cephalonica*. Relative growth rate (RGR), relative consumption rate (RCR), efficiency of conversion of ingested food (ECI) and feeding deterrence index (FDI) were measured. The impact of plant derived essential oils on biochemical parameters were determined. Eugenol and eugenol acetate were found to be effective in causing feeding deterrence and reduced nutritional index. Total protein, carbohydrates and lipid content were reduced in larvae exposed to eugenol, hence this opens up an opportunity to employ plant derived essential oils and their constituents as potential sources to manage larval stages of *C. cephalonica*.

**Key words:** Rice moth, *Trachyspermum ammi*, *Piper betle*, nutritional index, essential oils

## Structure Activity Relationship (SAR): A novel approach for developing new generation insecticides

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### ABSTRACT

Toxicology and insecticide discovery that differ in their objectives, utilise computational tools, strategies and approaches that are simultaneously employed. SAR application comprises of two steps viz., characterization of chemicals and application of chemometric methods to explore and discover data patterns to establish the relationships between structure and activity. This review briefly outlines the significance of SAR in developing newer insecticides with prominence to agricultural entomology and also discusses methodologies commonly used in insecticide toxicology and employing computational techniques for SAR determination. Recent advancement by utilizing SAR for synthesizing insecticide analogues are also swotted with summarized illustrations of substitution-based properties. The role of SAR in the discovery and development of different insecticides and its analogues are particularly underscored which has potently devised or helped in devising structure and activity of many insecticides like metofluthrin, broflanilide and dichloromezotiaz. It has proven greatly important by developing novel insecticides with higher activity, better specificity and least side-effects. Moreover, methods like MRL, PLS and ANN have provided appreciable information on chemical edifice and bioactivity of insecticides generating hefty solutions. Thus, suitable method and multidimensional QSAR studies can also unveil symptomatology of many past insecticides and upcoming explorations can be approached better with lesser shortcomings.

**Keywords:** Computational techniques, insecticide analogues, insecticides, SAR, QSAR



## Identification of potential resistance donors against brown planthopper, *Nilaparvata lugens* from indigenous genotypes of India

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### ABSTRACT

Management of brown planthopper, *Nilaparvata lugens* with resistant varieties is environmental friendly, effective and sustainable strategy. Hence a total of 900 indigenous varieties were screened and subsequently genotyped using 93 molecular markers linked to 34 different *N. lugens* resistance genes for marker-trait association and genetic diversity. Present study identified new resistance donors against *N. lugens*. Further, genotypic analysis revealed that 8-10 % variance existed among the populations. Population structure and cluster analysis results revealed that rice landraces were grouped into three major genetic clusters with a clear genetic difference between resistance and susceptible genotypes. Resistant, moderately resistant and susceptible genotypes occupied separate quarters in principal coordinate analysis (PCoA). Significant marker trait association was found in the following markers viz., RM463 (*bph2*), RM586 (*bph4*), RM6997 (*Bph6*), RM28449 (*Bph17*), RM28472 (*Bph18*), RM6308 (*bph19*), RM28561 (*Bph21*), RM5479 (*Bph25*), RM309 (*Bph26*), RM222 (*Bph30*), RM19291 (*Bph30*), RM17006 (*Bph33*), RM551 (*Bph33*), RM7 (*Qbph3*) and RM5633 (*Qbph4.4*) with different phenotypic parameters. Thus, reported resistance genes could be introgressed into popular varieties, either alone or in combination, to generate robust resistant rice varieties against *N. lugens*.

**Keywords:** Sucking pest, rice, yield, protection, eco-friendly, genotype, landrace

**Bioinsecticidal potency of *Piper chaba* Hunter leaf extract against *Aulacophora foveicollis* Lucas: evaluation of active chemical constituents, mode of action and phytotoxicity**

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**ABSTRACT**

With increasing need for organic food production and less risk of environmental contamination, introduction of safer pesticides is an urgent strategic need and biopesticides have immense potential in this regard. Hence, the study describes bioinsecticidal potency of an unexplored plant *Piper chaba* Hunter (piperaceae) against red pumpkin beetle (*Aulacophora foveicollis* Lucas). The hexane leaf extract (E1) of *P. chaba* showed excellent efficacy compared to ethyl acetate (E2) and methanol (E3) fractions i.e. 70.53, 73.81, 77.78, 80.56 and 83.33% mortality of *A. foveicollis* adults at 0.375, 0.75, 1.50, 3.125 and 6.25% doses of E1, respectively (total mortality at 12.50, 25 and 50% doses) with estimated lethal concentration (LC<sub>50</sub>) of 0.011%. A group of saturated hydrocarbon complex (77.08%), constituted of the 4 most abundant alkanes viz. hexacosane, heptacosane, tetracosane and eicosane along with aromatics (18.71%) and sulfurous acid esters (4.21%) provided cumulative insecticidal effect. The contact action of E1 was due to cuticular penetration of oil followed by nerve poisoning. The E1 extract treated cucumber leaves showed no phytotoxicity symptom up to 1.50% dose; whereas 5% and 18-24% leaf chlorosis was recorded at 3.125 and 6.25% doses. Therefore, *P. chaba* can be considered as a promising biopesticidal candidate in future.

**Keywords:** *Aulacophora foveicollis*, Bioassay, Chemical profiling, LC<sub>50</sub>, Phytotoxicity, *Piper chaba*

## Exploration of Insecticidal Property in the Bruchid Resistance Genotype V2802BG of *Vigna radiata* through GC-MS Analysis

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### ABSTRACT

Green gram, amongst the most important food crops in regular life diets is substantially attacked by the storage insect bruchid, posing a serious hindrance to crop yield. Understanding the complexities of the mechanisms underlying resistance to bruchids in green gram genotype V2808 BG is crucial for developing options to strengthen resistance in highly susceptible crop species. The GC-MS analysis of the methanolic extract was performed according to standard methodology. The investigations indicated variations in the expression of volatile chemicals in Bruchid-resistant and vulnerable genotypes. Variation in six of the 14 identified metabolites: 3-O-Methyl-d-glucose, Bis(2-ethylhexyl) phthalate, 9,12-Octadecadienoic acid (Z, Z)-, TMS derivative, 9,12,15-Octadecatrienoic acid, methyl ester, (Z, Z, Z)- Gamma-Sitosterol and stigmasterol were found in resistant and susceptible green gram genotypes, which may have contributed to resistance. Among these 9,12- (Z, Z)-octadecadienoic acid, a precursor for the formation of many short-chain aromatic compounds via the lipoxygenase (LOX) pathway is thought to operate in control and infected susceptible seeds but not in control and infected resistant seeds. Also, only the resistant genotypes include 9,12,15-octadecatrienoic acid, methyl ester, (Z, Z, Z), and dodecanamide, N-(2-hydroxyethyl), which have previously been shown to have insecticidal properties. As a result of the insecticidal property inherent in the V2802 genotype, they can be used in the breeding programme to generate bruchid resistant genotypes.

**Key Words:** V2802 BG, *Vigna radiata*, *Callosobruchus maculatus*, GC-MS analysis

**Sorption behaviour of Modified QuEChERS clean-up agents on pesticides**

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**ABSTRACT**

Pesticide usage in agriculture is indispensable to safeguard the crops in order to meet the goals of food security of human population and to attain the financial stability. However, their irresponsible use pose major challenges like pest resurgence, environmental pollution, residue problems and health hazards. Pesticide residues have been found in various fruits and vegetables, food grains and even in processed foods. Quantification of these pesticide residues in any commodities is a difficult task because of occurrence of various co-extractives within it. However there exist numerous methods, but are tedious and time consuming. As the technological advances, QuEChERS is used as best extraction and clean-up tool. While doing QuEChERS, it is of utmost importance to know the suitable clean-up agents and their behavior with the pesticides.

**Keywords:** Pesticides, QuEChERS, Clean-up agents

**Evaluation of newer insecticides against sucking pests of brinjal**

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**ABSTRACT**

The evaluation of newer insecticides against sucking pests of brinjal was carried out at the Research Farm of Department of Agricultural Entomology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, India during *Kharif* 2018-19 using variety "Ajay". Three insecticidal spray was given during this experiment. Field evaluation of various chemical insecticides indicated superiority of the treatment Cyantraniliprole 10.26% OD recording the lowest number of jassids and whiteflies which was significantly at par with all treatments i.e fenprothrin 30% EC, chlorantraniliprole 18.5% SC and cartap hydrochloride 75% SG. It was revealed from the experiment that fenprothrin 30% EC shows the lowest number of mite which was significantly at par with all insecticidal treatments.

**Keywords:** Brinjal, Sucking pests, Newer insecticides



## **Effect of pesticide residue on vegetable**

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### **ABSTRACT**

India's pesticide industry is largely focused on exports. Although the overall trend is negative, the growth rate of domestic pesticide consumption has showed wide variations over the years (-2.48 per cent). Seventy percent of all pesticides were consumed in Uttar Pradesh, Maharashtra, Andhra Pradesh, Punjab, and Haryana. Jammu and Kashmir has the highest use-intensity, followed by Punjab and Haryana. The consumption of pesticides has, however, been on the decline in Punjab and Haryana. Producing high-quality vegetables in big quantities is significantly hampered by the insect-pest and disease issue. Vegetable growers are losing 10 to 30 percent of their crop production as a result of insect problems. In some crops, the losses are greater. India is currently the world's second-largest producer of vegetables, trailing only China, with production totaling close to 175 million tonnes from an area of 10.30 million hectares (NHB 2017). Even if the area, output, and productivity of vegetables in our nation have increased dramatically over the past six decades, there is still a significant disparity between current supply and anticipated future demand. In order to fulfil present and future demands, this calls for boosting vegetable productivity or decreasing production losses. The percentage of insecticides (60%) is the greatest among the various kinds of pesticides used in India, followed by the percentages of fungicides (19%), herbicides (16%), biopesticides (3%) and other pesticides (3%).

**Keywords:** NHB, insecticide, pesticides



**Understanding of programmed cell death (PCD) in *Xanthomonas axonopodis* pv. *glycines* for plant disease control**

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**ABSTRACT**

The plant pathogenic bacteria *Xanthomonas* (*X. axonopodis* pv. *glycines*, *Xag*) causes up to 35% crop loss in Soybean. In our laboratory, this bacterium has been shown to undergo programmed cell death (PCD) under metabolic stress. However, the key proteins regulating the metabolic stress remained unrevealed. In this study, transcriptomic and proteomic analyses were performed to investigate the prominent pathways in the induction of stress in *Xag* wild type (wt) cells undergoing PCD. A mutant strain *Xag* M42 was also utilised in the study, which is a PCD-negative and caspase-3 like protein mutant of *Xag*. The analysis revealed the major role of metabolic pathways related to branched chain amino acid degradation, such as acyl-CoA dehydrogenase and electron transport chain related proteins, in *Xag* wt cells undergoing PCD. Oxidative stress response genes showed major upregulation in these cells. However, no such upregulation was observed at the protein level, while *Xag* M42 cells showed upregulation of these genes both at the transcript as well as protein level, indicative of adaptive response under a low level of stress. Also, increased reactive oxygen species accumulation and oxidative stress damage in *Xag* wt cells undergoing PCD were observed. Antioxidant defence enzyme activity analysis revealed catalase and superoxide dismutase induction in these cells. However, *Xag* M42 cells grown in PCD inducing conditions showed much higher activity of catalase and peroxidase, which might play a role in its survival and adaptation. Thus, the data suggest that branched amino acid metabolism related regulatory enzymes have a major role in the PCD through oxidative stress induction.

**Keywords:** Branched-chain amino acid, acyl-CoA dehydrogenase, oxidative stress, catalase.

***In vitro* evaluation of the efficacy of fungicides against basal rot of garlic**Sonakshi<sup>1</sup>, Rishika Dangi<sup>1</sup> and Meenu Gupta<sup>2</sup><sup>1</sup>Department of plant pathology, CCS HAU, Hisar, Haryana, 125004<sup>2</sup>Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., 173230\*Corresponding author email id: [sonakshidahiya94@gmail.com](mailto:sonakshidahiya94@gmail.com)**ABSTRACT**

Garlic (*Allium sativum*), a bulbous crop well known for its medicinal and flavoring properties, is extensively grown in India and occupies the second position in area and production. In Himachal Pradesh, it is an important cash crop. In recent times basal rot of garlic has emerged as a significant disease causing severe losses to farmers. Symptoms include pre-emergence decay of cloves and seedlings, in season decay of stem plate and storage. Based on cultural and morphological characteristics, the associated pathogen was identified as *Fusarium sp.* *In vitro* evaluation of various systematic, non-systemic and combination fungicides against the test pathogen revealed that Carbendazim and Tebuconazole + Trifloxystrobin were most effective in giving complete mycelial inhibition on PDA medium at 50, 100, 250 ppm. In contrast, Mancozeb showed minimum control at all concentrations.

**Key words:** Basal rot, *Fusarium sp.*, Carbendazim, Tebuconazole + Trifloxystrobin, Mancozeb)

***In vitro* evaluation of fungicides, bioagents and botanicals against *Alternaria alternata* causal agent of leaf and fruit spot of Apple.**

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**ABSTRACT**

Apples are the most predominantly produced fruits cultivated in all temperate regions across the globe. *Alternaria* leaf and fruit spot (ALFS) disease caused by *Alternaria* spp., poses a severe threat to apple production and productivity. Over the last decade, *Alternaria* disease in apple has caused severe losses to the apple industry in most apple growing regions of the world. The disease management strategies are not available/or not standardized in India. The present study is focused on evaluating thirteen fungicides, six bioagents and seven botanicals *in vitro* against *Alternaria*. Among thirteen fungicides evaluated by poison food technique, Hexaconazole, Propiconazole, Fluxapyroxad + Pyraclostrobin at all the test doses completely inhibited (100%) the growth of *Alternaria* spp. followed by Hexaconazole + Carbendazime (96.6 %), Tebuconazole 50 + Trifloxystrobin (90 %), Ziram and Myclobutanil (80 %) and Metalaxyl and Mancozeb showed least inhibition (50 %) compared to untreated control. Seven different botanicals viz., oreganum leaf extract, oreganum flower extract, lemon balm leaf extract, Artemisia leaf extract, lavender leaf extract, Walnut leaf extract, and Walnut fruit extract were evaluated, among them Oreganum leaf and Oreganum flower extract at all test doses completely inhibited (100%) the growth of *Alternaria* compared to untreated control. Rest all the extracts didn't show any effect on inhibition of *Alternaria*. Among six isolates of *Trichoderma harzianum* isolated from soil and apple endophytic microbiota, isolate TH-6 has been found to have 95% inhibition of mycelium growth in dual culture technique and dominated by growing on *Alternaria* mycelium. Other *Trichoderma* isolates inhibited mycelium growth (90%) compared to untreated control.

**Key words:** Apple, *Alternaria*, *Trichoderma*, Fungicide





## ***In-Vitro* Bioremediation of E-Polymer Employing Potent Bacterial Strains**

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### **ABSTRACT**

Globally, e-waste generation is estimated at 20 to 50 million tonnes annually. Electronic waste management (e-waste) has become a global issue in this digital era. E-waste is the fastest growing waste on the planet, with an annual growth rate of 3–4%. Presently, only 15% of e-waste is recycled. One of the most significant constituents of e-waste is plastics, accounting almost for 20% of it. In this context, the present study explores a non-toxic, eco-friendly approach to the degradation of e-plastic (electronic plastic) with the incorporation of *Sporosarcina* sp. MGP4. In this study, the enrichment isolation technique and detailed characterization of the strain, designated as MGP4, isolated from soil samples of Kichha, Uttarakhand, India (28.9115°N, 79.5154°E) was reported. Strain MGP4 was isolated from diluted soil samples that were inoculated in Minimal media and seeded with e-waste granules as a carbon source. The biodegradation of e-waste by the selected strain during enrichment was confirmed by FTIR analysis of both the control and treatment. The growth pattern of the bacterial isolate in the presence of e-waste polymer at different intervals is also exhibited using UV-spectrophotometer at 600 nm. Furthermore, the FE-SEM images confirmed the results of FTIR showing the significant changes in the surface topography of the treated samples compared to that of the control e-polymers.

**Keywords:** e-waste, biodegradation, e-polymers, FTIR, FE-SEM.



## Management of Anthracnose Rot (*Colletotrichum* Spp.) of Tomato using ethanol based plant extracts

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### ABSTRACT

Tomato (*Solanum lycopersicum* L.), a member of the *Solanaceae* family is a widely grown warm season crop worldwide. In India, tomato is a major cash crop. Tomato is a 'functional food' as it reduces the risk of cancer and cardiovascular diseases due to its high nutritional value. Among various fungal diseases of tomato, anthracnose fruit rot caused by *Colletotrichum* species is a devastating fungal disease affecting tomatoes mainly after harvest. An estimated annual loss of about 29.5 per cent had been reported from India due to anthracnose disease. The fungal pathogen causing anthracnose fruit rot of tomato was isolated and identified as *Colletotrichum truncatum* based on morphological characters and sequencing of DNA region coding for internal transcribed spacer (ITS) region. The *in vitro* experiment was conducted to evaluate the effectiveness of ethanol based biopesticides viz., *Azadirachta indica* (Neem), *Melia azedarach* (Darek), *Cannabis sativus* (Hemp), *Eucalyptus citriodora* (Safeda), *Tagetes erecta* (African marigold) and *Ocimum tenuiflorum* (Holy basil) at four different concentration i.e., 1,2,3 and 4 per cent using poisoned food technique. Ethanol based extract of *Eucalyptus citriodora* resulted in maximum average mycelial growth inhibition of the pathogen.

**Keywords:** Tomato, anthracnose rot, fungal pathogen, ethanol based biopesticides

**Antifungal potentiality of *Aspergillus niger* isolates as a bio-control agent against *Fusarium* wilt of guava**

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**ABSTRACT**

Guava wilt is considered a National problem of India, which is accountable for significant economic loss. *Fusarium* species mainly cause the disease, *F. oxysporum* f. sp. *psidii* (FOP) has been the dominant one. Management using fungicides is not successful due to complex etiology, biological control is the effective alternate strategy for successful disease management. The present study is carried out to screen eleven *Aspergillus niger* isolates for their antagonistic against guava wilt pathogen (FOP) under both *in-vitro* and *in-planta* conditions. Isolates were identified morphologically and molecularly using the ITS (Internal transcribed spacer) region. The isolates were evaluated through volatile, non-volatile and dual culture methods under an *in-vitro* study. AN-11, AN-6, and AN-2 inhibited the pathogen (FOP) 67.16%, 64.01%, and 60.48%, respectively. *In-planta* study conducted in greenhouse conditions using air layered guava plants of 6 months old (var. Allahabad Safeda) by pre and post-inoculation of FOP. Isolates (AN-11 and AN-6) were found most effective under pre- and post-inoculation trials. The plants exhibited maximum recovery from wilting and lower wilt incidence, respectively. These selected isolates could be further carried to multi-location trails to confirm the robustness and potentiality in guava wilt disease management.

**Keywords:** Guava wilt, *Aspergillus niger*, Bio-control, Volatile, *Fusarium oxysporum* f. sp. *psidii*, ITS



**Growth and nutrient uptake of black pepper cuttings as positively affected by arbuscular mycorrhizal fungi under nursery conditions**

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**ABSTRACT**

Arbuscular mycorrhizal (AM) fungi have symbiotic associations with most vascular plants. Their association benefits the host plant by improving nutrient uptake, providing the increased capability to cope with biotic and abiotic stress conditions. The present study used healthy single node black pepper (*cv. Sreekar*) cuttings with three leaves stage and even thickness. Results showed that the black pepper cuttings inoculated with AM had significantly higher root length and dry biomass as compared to the uninoculated plants. Nutrient uptake was positively correlated with the mycorrhizal treatments in black pepper plants. On 120 days after inoculating AM, nitrogen uptake was observed to be significantly higher in AM inoculated plants ( $34.72 \text{ g plant}^{-1}$ ) compared to uninoculated ( $25.2 \text{ g plant}^{-1}$ ). As expected, P uptake was significantly increased by AM inoculated plants from 90 days after inoculation onwards. Apart from N and P, AM fungi can increase the potassium, magnesium, zinc and iron uptake under inoculated treatments. Soil enzymes play significant roles in improving soil health and its environment. The present investigation observed the highest acid phosphatase and dehydrogenase activity at 120 days in AM inoculated soil samples. In turn, alkaline phosphatases,  $\beta$  glucosidase and urease activities were not significantly enhanced under AM inoculated soil samples. Thus, AM symbiosis mainly regulates nutrient cycling and plays a vital role in the growth and biomass of the black pepper cuttings under nursery conditions.

**Keywords:** Arbuscular mycorrhizal fungi, Black pepper, Biomass, Nutrient uptake, Soil enzymes



## Identification of new sources of resistance to MYMV and powdery mildew in green gram

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### ABSTRACT

Green gram (*Vigna radiata* (L) Wilczek) is an important food legume and is a rich source of easily digestible protein. Because of its short duration and availability of photo-thermo-insensitive cultivars which can be grown throughout the year especially in southern parts of India. Mungbean Yellow mosaic virus (MYMV) and powdery mildew diseases are the major constraints in mungbean cultivation in most parts of India. The development and use of resistant cultivars are the most effective and economic strategies against these diseases. Total 78 accessions of mungbean evaluated under natural field conditions against MYMV and powdery mildew during *Kharif*/spring summer season-2020-21. Out of seventy-eight accessions screened against powdery mildew and mungbean yellow vein mosaic virus (MYMV) disease under natural field conditions, the accessions such as EC-398885, EC-398891, IPM-604-1-7, Bari mung-2, Coll.no NR/18-57 and Coll.no NR/18-79 were identified as resistant against powdery mildew and the accessions such as IC-296672, IPM-604-1-7, V1002195AG, Coll.no NR/18-06, IPM-312-394-1, IPM-14-10, IPM-2-14, IPM-410-3, IPM-430-4 and IPM-205-7 were found to be resistant against mungbean yellow vein mosaic virus and these identified potential genotypes could be used for disease resistance breeding in mungbean.

**Keywords:** Mungbean, MYMV, Powdery mildew, Germplasm, resistance sources.

## Profiling of Non-volatile Secondary Metabolites of *Chaetomium globosum* and *In-vitro* evaluation for potential antifungal activity against soil borne fungi

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### ABSTRACT

Recently biological management has drawn more attention to soil-borne pathogens. *Chaetomium sum* Kunze: Fr., a saprophytic ascomycete, is thought to be a potential antagonist for a number of plant diseases. The goal of the current study is to profile different bioactive secondary metabolites and evaluate their potential efficacy against soil-borne phytopathogens. Four isolates of *C. globosum* have been tested against *Sclerotinia sclerotiorum*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* by dual culture technique. Among them production of potential isolate (CG-5157) has been carried out in Potato Dextrose medium. Culture filtrate was sequentially extracted by cold extraction with petroleum ether, followed by ethyl acetate and methanol. Extracted solvents were evaporated under reduced pressure below 40°C in a rotary evaporator to obtain various concentrates. Profiling of ethyl acetate and methanolic concentrates were initially subjected to HPLC analysis to separate various compounds with the mobile phase of ACN: H<sub>2</sub>O (60:40) at a flow rate of 0.6 mL/min, which revealed similar peaks at  $\lambda_{max}$  254 nm. UPLC-QTOF-MS analysis of ethyl acetate concentrate resulted in several peaks corresponding to various metabolites like chaetomin (733.6152), chaetominin (696.0980), parietin (284.0674), chaetoviridins A, C, E (432.1339), chaetoquadrin (425.1821), chaetominone (284.2967), chaetomugilin I (406.1532) and chaetomugilin J (390.1599), which was identified by their accurate molecular mass and mass fragmentation pattern. Similarly methanolic concentrate exhibited molecular ion corresponding to chaetoglobosins A (229.2630), chaetoglobosins B (229.2630), chaetoglobosin C (229.2630), chaetoglobosin D (266.2669), chaetoglobosin N (543.2763), chaetoglobosin Q (546.2717), chaetoglobosin W (532.2937), chaetoglobosin I (483.2951), Prochaetoglobosin II (497.2621), prenisatin (216.0941), globosuxanthone (357.2305), chaetominine (338.1451) and chaetominine (338.1451). The fungicidal activity was carried out *in-vitro* against the fungi using the poisoned food technique to determine the percent inhibition (%). Ethyl acetate concentrate (100 µg/mL; EC<sub>50</sub> 112.1 µg/mL) was highly effective against *S. sclerotiorum*. Comparative antifungal activity of ethyl acetate concentrate of *C. globosum* with respect to *T. harzianum* A28 suggested similar percent growth inhibition of *S. sclerotiorum*. A suitable microbial spore-based formulation may be developed for efficient control of *S. sclerotiorum*.

**Keyword:** Secondary metabolite, HPLC, UPLC-Q-TOF/MS, *In-vitro*



## **Plant defense inducers for the management of *Alternariaster* leaf spot and Sunflower necrosis disease**

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### **ABSTRACT**

Plants are infected by various microbial organisms such as fungus, virus, and bacteria which threaten their survival or reduce the growth of plants. In response to pathogen attack, plants have evolved several strategies to counteract pathogen infection. There are changes in plants physiology of plants after microbial attack results in active induced defense mechanisms. These active defense mechanisms refer to induced resistance, which occurs after the infection of plants by the pathogen and protects against the subsequent attack of the pathogen. Systemic acquired resistance (SAR), is induced by inoculation of virulent or non virulent pathogen and Salicylic acid dependent. Therefore, the present experiment aimed to use plant defence inducers to manage *Alternariaster* leaf spot and Sunflower necrosis disease. Our results indicate that Seed treatment with salicylic acid @ 100 ppm followed by foliar spray of salicylic acid @ 100 ppm at 30 and 45 days after sowing have contributed more yield 1576 kg/ha and B:C ratio of 1.54 with least *Alternariaster* leaf spot 20.93% and necrosis diseases 6.37% followed by Seed treatment with salicylic acid @ 50 ppm followed by foliar spray of salicylic acid @ 50 ppm at 30 and 45 days after sowing have contributed more yield 1413 kg/ha and B:C ratio 1.28 with least *Alternariaster* leaf spot 26.43% and necrosis diseases 11.16%. Whereas the highest *Alternariaster* leaf spot 57.19% and necrosis diseases 19.89% were recorded in control.

*Keywords: Alternariaster leaf spot, Induced resistance, Systemic acquired resistance*



**Antagonistic activity of yeasts and botanicals against the post-harvest rot caused by  
*Penicillium digitatum* in Kinnow mandarin**

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**ABSTRACT**

Citrus is a flowering tree and shrub belonging to the family Rutaceae. Citrus trees are evergreen grown in tropical to subtropical climates worldwide. Citrus fruits rank third in terms of production among the fruit crops in India. Kinnow mandarin, a hybrid of two cultivars 'King' (*Citrus nobilis*) and 'Willow leaf' (*Citrus deliciosa*) is one of the most important crops belonging to the citrus group, due to its high productivity (21 mt./ha). This crop is easily prone to many fungal, bacterial and viral pathogens. Among these losses, post-harvest pathogens contribute more than 25 percent of total yield. In addition, *Penicillium digitatum* causing green mould fruit rot, is the economically important pathogen leading to the 30 percent loss in the fruit yield. At present, chemical fungicides are in use for the management of this disease. However, fungicide residues have been reported in edible fruits which are bound to have adverse effects on the health of the consumers. There are effective alternatives to chemical fungicides which either alone or in combination can effectively manage diseases in citrus crops. In such efforts, the locally available botanical extracts and yeast isolates with antifungal properties were promising against *Penicillium digitatum*. As the result of the evaluation of those locally available eco-friendly treatments, curry leaf, karvaya and peppermint and yeast strains isolated from raisins, chickpea and grapes were found to have more promising efficiency in inhibiting pathogen growth.

**Keywords:** Kinnow, *Penicillium digitatum*, yeast isolates, botanicals, eco-friendly





## Development of bio-formulation based on botanicals and yeasts against

### *Alternaria* spp. causing leaf spots in cauliflower

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#### ABSTRACT

Characteristic symptoms of *Alternaria* leaf spot are the presence of yellow, dark brown to black circular leaf spots with a target like concentric rings. The objective of the study was the development of bio-formulation based on botanicals and yeasts for biocontrol of *Alternaria brassicicola*. Antagonistic yeasts were isolated from the phylloplane. The cultural study indicated that the yeasts produced white; creamy pigmentation, oblong/ eclipse colony with cell length of 2-8  $\mu\text{m}$  and cell breadth of 2-5  $\mu\text{m}$  and attained a full growth of 90 mm on Yeast Peptone Dextrose Agar medium at  $25 \pm 1$   $^{\circ}\text{C}$  in 3-4 days. A total of 6 yeast isolates were screened *in vitro* to determine their antagonistic effect against *A. brassicicola*. Among six yeasts, BK5 and BK7 showed the greatest antagonistic activity *in vitro* against *A. brassicicola*. These yeast isolates were evaluated singly and in combination with different formulations of effective botanicals. The study indicated that individual treatment with yeast-BK5 and mancozeb among different treatments were found most effective, followed by buttermilk in mycelial growth inhibition of the pathogen in comparison to control. Minimum per cent growth inhibition was reported in Field formulation 1 (in water). The interesting part of the study is that the making of bio-formulations by combining other treatments with yeast-BK5 and buttermilk did not enhance the efficacy of the combinations. Instead, the effectiveness of such treatments was reduced, indicating that the active ingredients in Field Formulations 1 and 2 (in cow urine) may have exerted an inhibitory effect on the active ingredients of yeasts present in yeast-BK5 and Buttermilk. Due to their antagonistic ability, easy cultivation requirements, and safe use, many of these unicellular fungi have been considered for biocontrol applications. Antagonistic yeasts can be effectively included in the integrated disease management strategies to improve the biocontrol efficacy against different plant pathogens.

**Keywords:** bio-formulation, yeasts, botanicals, *Alternaria*, buttermilk



***In vitro* evaluation of chemicals against *Xanthomonas campestris* pv. *mangiferaeindicae* causing Bacterial canker in Mango**

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**ABSTRACT**

Mango (*Mangifera indica* L.) is India's most important commercial fruit crop, with over 30 tropical fruit tree species. It is one of the most popular tropical fruits and is known as the "King of Fruits." Mango bacterial leaf spot disease is caused by *Xanthomonas campestris* pv. *mangiferaeindicae* is also known as mango canker, bacterial spot, bacterial canker, black spot, mango blight or bacterial black spot. This is one of the most damaging bacterial diseases of mango worldwide, causing 10 to 70 percent fruit drop, 10 to 85 percent loss in fresh output, and 5 to 100 percent loss in storage worldwide. Various chemicals (Bordeaux mixture, copper oxychloride, copper hydroxide, chitosan, captan, cuperous oxide and streptomycin) were tested *in vitro* against the bacterium using the paper disc method at different concentrations. Chitosan (high, medium and low molecular weight), streptomycin, Bordeaux mixture, copper hydroxide, and copper oxychloride were found to be more efficient than the control in suppressing bacterial growth. The maximum inhibitory zone was observed in the case of high molecular weight chitosan. In the case of captan, however, the minimal inhibition zone was observed.

**Keywords:** Mango, Bacterial canker, Chitosan, Captan

**Recombinase polymerase amplification assays for *Pythium* spp. and *Ralstonia pseudosolanacearum* detection in ginger**

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**ABSTRACT**

Ginger (*Zingiber officinale* Rosc.) is a tropical and subtropical spice representing the family *Zingiberaceae*. Soft rot caused by *Pythium* spp. and bacterial wilt caused by *Ralstonia pseudosolanacearum* (earlier *R. solanacearum*) are the major production constraints in ginger. Effective and sensitive techniques are required for reliable and accurate diagnosis of these pathogens, which are transmitted primarily through ginger rhizomes. In the present study, uniplex and duplex recombinase polymerase amplification (RPA) assays were developed for specific and sensitive detection of *Pythium* spp. and *Ralstonia pseudosolanacearum* by manipulating magnesium acetate concentration, incubation time and temperature. The duplex RPA assay was 10-100 times more sensitive than the duplex PCR assay. The developed assays did not show any cross-amplification with other rhizome-borne pathogens of ginger such as *Fusarium* spp., *Macrophomina phaseolina* and *Sclerotium rolfsii*. In addition, the assays could be performed under isothermal conditions at a temperature ranging from 37-40°C in a heating block. In validation tests, these pathogens could be successfully detected using crude DNA extracted from ginger rhizome samples collected from the field, storage and market. This is the first report of simultaneous detection of fungal and bacterial pathogens using duplex RPA assay in ginger.

**Keywords:** RPA, Ginger, Rhizomes, Soft rot, Bacterial wilt



**Influence of weather parameters on the incidence of mango anthracnose (*Colletotrichum gloeosporioides* Penz and Sacc.) in South Chhattisgarh**

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**ABSTRACT**

The present has been conducted at Horticulture Nursery, S. G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur mango mother orchard of variety Langra during 2019-20, 2020-21 and 2021-22. Anthracnose incidence was recorded on a weekly basis and disease incidence was calculated based on the total number of leaves and panicles observed on a tree and the number of leaves having disease symptoms. Minimum temperature, morning soil temperature (5 cm and 10 cm), rainfall, rainy days and afternoon relative humidity, morning and afternoon vapor pressure showed a positive correlation between anthracnose disease incidence, the relationship between these weather parameters and disease incidence was found to be prevalent during the rainy season, which is privileged by warm temperature with the advancement of the summer season, an abundance of water for the pathogen to germinate and favorable humid condition during the period of June to September. The severity of the disease is strong positive linear relationship with minimum temperature with  $r = 0.75$  and equation,  $y = 1.57x - 17.61$ ; morning soil temperature also showed a positive linear relationship having coefficient  $r=0.62$  and  $r= 0.54$ , respectively and equation justifies as,  $y = 1.67x - 27.27$  and  $y = 1.61x - 28.35$  and soil temperature respectively.

**Keywords:** Disease incidence, severity, minimum temperature, soil temperature

**Identification of novel multi-race resistance in Lentil germplasm against seven races of  
*Fusarium oxysporum* f. sp. *lentis***

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**ABSTRACT**

*Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *lentis* (*Fol*) is the most devastating disease of lentil present worldwide and in India. Identifying novel sources for resistance against prevalent races can be utilized in devolving multi-race resistant cultivars. In the present study, the potential of a hundred lentil germplasms belonging to *Lens culinaris* subsp. *culinaris* (70), *L. c.* subsp. *tomentosus* (2), *L. c.* subsp. *orientalis* (7), *L. c.* subsp. *odemensis* (5), *L. lamottei* (3), *L. nigricans* (6) and *L. ervoides* (7) were evaluated against seven races of *Fol* for two consecutive seasons. The pot evaluation of germplasms was carried out in ICAR-NBPGR, New Delhi during 2020-21 and 2021-22. The performance of disease pressure was compared with a resistant check (PL639) and a susceptible check (L-9-12). Disease incidence (DI) was recorded every week until the late flowering stage and a scale of 1-9 was used to categorize and identify resistance accessions. The germplasm showed varying disease resistance to races of the pathogen. The accessions exhibiting high resistance (HR) responses included 24, 26, 39, 27, 17, 39 and 26 in 2020 and 24, 38, 26, 17, 38 and 25 in 2021 against races 1 to 7, respectively. Wild species, *L. c. subsp. odemensis* showed resistance to all the races of *Fol* in both seasons. Accessions of *L. culinaris* sub sp. *culinaris* and *L. culinaris* sub sp. *orientalis* showed the most diverse reaction with scale of 1-9 and mean disease incidence (DI) of 4.85-7.20±0.29-0.32 and 3.00-6.67±1.2-1.9 respectively in 2020 and 4.88-7.22±0.28-0.36 and 3.00-6.67±1.2-1.9 in 2021 to all the races of *Fol*. All the accessions belonging *L. c.* sub sp. *tomentosa* were highly resistant to Race 3 (RJ-8) and 7 (BR-27) with mean DI of 1.00 0.0 during both seasons. All the accession of *L. lamottei* were highly resistant to Race 3 (RJ-8) with mean DI 1.00±0.0 during 2020 and 2021. Contrastingly, it showed moderate susceptible to susceptible reaction with mean DI of 7.67±0.6 to race 5 (CG-5) and race 7 (BR-27). The differential reaction of species to races is probably due to the heterogeneous genome structure of germplasm within single species and the differential interaction of resistant genes towards a particular race. The wild species were found to be more resistant than cultivated species probably due to a broad genetic base. The present study has explored the potentiality of all species and subspecies of lentil against existing races of *Fol* providing an excellent source of multi-race resistance breeding.

**Keywords:** Lentil, *Fusarium oxysporum* f. sp. *lentis*, Resistance screening

## Morphological and molecular screening of different wild *Ipomoea* sp. and sweet potato

### (*Ipomoea batatas* (L.) Lamarck for sweet potato weevil resistance

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### ABSTRACT

Sweet potato (*Ipomoea batatas* (L.) Lamarck) is ranked as the seventh most important crop in the world. Despite the high economic significance, the cultivation of sweet potatoes is mostly affected due to the sweet potato weevil (*Cylas formicarius* (Fabricius)) infestation. It is the major pest of sweet potato, causing tuber yield loss of up to 80%. Hence identification of host plant resistance genes against sweet potato weevil is one of the alternative pest control strategies. These genes have an important role in the management of the pest. The present work deals with a morphological screening of different *Ipomoea* sp. viz (*Ipomoea batatas*, *I. obscura*, *I. palmata*, *I. triloba* and *I. mauritiana*) using choice and no choice assay method for insect preference/feeding. Among the different *Ipomoea* sp. the sweet potato weevil preference for *Ipomoea mauritiana* was significantly less compared to *I. batatas*, *I. triloba*, *I. obscura*, *I. palmata*. Mortality of weevils was also observed during the choice assay test by feeding leaves, vines and tubers of *Ipomoea mauritiana* by the third day. Further, the methanol extract of the tubers of sweet potato and *I. mauritiana* was prepared for the bioassay study and the weevils showed a repellent effect for the solvent extract from *I. mauritiana* compared to sweet potato root extract which shows the difference in the semiochemical composition. The root extract will be used for GC-MS analysis to identify compounds responsible for the repellent effect of weevils. A cysteine protease inhibitor, proteinase inhibitor, and kunitz trypsin inhibitor genes specific primers were used for the molecular screening of wild *Ipomoea* sp. The PCR conditions of all the gene specific primers were standardized for all the *Ipomoea* sp. The results of the study show *I. mauritiana* as a resistance source of genes against sweet potato weevil.

**Key words:** *Ipomoea*, sweet potato weevil, proteinase inhibitor, screening



**Prevalence and distribution of *Euphorbia heterophylla* rust (*Melampsora euphorbiae*) in Western Maharashtra**

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**ABSTRACT**

*Euphorbia heterophylla* also called ‘Dudhi’ in the marathi language, is a widespread weed species found in all cultivated fields across ‘Western Maharashtra’ highly susceptible to rust. This plant was brought as an ornamental to South and Southeast Asia, since then it has become a weed in India where it has infested the agricultural lands. Many herbicides failed to suppress it and have spread fast worldwide. During December 2020, This weed plant was found heavily infected with rust disease in the catchment area of the Bheema river in the Solapur district. Therefore, an intensive survey was conducted from Feb 2021 to Feb 2022 to watch over the incidence and spread of rust on euphorbia weed. It was noticed that a substantial prevalence of euphorbia rust disease was found spread in all districts of Western Maharashtra on this euphorbia weed. The symptoms were yellow orange rust pustules, observed on the lower side of infected leaves with yellow-orange spore masses. While the necrotic areas appeared on the upper leaf surface. The rust pustules were initiated on capsules (fruits) in later stages. The heavy infection killed the plant in its advanced stages before the seed set. Under laboratory tests *Melampsora euphorbiae* was identified as the causative agent based on morphology. As the pathogen (*Melampsora euphorbiae*) is not found to be associated with any crop disease, it can be used as a potential biocontrol agent in weed management practices against *Euphorbia* spp.

**Keywords:** *Euphorbia*, Dudhi, Rust, Weed, *Melampsora*, Biocontrol.



## Effect of native *Trichoderma* spp. on *Fusarium* wilt disease of Banana

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### ABSTRACT

Banana (*Musa* spp.) is seriously threatened by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense*, also known as panama disease. A total of 33 *Trichoderma* isolates were isolated from the soil samples collected from the banana growing areas. The isolates were identified as *Trichoderma harzianum*, *Trichoderma asperellum* and *Trichoderma longibrachiatum* through microscopic and molecular characterisation. *In vitro* evaluation of *Trichoderma* spp. showed that all the isolates significantly inhibited the growth of *Fusarium*. The inhibition zone ranged from 43.3 to 71.55 per cent by the different *Trichoderma* isolates. The species *Trichoderma asperellum* showed the highest inhibition level followed by *Trichoderma harzianum*. The isolates MNF-3 was superior and showed 71.55 per cent inhibition, followed by CKF- 4 (68.28 %). Further, in the potential bioagents screened under pot conditions, the isolate *T. asperellum* (MNF-3) showed the least wilt incidence and internal discolouration compared to the control. In addition to suppressing *Fusarium* wilt, *T. asperellum* (MNF-3) also showed a significant increase in the plant height, a number of leaves and pseudostem girth compared to control plants.

**Keywords:** Bioagents, Soil, *Fusarium*, Banana.





**Soil solarization along with FYM enriched *Pochonia chlamydosporia* is effective in managing root knot nematodes in organic capsicum under polyhouse**

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**ABSTRACT**

Soil solarization, a non chemical pre planting method is an important strategy for controlling soil-borne pathogens and plant parasitic nematodes in organic cultivation. The higher temperature created because of solarization and soil moisture enhances the mineralisation rate of soil organic matter and thus, promotes crop growth. Root-knot nematodes, especially *Meloidogyne incognita*, are a serious threat to protected cultivation in almost all of the country. Chemicals successfully control these nematodes, but for organic growers, this solution won't suit. A demonstration trial was laid in a farmer's one-acre polyhouse used for organic cultivation at Panipat, Haryana. The polyhouse soil was heavily infested with root knot nematode, having a population range between 7 to 8 J2 /g soil. After slight irrigation the soil was covered with a 25 micron thickness polythene sheet. Two rows were left uncovered to serve as a control. The experiment was laid in the month of May-June of 2020-2021. Simultaneously four FYM enriched biocontrol agents (4 treatments) viz. *Trichoderma viride*, *Pseudomonas fluorescens*, *Paecilomyces lilacinus* and *Pochonia chlamydosporia* were applied in polyhouse after the removal of polythene sheet *i.e.* 15 days before transplanting of capsicum seedlings. The plant height, nematode population, root gall index, soil temperature during the month of May-June were analysed and it was observed that after solarization and application of FYM enriched bioagents, the population levels of root knot nematode were found to be zero for all the treatments till the first harvest of crop. The maximum recovery of free living nematodes and plant height after 30 and 60 days was observed in treatment where soil was treated with *P. chlamydosporia* along with soil solarization. In addition, the maximum yield obtained for this treatment was 20.94 q/ha with the lowest root knot index (2).

**Keywords:** solarization; *Meloidogyne*, bioagents, nematode survey; polyhouse



**Physiological and molecular portraying of the saprophytic pathogen, *Macrophomina phaseolina* in Castor for developing self-effacing biological management strategies**

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**ABSTRACT**

Castor is an important indigenous non-edible oilseed crop. The consumption of castor oil in various sectors has increased at 7.32 thousand tons per year worldwide, creating demand for its large-scale cultivation. Castor is a hardy crop, with the changing weather conditions minor pathogens on the crop causing root rot (*Macrophomina phaseolina*) is attaining severity, it causes 80-100 per cent loss if not managed. The growth of the pathogen was maximum under the pH 6.0 to 6.5 (1.46mg/100ml) and a temperature 40<sup>0</sup> C (87 mm) under laboratory conditions. These edaphic factors critically affect the survival of *M. phaseolina* and influence the increase of charcoal rot. The raising temperature observed in the changing climatic condition is critical for the severity. Hence, biological strategies of resistance lines and biocontrol agents were assessed. Germplasm line BCG-2 showed absolute resistance and MI-54, 10 per cent incidence out of the 54 lines screened against *M. phaseolina* revealing addition of *Trichoderma harzianum* (GJ 16B) and *T. viride* (8) which exhibited the highest mycelium growth inhibition of 52.84 and 52.23 per cent over control under *in vitro* studies for adoption as soil application under biological crop protection strategies.

**Effect of foliar application of plant defense activators on alternaria blight and seed yield  
in radish seed crop cv. Japanese white**

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**ABSTRACT**

A field experiment was carried out in the Department of Seed Science and Technology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2017-18 and 2018-19 to study the effect of foliar application of plant defense activators on *Alternaria* disease severity and seed yield of radish cv. Japanese white. In the experiment there were 13 treatments based on various plant defense activators including control *viz.*, salicylic acid @ 50ppm (T1), salicylic acid @75ppm (T2), salicylic acid @100ppm (T3), jasmonic acid @ 55 ppm (T4), jasmonic acid @ 110 ppm (T5), jasmonic acid @ 165 ppm (T6), butyric acid @ 250 ppm (T7), butyric acid @ 500 ppm (T8), butyric acid @ 750ppm (T9), potassium nitrate @ 1% (T10), potassium nitrate @ 1.5% (T11), potassium nitrate @ 2% (T12) and untreated control (T13). Three foliar applications were given, first at the initiation of the flowering stalk, second at flowering and third at the pod development stage and their effect on disease and seed yield and quality parameters were observed. The severity of *Alternaria* blight was recorded lowest (9.44%) in the plots sprayed with butyric acid @ 750ppm (T9) followed by 11.31 % in salicylic acid @100ppm (T3). The maximum seed yield (379.71g/plot) was observed with salicylic acid @100ppm (T3), which was followed by potassium nitrate @ 2% (T12) in which the yield was 352.72 g/plot. The other seed yield and quality parameters like number of siliqua/plant, length of siliqua, number of seeds/siliqua, 1000 seed weight, seed germination, speed of germination, SVI-1 and SVI-2 were observed significantly higher *i.e.* 311, 7.28cm, 6.3, 17.1g, 93.6%, 91.8, 2248.1 and 1256.9, respectively after foliar application of salicylic acid @100ppm (T3) as compared to other treatments.

**Keywords:** *Alternaria* blight of radish, Plant defense activators, Salicylic acid, Potassium nitrate, Butyric acid and Jasmonic acid



**Evaluation of bacterial endophytes for biocontrol potential against web blight disease  
in cowpea (*Vigna unguiculata* (L.) Walp.)**

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**ABSTRACT**

Cowpea is a leguminous vegetable crop widely grown throughout the year in tropical and subtropical regions. Among various fungal diseases, web blight caused by *Rhizoctonia solani* Kuhn, has become a severe problem in cowpea growing tracts and leads to drastic yield loss. Thirty-eight endophytic bacteria were isolated from healthy root, stem and leaves of fodder cowpea var. Aiswarya (22 isolates) and bush cowpea var. Bhagyalakshmi (16 isolates). Based on the results of dual culture assay and culture filtrate assay isolates CFLE3, CBRE5 and CBSE5 were selected as promising ones for further *in vivo* studies. The species identity of isolates was confirmed through 16S rRNA analyses as *Bacillus subtilis* (CFLE3), *B. amyloliquefaciens* (CBRE5) and *B. velezensis* (CBSE5). Under green-house experiment, the lowest disease index occurred in plants treated with seed biopriming for 4 h along with foliar application (20 and 40 DAS) of *B. velezensis* CBRE5 with 54.91 % disease suppression. whereas combined seed biopriming for 4 h along with foliar application (20 and 40 DAS) of *B. amyloliquefaciens* CBSE5 and *B. velezensis* CBRE5 was the best treatment in plant growth promotion. Production of IAA, ammonia, phosphorus and siderophore were also investigated for elucidation as plant growth promoting traits. This study suggests that selected endophytic bacteria *B. velezensis* CBRE5 as putative PGPR and potent biocontrol agent against web blight disease for eco-friendly and sustainable safe-to-eat crop production.

**Keywords:** Cowpea, Endophytic bacteria, *Rhizoctonia solani*, Biological control, Plant Growth Promotion



**Sustainable management of post harvest disease fruit rot in papaya caused by  
*Colletotrichum gloeosporioides***

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**ABSTRACT**

Papaya (*Carica papaya* L.) fruits are highly perishable commodities which suffer from heavy post harvest losses and cause about 8 to 18 per cent losses during storage to marketing. These losses in papaya are caused by biotic and abiotic factors. Among different biotic factors, anthracnose is an important post-harvest disease that causes heavy loss in papaya quality. The investigations were carried out from 2018 to 2020 on the management of fruit rot of papaya through wrapping materials, botanicals and oil coating of fruit by pre inoculation of pathogens in papaya fruits. The significantly minimum disease intensity after 15 days of incubation was observed in wrapping papaya fruits with polythene bag 37.78 per cent with 57.50 per cent disease control followed by news paper 46.67 per cent. Among nine botanical extracts at 10 per cent concentration the minimum disease intensity was observed in garlic extract (28.89%) with 68.29 per cent disease control followed by neem extracts (35.56%) with 60.97 per cent disease control as well as taken 2.83 days for initiation of symptoms. Among eight different oil coatings, significantly minimum fruit rot intensity was observed in fruits treated with lemon grass oil (31.11%) and it was at par with mustard oil (33.33%) with 67.44 and 65.12 per cent disease control, respectively.

**Key words:** botanicals, pathogens, papaya, lemongrass oil



***In vitro* evaluation of different chemicals against pumpkin and bottle gourd isolate of**

***Xanthomonas cucurbitae***

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**ABSTRACT**

The “Gourd family” or the family *Cucurbitaceae* consists of many crops, which are commonly called cucurbits. The family contains 118 genera and more than 825 species. The already existing list of about 200 diseases which hamper the cultivation of cucurbits worldwide has been expanded with the severe emergence of bacterial leaf spot disease, caused by *Xanthomonas cucurbitae*. In India, it was first reported on cucumber in Bihar. In Himachal Pradesh, a bacterial leaf spot was first reported on a bottle gourd. The disease has been reported to cause 20 per cent yield loss and the disease severity at the time of storage of fruit may reach up to 50-60 per cent. Among various chemicals evaluated *in vitro* against the bacterium, the Bordeaux mixture followed by copper oxychloride and streptomycin proved effective in the case of pumpkin isolate. However, in the case of bottle gourd isolate, copper oxychloride followed by Bordeaux mixture and streptomycin proved effective. The minimum inhibition zone of both the isolates of the bacterium was recorded with captan.

**Keywords:** Pumpkin, Bottle gourd, Bacterial leaf spot, Bordeaux mixture, Streptomycin

## Effect of plant derived essential oils against Dry Root Rot of Urdbean

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### ABSTRACT

Dry root rot of urdbean caused by *Macrophomina phaseolina* (Sclerotial stage: *Rhizoctonia bataticola*) is a major soil-borne disease, limiting yield and its quality parameters in pulses. The ineffectiveness of existing chemicals against soil borne pathogens, the emergence of fungicide resistant strains and the demand for organic products necessitate the search for effective alternatives. Safe and environment-friendly plant derived essential oils have been reported for their antifungal activity. To study the antifungal activity of plant oils, the essential oils from Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and their spent wash (by-products) at three different concentrations viz., 100ppm, 500ppm, 1000ppm along with the fungicides, carbendazim and mancozeb were tested for their efficacy against *Macrophomina phaseolina* under *in vitro* conditions using poisoned food technique both in solid and liquid media. Among the treatments, the total inhibition (100 per cent) of mycelial growth was observed in potato dextrose agar medium amended with Palmarosa oil, Citronella oil and carbendazim at all three concentrations viz., 100, 500 and 1000 ppm. With respect to mycelial biomass, the same treatments viz., the essential oils of *C. martini* (Palmarosa) and *C. nardus* (Citronella) and the fungicides, carbendazim exhibited complete inhibition of mycelial growth in liquid medium. The spent wash of *C. martini* (Palmarosa) and *C. nardus* (Citronella) recorded mean mycelial biomass of 640 mg and 671 mg, respectively as against 798 mg in control with inhibition of 19.8 and 15.9 per cent respectively. The fungicide mancozeb also recorded a complete inhibition of mycelial growth and biomass at higher concentrations of 500 and 1000 ppm. In contrast, at 100 ppm it showed lesser inhibition of radial growth (78%) and mycelial biomass (92%) of *Macrophomina phaseolina*. It is revealed from the study that both the oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) are potential alternatives to chemical fungicides for the effective management of urdbean dry root rot.

**Key words:** Urdbean dry root rot, *Macrophomina phaseolina*, Essential oil, Palmarosa oil, Citronella oil, Disease management

## Efficacy of plant oils on the management of rice brown spot

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### ABSTRACT

Brown spot caused by *Bipolaris oryzae* (Syn. *Helminthosporium oryzae*) (Teleomorph: *Cochliobolus miyabeanus*) is a serious seed-borne disease of rice worldwide and it is considered as a major constraint in rice production. Since the existing chemical control measures are costly and favour the development of resistance to the pathogen, potential alternative methods using various plant oils have been tested for management. The essential oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and their spent wash (bye-products) at three different concentrations viz., 100 ppm, 500 ppm, 1000 ppm along with the fungicides viz., carbendazim and mancozeb were tested for their antifungal activity against *Bipolaris oryzae* under *in vitro* conditions using poisoned food technique both in solid and liquid media. Among the treatments, complete inhibition (100 per cent) of mycelial growth was observed in a PDA medium amended with oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and mancozeb at all three concentrations viz., 100, 500 and 1000 ppm. Whereas the spent wash of both *C. martinii* and *C. nardus* and carbendazim was not found effective (with less than 10 per cent inhibition even at 1000 ppm conc.) in inhibiting the radial growth of *Bipolaris oryzae*. With respect to mycelial biomass, the same treatments viz., oils of *C. martinii* (Palmarosa) and *C. nardus* (Citronella) and the fungicide, mancozeb totally inhibited the growth under liquid medium. The spent wash of *C. martinii*, *C. nardus* and carbendazim recorded a mean mycelial biomass of 727 mg, 682 mg and 586 mg, respectively, against 751 mg in control with an inhibition of 3.2, 9.2 and 22.0 per cent, respectively. It is evident from the study that both the oils of *Cymbopogon martinii* and *Cymbopogon nardus* are potential alternative to mancozeb for the management of rice brown spot.

**Key words:** Rice brown spot, *Bipolaris oryzae*, Essential oil, Palmarosa oil, Citronella oil, Disease management





## Screening of sugarcane varieties against Pokkah boeng Disease under natural condition

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### ABSTRACT

Sugarcane is one of the primary crops grown for its commercial value. Among various diseases attacking sugarcane, the Pokkah boeng disease of sugarcane caused by *Fusarium* spp. is one of the fungal disease which was previously classified as a minor disease that is becoming significant due to its increasing disease incidence. Therefore, a field trial was conducted at Norman E. Borlaug Crop Research Centre of G.B.P.U.A & T, Pantnagar, Uttarakhand, India during cropping season of 2019 and 2021. An experiment was laid out in Randomized Block Design with three replications of 26 sugarcane varieties. The experiment aimed to determine sugarcane varieties' disease reaction against Pokkah boeng disease of sugarcane. The disease status was observed based on the resistant, moderately susceptible, susceptible and highly susceptible reactions. The results revealed that among 26 cultivars, 14 showed a resistant reaction, 7 showed a moderately susceptible reaction, 4 showed susceptible reaction and only one showed a highly susceptible reaction.

**Keywords:** Pokkah boeng, Screening, Sugarcane varieties



## Management of vigna pulses diseases through host resistance and new fungicides

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### ABSTRACT

Powdery mildew (*Erysiphe polygoni*), Cercospora (*Cercospora canescens*), Anthracnose (*Colletotrichum* spp) and MYMV diseases are the major and emerging threats and cause nearly 10-15% reduction in vigna pulses production in southern Peninsular India. In this context, field experiments were conducted to identify resistance donors and suitable fungicides against major diseases of mungbean. In this study, we evaluated 348 mungbeans, 95 urdbean and 47 cowpea genotypes against four major diseases under natural conditions. Further, we tested the efficacy of nine different fungicides against major diseases of mungbean. The results of the studies indicated, that among the genotypes evaluated, mungbean genotype V1003490AG was found resistant to Cercospora leaf spot. Five mungbean entries *viz.*, VI002529B-BL, VI004145B-BLM, VI005024B-BL, VI005022 BG, and VI005030BY were identified as resistant to MYMV. Among the cowpea lines, GP-1, DC 18-1, VCP 18-013 and VCP-18-032 were resistant to PM disease. Among fungicides evaluated, two foliar sprays of fungicides *viz.*, Fluopyram (17.6%) + Tebuconazole (17.6%) or Azoxystrobin (20% W/V) + Difenconazole (12.5% W/V) at 0.1% found to be effective for PM, Cercospora and Anthracnose leafspot diseases with 41% and 36% increase in yield, respectively. The lines identified would facilitate plant breeders in developing resistant varieties and the fungicides identified would help in controlling the fungal diseases in mungbean.

**Key words:** Vigna pulses, diseases, resistance, management



## Effect of commonly used pesticides on growth and development of *R. solani*

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### ABSTRACT

Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* (Kühn) f. sp. *sasakii* Exner is a widely spread and destructive disease of maize in India, especially in *tarai* region of Uttarakhand. In the present study efforts were made to know the effect of commonly used pesticides on the growth and development of *R. solani* under *in vitro* conditions. Mycelial growth of *R. solani* was completely inhibited by carbendazim and penflufen at 10 µg/ml concentration while at 50 µg/ml concentration by mancozeb. Sclerotia germination was completely arrested by carbendazim at 10 µg/ml, penflufen at 50 µg/ml while mancozeb failed even at 100 µg/ml concentration. Among insecticides chlorpyrifos, carbofuran and cartap hydrochloride and in herbicides pendimethalin, 2, 4-D ethyl ester and atrazine at 50 µg/ml concentration effectively inhibited the mycelial growth and sclerotial formation but moderately inhibited the sclerotia germination. Germination of sclerotia of *R. solani* in soil was completely inhibited by penflufen and pendimethalin. In combinations mancozeb + 2,4- D ethyl ester carbendazim + atrazine, carbendazim + cartap hydrochloride, 2,4- D ethyl ester + cartap hydrochloride, penflufen+2,4-D ethyl ester + chloropyrifos, mancozeb + 2,4-d ethyl ester + cartap hydrochloride significantly inhibited sclerotia germination in soil.

**Keywords:** Banded leaf and sheath blight, *R. Solani*, Sclerotia and Inhibition.



**Effect of different media on growth and sporulation of *Fusarium* spp. associated with wilt disease of chickpea.**

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**ABSTRACT**

Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop, but its production has hardly changed over the past few decades due to its susceptibility to wilt, caused by *Fusarium oxysporum* f.sp. *ciceri*. Chickpea wilt is one of the most significant factors limiting chickpea production worldwide. Due to its continuous outbreak and losses throughout the world a laboratory study was done to know the effect of different media on the growth and sporulation of the *Fusarium oxysporum* f.sp. *ciceri*. So that it helps in laboratory evaluation and know the ecological survival which may indirectly help in the management strategies. Keeping this view in mind, the isolated pathogen from the symptomatic plant was grown on eight different media i.e., Malachite green, Malt agar, Potato dextrose agar, V8 juice agar, Asthana and Hawker's media, Oatmeal agar, Richard agar and Czapek dox for studying their effect on growth and sporulation. It was found to be maximum radial growth on the PDA (potato dextrose agar) culture media followed by Richards agar and oatmeal agar respectively. The growth of the mycelium varied from sparse growth to dense cottony growth. Sporulation was maximum in the Czapek dox medium and lowest in the Malachite green medium.

**Keywords:** ecological, susceptibility, symptomatic, sporulation, wilt



***In vitro* antagonistic effect of endophytes against dry-root rot causing *Fusarium solani*  
in Acid lime**

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**ABSTRACT**

Acid lime (*Citrus aurantifolia* Swingle) is an important fruit crop grown worldwide. India is the largest producer of acid lime in the world. Andhra Pradesh holds the first rank in acid lime production. Endophytes are the microorganisms present in the living tissues of various plant parts and are a good source of antibiotics. Presently, most soil-borne pathogens are being managed using endophytic bio-agents. In acid lime, dry root rot caused by *Fusarium solani* is a serious threat abetting their production. In this study, 6 fungal (EFA 1-6) and 8 bacterial (EBA 1-8) endophytes were isolated and selected, from the roots of healthy acid lime plants. The *in vitro* results revealed that the isolates EFA 4 and EBA 7 exhibited antagonistic activity on *Fusarium solani* with 66.92 and 63.42 per cent inhibition over control, respectively followed by the isolates EFA 5 and EBA 8 which showed the lowest inhibition percentage of 45.68 and 48.75, respectively against the pathogen.

**Keywords:** Endophytes, antagonistic activity, *Fusarium solani*.

### **Sorption behaviour of Modified QuEChERS clean-up agents on pesticides**

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#### **ABSTRACT**

Pesticide usage in agriculture is indispensable to safeguard the crops in order to meet the goals of food security of human population and to attain the financial stability. However, their irresponsible use pose major challenges like pest resurgence, environmental pollution, residue problems and health hazards. Pesticide residues have been found in various fruits and vegetables, food grains and even in processed foods. Quantification of these pesticide residues in any commodities is a difficult task because of occurrence of various co-extractives within it. However there exist numerous methods, but are tedious and time consuming. As the technological advances, QuEChERS is used as best extraction and clean-up tool. While doing QuEChERS, it is of utmost importance to know the suitable clean-up agents and their behavior with the pesticides.

**Keywords:** Pesticides, QuEChERS, Clean-up agents



**Influence of soil types, cropping sequence and depth of inoculums on survival of  
*R. solani* under field conditions**

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**ABSTRACT**

Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* (Kuhn) f. sp. *sasakii* Exner is a widespread and destructive disease of maize in India, especially in the *tarai* region of Uttarakhand. In the present study efforts were made to know the effect of soil types, cropping sequence and depth of inoculums on the survival of primary inoculum. On soil surface and 30 cm depth of inoculum *R. solani* survived for a shorter duration than 15 cm depth of soil. Survival of inoculum reduced in fallow condition followed by maize-wheat-maize and maize-potato-maize cropping sequence. In loam soil inoculum survived for a shorter duration followed by sandy loam and silty clay loam soil.

**Keywords:** Inoculum, Survival, *R. solani* and cropping sequence



## Effect of pesticide residue on vegetable

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### ABSTRACT

India's pesticide industry is largely focused on exports. Although the overall trend is negative, the growth rate of domestic pesticide consumption has showed wide variations over the years (-2.48 per cent). Seventy percent of all pesticides were consumed in Uttar Pradesh, Maharashtra, Andhra Pradesh, Punjab, and Haryana. Jammu and Kashmir has the highest use-intensity, followed by Punjab and Haryana. The consumption of pesticides has, however, been on the decline in Punjab and Haryana. Producing high-quality vegetables in big quantities is significantly hampered by the insect-pest and disease issue. Vegetable growers are losing 10 to 30 percent of their crop production as a result of insect problems. In some crops, the losses are greater. India is currently the world's second-largest producer of vegetables, trailing only China, with production totaling close to 175 million tonnes from an area of 10.30 million hectares (NHB 2017). Even if the area, output, and productivity of vegetables in our nation have increased dramatically over the past six decades, there is still a significant disparity between current supply and anticipated future demand. In order to fulfil present and future demands, this calls for boosting vegetable productivity or decreasing production losses. The percentage of insecticides (60%) is the greatest among the various kinds of pesticides used in India, followed by the percentages of fungicides (19%), herbicides (16%), biopesticides (3%) and other pesticides (3%).

**Keywords:** NHB, insecticide, pesticides





## Understanding of programmed cell death (PCD) in *Xanthomonas axonopodis* pv.

### *glycines* for plant disease control

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### ABSTRACT

The plant pathogenic bacteria *Xanthomonas* (*X. axonopodis* pv. *glycines*, *Xag*) causes up to 35% crop loss in Soybean. In our laboratory, this bacterium has been shown to undergo programmed cell death (PCD) under metabolic stress. However, the key proteins regulating the metabolic stress remained unrevealed. In this study, transcriptomic and proteomic analyses were performed to investigate the prominent pathways in the induction of stress in *Xag* wild type (wt) cells undergoing PCD. A mutant strain *Xag* M42 was also utilised in the study, which is a PCD-negative and caspase-3 like protein mutant of *Xag*. The analysis revealed the major role of metabolic pathways related to branched chain amino acid degradation, such as acyl-CoA dehydrogenase and electron transport chain related proteins, in *Xag* wt cells undergoing PCD. Oxidative stress response genes showed major upregulation in these cells. However, no such upregulation was observed at the protein level, while *Xag* M42 cells showed upregulation of these genes both at the transcript as well as protein level, indicative of adaptive response under a low level of stress. Also, increased reactive oxygen species accumulation and oxidative stress damage in *Xag* wt cells undergoing PCD were observed. Antioxidant defence enzyme activity analysis revealed catalase and superoxide dismutase induction in these cells. However, *Xag* M42 cells grown in PCD inducing conditions showed much higher activity of catalase and peroxidase, which might play a role in its survival and adaptation. Thus, the data suggest that branched amino acid metabolism related regulatory enzymes have a major role in the PCD through oxidative stress induction.

**Keywords:** Branched-chain amino acid, acyl-CoA dehydrogenase, oxidative stress, catalase.

**Relationship of soil available sulphur, exchangeable calcium and magnesium with physico-chemical properties in tomato growing areas of Sirmour district of Himachal Pradesh**

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**ABSTRACT**

Soil testing provides a base for monitoring the availability of nutrients for the optimum fertilizer use at farm levels devise nutrient management strategies and improving the soil health. There is exhaustive mining of nutrients from the soil due to introduction of heavy nutrient feeders and high yielding hybrid varieties of vegetable crops. Therefore, research was carried out to evaluate the soil nutrient status and relationship between different soil properties in tomato growing areas of Sirmour district of Himachal Pradesh for which one hundred representative soil samples were collected and analyzed. The results depicted that the studied soils were found to be neutral to slightly alkaline in relation, medium to high categories in OC content and in safe limit of EC. Correlation studies revealed that exchangeable Ca, Mg and available S showed a negative relationship with bulk density and particle density but it did not achieved statistical significance. However, they were positively and highly significantly correlated with water holding capacity. Exchangeable Ca and Mg exhibited a positive but non-significant relationship with soil pH and EC but available S was negatively and non-significantly correlated with soil pH. They were found to have a positive and highly significant correlation with organic carbon.

**Keywords:** Correlation, Exchangeable cations, Secondary nutrients, Soil fertility

***In vitro* evaluation of the efficacy of fungicides against basal rot of garlic**Sonakshi<sup>1</sup>, Rishika Dangi<sup>1</sup> and Meenu Gupta<sup>2</sup><sup>1</sup>Department of plant pathology, CCS HAU, Hisar, Haryana, 125004<sup>2</sup>Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, H.P, 173230\*Corresponding author email id: [sonakshidahiya94@gmail.com](mailto:sonakshidahiya94@gmail.com)**ABSTRACT**

Garlic (*Allium sativum*), a bulbous crop well known for its medicinal and flavoring properties, is extensively grown in India and occupies the second position in area and production. In Himachal Pradesh, it is an important cash crop. In recent times basal rot of garlic has emerged as a significant disease causing severe losses to farmers. Symptoms include pre-emergence decay of cloves and seedlings, in season decay of stem plate and storage. Based on cultural and morphological characteristics, the associated pathogen was identified as *Fusarium sp.* *In vitro* evaluation of various systematic, non-systemic and combination fungicides against the test pathogen revealed that Carbendazim and Tebuconazole + Trifloxystrobin were most effective in giving complete mycelial inhibition on PDA medium at 50, 100, 250 ppm. In contrast, Mancozeb showed minimum control at all concentrations.

**Key words:** Basal rot, *Fusarium sp.*, Carbendazim, Tebuconazole + Trifloxystrobin, Mancozeb)

## COCONUT BASED INTEGRATED FARMING SYSTEM: TOWARDS SUSTAINABILITY OF SOIL HEALTH AND ALLEVIATION OF RURAL POVERTY

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### ABSTRACT

Coconut is an important horticultural crop which has a significant bearing on the livelihood security of small and marginal farmers across the globe. In the recent past, coconut turned out to be a sensitive victim to the catastrophes of drought events, price fluctuations, debilitating pests and dreadful diseases affecting the livelihood security of small and marginal farmers. An attempt was made at Coconut Research Station, Aliyarnagar during 2015 to integrate Telicherry breed of goats (6+1) across coconut area of one ha to augment system productivity. IFS with coconut + Telicherry Breed of Goats + Fodder Trees + Pasture Crops (T<sub>1</sub>) was compared with monocrop of coconut (T<sub>2</sub>). Average nut yield realized from IFS during 2016-2021 was 19780 nos. per ha as against 18820 nos. in monocropping. Gross returns accrued through lamb production, pasture production and goat manure was Rs. 3.58 lakhs per ha as against Rs.2.25 lakhs in monocropping. Incremental income realized from coconut based IFS was Rs. 1.12 lakh per ha per year. Fertilizer replacement value is 412 kgs of urea, 281 kgs of SSP and 138 kgs of MOP. Green House Gas emission -17875.3 units and thus is ecologically safe.

**Keywords :** Coconut, Monocrop, Net Returns, Fertilizer Replacement, Telicherry Breed.

### Evaluation of newer insecticides against sucking pests of brinjal

Akanksha Narayan Humane and P.R. Zanwar

### ABSTRACT

The evaluation of newer insecticides against sucking pests of brinjal was carried out at the Research Farm of Department of Agricultural Entomology, Vasantnaik Marathwada Krishi Vidyapeeth, Parbhani, India during *Kharif* 2018-19 using variety “Ajay”. Three insecticidal spray was given during this experiment. Field evaluation of various chemical insecticides indicated superiority of the treatment Cyantraniliprole 10.26% OD recording the lowest number of jassids and whiteflies which was significantly at par with all treatments i.e fenprothrin 30% EC, chlorantraniliprole 18.5% SC and cartap hydrochloride 75% SG. It was revealed from the experiment that fenprothrin 30% EC shows the lowest number of mite which was significantly at par with all insecticidal treatments.

**Keywords:** Brinjal, Sucking pests, Newer insecticides



## **Effect of coconut shell biochar on physical, chemical properties and available major nutrient status of acidic soil**

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### **ABSTRACT**

The effect of coconut shell biochar addition on the physical and chemical properties of acidic soil such as soil bulk density, maximum water holding capacity, pH, electrical conductivity (EC), available major nutrients were investigated in a field experiment with soybean. This study was conducted by application of coconut shell biochar in combination with recommended Lime. The coconut shell biochar was applied at three rates (5, 7.5 and 10 t ha<sup>-1</sup>) and lime (calcium carbonate) was applied at two rates (100% and 50% recommendation) to acidic soil. Amendment type, application rate, and their interaction had significant effects ( $p < 0.05$ ) on soil bulk density, maximum water holding capacity, pH, EC, and available major nutrients after the harvest of soybean. Application of coconut shell biochar at 10 t ha<sup>-1</sup> in combination with 50% recommended lime had shown a relatively higher improvement in soil physical and chemical properties after the harvest of soybean.

**Keywords:** Coconut shell biochar, Soybean, Soil physical, Chemical properties Acidic soils

**To study the effect of rescheduling of fertilizer application on nutrient availability, soil chemical properties, yield and agronomic parameters of widely spaced sugarcane crop (*Saccharum officinarum*)**

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**ABSTRACT**

A field experiment was conducted during the year 2020-21 at Regional Research Station, CCS HAU, (Uchani), Karnal, Haryana. The experiment consisted of two main treatments along with four sub plot treatments and was laid out in split plot design with three replications with each plot size of 8.4m x 6.8m. The eight treatment combinations were the two main plot B1 (Broadcast) and B2(band placement), and 4 subplots of split doses of Nitrogen and Potassium. Significantly higher cane yield (96.58 t ha<sup>-1</sup>) was reported with treatment which received RDF through band placement (B1) which was 8.01 % higher than treatment receiving RDF through broadcast method (B1) with which 88.84 t ha<sup>-1</sup> cane yield was obtained. The higher (131.86 kg ha<sup>-1</sup>) values of available N were recorded in band placement (B2) compared to broadcast (B1) (125.73 kg ha<sup>-1</sup>) at the stages after 45 DAP upto harvest. The available K were higher (220.50 kg ha<sup>-1</sup>) in broadcast (B1) compared to band placement (B2) (214.60 kg ha<sup>-1</sup>) at all the time intervals upto harvest. No significant changes were recorded in the organic carbon content, pH and EC of the soil. The juice quality parameters (Brix, Pol %, CCS %) cane girth, number of internodes per cane, length of internodes were not affected by either of band and broadcast method of fertilizer application. Among the sub plots at 60 DAT, significantly higher plant height was recorded by T4 (100.41 cm). Significantly, higher tiller population (110.59 000 ha<sup>-1</sup> and 102.68 000 ha<sup>-1</sup>) was recorded with band placement of fertilizers both at 60 and 150 DAP compared to broadcasting (B1) of fertilizers. The band placement method of fertilizer application (B2) produced significantly higher NMC (100.79 000 ha<sup>-1</sup>) at the time of harvesting.

**Keywords:** Split Doses, Band Placement, Broadcasting, Sugarcane, Brix, Pol%

***In vitro* evaluation of fungicides, bioagents and botanicals against *Alternaria alternata* causal agent of leaf and fruit spot of Apple.**

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**ABSTRACT**

Apples are the most predominantly produced fruits cultivated in all temperate regions across the globe. *Alternaria* leaf and fruit spot (ALFS) disease caused by *Alternaria* spp., poses a severe threat to apple production and productivity. Over the last decade, *Alternaria* disease in apple has caused severe losses to the apple industry in most apple growing regions of the world. The disease management strategies are not available/or not standardized in India. The present study is focused on evaluating thirteen fungicides, six bioagents and seven botanicals *in vitro* against *Alternaria*. Among thirteen fungicides evaluated by poison food technique, Hexaconazole, Propiconazole, Fluxapyroxad + Pyraclostrobin at all the test doses completely inhibited (100%) the growth of *Alternaria* spp. followed by Hexaconazole + Carbendazime (96.6 %), Tebuconazole 50 + Trifloxystrobin (90 %), Ziram and Myclobutanil (80 %) and Metalaxyl and Mancozeb showed least inhibition (50 %) compared to untreated control. Seven different botanicals viz., oreganum leaf extract, oreganum flower extract, lemon balm leaf extract, Artemisia leaf extract, lavender leaf extract, Walnut leaf extract, and Walnut fruit extract were evaluated, among them Oreganum leaf and Oregnum flower extract at all test doses completely inhibited (100%) the growth of *Alternaria* compared to untreated control. Rest all the extracts didn't show any effect on inhibition of *Alternaria*. Among six isolates of *Trichoderma harzianum* isolated from soil and apple endophytic microbiota, isolate TH-6 has been found to have 95% inhibition of mycelium growth in dual culture technique and dominated by growing on *Alternaria* mycelium. Other *Trichoderma* isolates inhibited mycelium growth (90%) compared to untreated control.

**Key words:** Apple, *Alternaria*, *Trichoderma*, Fungicide

## Screen printed electrode based nanosensor for nitrate detection in agriculture

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### ABSTRACT

Globally, the progressively increasing contamination of food and water with high content of nitrate is a serious concern today. Due to excessive use of nitrogen fertilizers in agriculture to get high production, the leeching of nitrate to water resources and accumulation in food is an emerging issue. Since the main source of nitrate uptake by plants is soil, present work reported an electrochemical biosensor using CNT- $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanocomposite for the detection of nitrate in soil. The spectroscopic and microscopic characterization studies were further performed for revealing the synergic interactions between CNT and  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoflowers. The fabricated biosensor exhibited high sensitivity of 63.87  $\mu$ A/log(mg/L)/cm<sup>2</sup> and low detection limit of 0.09 mg/L. Various studies such as interference and stability studies were also conducted to evaluate the overall performance of the nanosensor. The high correlation ( $r^2= 0.998$ ) with the cadmium reduction method, highlights the futuristic scope of the fabricated biosensor for detection of nitrate. Further the results of the study can be applied for the fast, accurate and in-field assessment of nitrate in water, food, plants and soil.

**Keywords:** Nitrate detection, Nanosensor, Nanocomposite, Sensitivity, Soil



## **Soil Fertility Status and Nutrient Index for Primary Nutrients in Muttagi Sub-Watershed of Dharwad District, Karnataka, India**

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### **ABSTRACT**

The research work was conducted at Kalghatgi taluk, Dharwad district with the aim of evaluating the fertility status of soils using nutrient index approach, mainly for primary nutrients and soil fertility maps were prepared by using geospatial techniques. Prevailing climatic condition in study area is semi-arid and hot weather prevails for major part of the year. The area falls under Southern dry agro-climatic zone of Karnataka state and is categorized as drought prone. The average annual rainfall in *Kalghatgi taluk* is 889 mm. In general the taluk is covered by red soil. Patches of black cotton soil are also found at places. The red soil in general is derived from granite gneisses. Black cotton soils are derived from schist. Sixty-nine surface soil samples were collected (0-20 cm depth) grid-wise by using cadastral map of study area and were analyzed for their fertility status. Based on the fertility ratings, pH of soils was very strongly acidic to moderately alkaline. Electrical conductivity was normal to slightly saline and soil organic carbon was low to high. Among the Primary nutrients ie., nitrogen remained low, low to high phosphorous and potassium was medium to high. Sulphur ranged from 5.5 to 55.6 kg<sup>-1</sup> ha and it was rated as low to high. The micronutrients like Fe, Mn, Cu, Zn were sufficient and boron was low in the soils.

**Keywords:** Soil Fertility, Nutrient index, GIS

## Relevance of soil chemical properties with available nutrient elements in mango orchard soils of Bilaspur district in Himachal Pradesh

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### ABSTRACT

Mango (*Mangifera indica* L.) is one of the most popular and important fruit crops in India and its cultivation in different agro-ecological region have significance in term of economic dependency and livelihood security of farming community. It occupies an area of 2293.0 thousand ha with a production of 20798.0 thousand MT. Mango production in the country is estimated to increase 4.24%. Based on uniformity in respect of age and tree vigour, 20 representative orchards were selected and “Dashehri” variety of mango was selected for study as most of the well-established orchards in these blocks were under this variety. The soils were nearly neutral to alkaline in reaction. The electrical conductivity values were in safe limits (less than  $0.8 \text{ dSm}^{-1}$ ). The organic carbon contents were medium to high. The soil pH of the surface layers was significantly and positively correlated with available Ca ( $r = 0.49^*$ ), Mg ( $r = 0.50^*$ ), Cu ( $r = 0.49^*$ ), Zn ( $0.47^*$ ), but was found to be significantly and negatively correlated with available Mn ( $r = -0.55^*$ ). For the sub-surface layers, the soil pH was non-significant with all nutrient elements. The organic carbon content in the surface soils was significantly and positively correlated with available N ( $r = 0.93^{**}$ ) but shows significant and negative correlation with Fe ( $r = -0.47^*$ ). For the sub-surface layers the organic carbon was found to be positively correlated with soil N ( $r = 0.97^{**}$ ) which were found to be significant (Table 4.16). The significant and positive relationship of organic matter with N content of soils is obvious since bulk of the total N in soils is present in organic combinations but shows significant and negative correlation with Fe ( $r = -0.51^*$ ).

**Keywords:** Mango, Organic carbon, Nitrogen

## **Uptake of nutrient and soil chemical properties as influenced by different organic management practices in rice**

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### **ABSTRACT**

A field experiment was conducted at CCS HAU, Rice Research Station, Kaul, Haryana to elucidate the advantages of organic farming over inorganic farming in sustainable agriculture. The objective was to compare the yield and economics of the different organic management practices in rice crop and its effect on nutrient status and uptake by rice crop. The experiment was laid out in Randomized complete block design with seven treatments and five replications. The treatments were: T<sub>1</sub>: Absolute Control, T<sub>2</sub>: 100% RDN, T<sub>3</sub>: 100 % N (FYM) T<sub>4</sub>: 150% N (FYM), T<sub>5</sub>: 50 % N (FYM) + 50 % N (*sesbania*), T<sub>6</sub>: 50 % N (FYM) + 50% N (vermicompost), T<sub>7</sub>: 50 % N (FYM) + 50 % N (mustard cake). A significant increase in available N, P and K content of the soil was observed with the application of 100 % recommended dose of N through different organic combinations viz. FYM + *sesbania* (163.9, 24.02 and 318.2 kg/ha, respectively), FYM + vermicompost (164, 22.64 and 314.2 kg/ha, respectively), FYM + mustard cake (166.1, 25.02 and 316.1 kg/ha, respectively) over unfertilized control (124.5, 15.9 and 258.6 kg/ha, respectively) in basmati rice. Similarly, the total uptake of N, P and K (grain+panicle) with various organic combinations was found at par with that of the inorganic source. The grain yield of rice ranged from 2931 to 3039 kg/ha in the treatments where RDN was applied through various combinations of organic sources as compared to control (2485 kg/ha). The lower net return (Rs. 31419/acre) and B:C (2.78) was found where treatment 50 % N (FYM) + 50 % N (mustard cake) was applied.

**Keywords:** Rice, Organic Amendments, Uptake, Soil chemical properties, Rice

## **Effect of integrated nutrient management on soil nutrient balance sheet and nutrient harvest index of brinjal**

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### **ABSTRACT**

To meet the need of blooming population, we need to exploit the land beyond its capability. We cannot extend the area under cultivation to boost productivity since land is a finite natural resource. Integrated nutrient management practice aims to maintain or adjust soil fertility and supply plant nutrient to an optimal level for sustaining crop productivity through the integration of all possible sources of plant nutrients. Brinjal is a heavy yielding and removes large quantities of nutrients in one cycle of plant growth which results in quick nutrient depletion from the soil which highlights the importance of the study. The results of the study depicted that the maximum value of nutrient harvest index was obtained by phosphorus followed by nitrogen and sulphur while least was obtained by potassium. Among the different treatments, highest nutrient harvest index value was obtained from control. The soil nutrient balance sheet was found to be negative in unfertilized plot i.e. control due to no addition of fertilizer. It was also found to be more negative for nitrogen with the increase in yield and positive for phosphorus in all treatments except control. There was also an apparent negative balance of potassium.

**Keywords:** Brinjal, Nutrient balance sheet, Nutrient harvest index, Nutrient management, Soil fertility

## **Effect of application of foliar nitrogen and potassium application on leaf nutrient contents of fig (*Ficus carica* L.)**

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### **ABSTRACT**

A field experiment was carried out in the model farm of Dr Y S Parmar University of Horticulture and Forestry, Nauli, Solan, Himachal Pradesh, during the years 2016-17 and 2017-18 to see the effect of foliar nitrogen and potassium applications on leaf nutrient contents of fig. Thirteen treatment combinations were arranged in a randomized block design comprising two levels of nitrogen viz. N<sub>0.5</sub> (0.5 per cent urea) and N<sub>1.0</sub> (1.0 per cent urea); two levels of K i.e. K<sub>1</sub> (1.0 per cent KNO<sub>3</sub>) and K<sub>2</sub> (2.0 per cent KNO<sub>3</sub>) and two application times i.e. September and January, and were replicated thrice. The maximum leaf N was recorded under treatment T<sub>9</sub> (2.71%), whereas, the highest leaf P (0.38%), leaf K (1.22%) and leaf Ca (4.64%) were recorded under treatment T<sub>13</sub>, comprising nitrogen application through urea spray @ 1.0 per cent and potassium through KNO<sub>3</sub> @ 2.0 per cent twice during September and January. The maximum leaf micronutrient contents were also observed in the same treatment.

**Keywords:** Fig, Urea, Potassium nitrate, Foliar spray, Leaf nutrient contents



## Effect of different levels of Zinc fertilizers on quality of Maize (*Zea mays* L.) in West Tripura

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### ABSTRACT

The present study was conducted at Experimental Farm, College of Agriculture, Tripura to find out the effect of different levels of Zn application on quality of maize during Rabi season of 2018 & 2019. The experiment was laid out in Randomized block design (RBD) design replicated three times. In this experiment zinc was applied by two methods, soil, foliar and their combinations. Zinc was applied @ 10, 20 and 30kg ha<sup>-1</sup> in soil during sowing while foliar application @1% Zinc sulphate was given during silking stage. Recommended dose of fertilizer for maize crop @150:70:70 kg N, P<sub>2</sub>O<sub>5</sub>& K<sub>2</sub>O ha<sup>-1</sup> were applied according to the treatment details. The application of zinc via soil and foliar @30 kg ha<sup>-1</sup> and 1% ZnSO<sub>4</sub> respectively recorded better quality of Maize grains in terms of N-content, P- content, K- content, protein content & other micronutrient content (Zn, Cu, Mn, Fe) etc. From the study, it was concluded that application of Zn via soil and foliar combination not only increased the maize quality but also the yield of Maize.

**Keywords:** Rabi Maize, Zinc fertilizer, Quality, West Tripura

**Title: Preparation, optimization, and testing of biostimulant formulations as stress management tools and foliar applications on brinjal and onion for growth and yield**

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**ABSTRACT**

Not only application of biostimulant formulations boost yields under typical and diverse biotic stress circumstances, but it will also be user and ecologically friendly. Due to their hydrophobic character and huge molecular volumes, the production of highly stable (~2 years shelf-life) emulsifiable concentrate (EC) formulations is the bottleneck of plant growth regulator (PGR) uses. Gibberellic acid (0.25% EC) and Brassinolide (0.15% EC) were developed using a variety of solvents [C-IX, toluene, dimethyl sulfoxide] and surfactants (CABS, NP-13). Emulsification, detergency, and wetting performance were outstanding in laboratory condition. Stable oil in water emulsions with outstanding compatibility (without phase separation) and emulsion stability (24 h) created using secondary alcohol ethoxylates and sulfonate anionic (5:5), which are affected by the hydrophilic-lipophilic balance (HLB) value (12.52) and type of nonionic and anionic surfactants. The phytohormone content fluctuation was estimated to be appropriate using LC-MS/MS (5.0%). Single and double dosed applications of 450 and 900 mL ha<sup>-1</sup> in brinjal (muktakeshi) and 180 and 360 mL ha<sup>-1</sup> in onion (sukhsagar) have significantly improved growth and yields above control plants. Gibberellic acid boosted brinjal yields by 37.5%, while Brassinolide raised onion yields by 33.9%. Development of PGR formulations might be a big step toward sustainable agriculture.

**Keywords:** Plant growth regulator, Abiotic stress, Emulsifiable concentrate, Accelerated storage stability, Leaf area index, Absolute growth rates.



## **Nano-Fertilizers- An effective way for increasing the nutrient use efficiency**

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### **ABSTRACT**

“Nano fertilizers are synthesized or modified form of traditional fertilizers, fertilizers bulk materials by different chemical, physical, mechanical or biological methods with the help of nanotechnology used to improve soil fertility, productivity and quality of agricultural produces”. Zeolite-based nano-fertilizers are capable of releasing the nutrients slowly to the crop plant which increase the availability of nutrient elements to the crops though out the growth period. The nano-particles used as nano fertilizers are absorbed by the plant roots efficiently due to their very small size. These are then transported through apoplastic and symplastic pathways to the xylem, cross the endodermis and then they move through the vascular bundles to the different parts of the plant. Nutrient use efficiency is one of the most important concepts for evaluating agricultural crop production systems, which can be highly influenced by various factors such as fertilizer management and soil and plant-water relationships. A nano-fertilizer possesses such unique physico-chemical properties that they can fulfill plant root requirements more efficiently as compared to the conventional fertilizers.

**Keywords:** Nano-fertilizers and nutrient use efficiency

## ***In-Vitro* Bioremediation of E-Polymer Employing Potent Bacterial Strains**

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### **ABSTRACT**

Globally, e-waste generation is estimated at 20 to 50 million tonnes annually. Electronic waste management (e-waste) has become a global issue in this digital era. E -waste is the fastest growing waste on the planet, with an annual growth rate of 3 –4%. Presently, only 15% of e -waste is recycled. One of the most significant constituents of e -waste is plastics, accounting almost for 20% of it. In this context, the present study explores a non -toxic, eco -friendly approach to the degradation of e -plastic (electr onic plastic) with the incorporation of *Sporosarcina sp.* MGP4. In this study, the enrichment isolation technique and detailed characterization of the strain, designated as MGP4, isolated from soil samples of Kichha, Uttarakhand, India (28.9115°N, 79.5154°E ) was reported. Strain MGP4 was isolated from diluted soil samples that were inoculated in Minimal media and seeded with e -waste granules as a carbon source. The biodegradation of e-waste by the selected strain during enrichment was confirmed by FTIR analysis of both the control and treatment. The growth pattern of the bacterial isolate in the presence of e-waste polymer at different intervals is also exhibited using UV-spectrophotometer at 600 nm. Furthermore, the FE-SEM images confirmed the results of FTIR showing the significant changes in the surface topography of the treated samples compared to that of the control e-polymers.

**Keywords:** e-waste, biodegradation, e-polymers, FTIR, FE-SEM.



## **Nitrogen mineralization rate of different organic sources in *Inceptisol* of umiam, Meghalaya**

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### **ABSTRACT**

Study of the release pattern of nitrogen from locally available organic sources helps to reduce the chance of occurrence of nitrogen pollution of soil and water and determine the period of peak nitrogen release from organic amendments. These considerations are more relevant in the case of farming in the state of Meghalaya where the farming by default is organic in nature. An incubation study was carried out for a period of 100 days with four organic amendments namely farm yard manure, Poultry manure, Pig manure and Vermicompost and a control (at a rate of 120kg/ hectare) which were evaluated at every 10 Days interval with the aim to quantify the amount of Nitrogen mineralised and the rate of Nitrogen mineralisation at different time intervals. Initially, soil nitrate and ammonium contents were 17.5ppm and 28.0ppm respectively but with advancement in the incubation period, nitrate and ammonium in soil were found to increase. Amendment with pig manure resulted in highest nitrate and ammonium content in soil (39.6ppm and 72.3ppm respectively corresponding to 126.2% and 158.2 % over the initial soil nitrate and ammonium content). Unamended soil recorded the lowest amount of mineralised nitrogen in soil which were only 13.14% and 20.71 % higher over the initial soil nitrate and ammonium content. Change in rate of mineralizable nitrogen (dN/dt) with respect to incubation periods was found to be highest i.e 0.39mg/kg ammonium nitrogen at 60 Days after Incubation and 3.13mg/kg nitrate nitrogen at 10 Days after Incubation. Nitrogen release kinetics were worked out using two models, namely, first order and second order. The first order kinetics model was found to provide best fit equation for predicting nitrogen mineralization rate at any point of time.

**Keywords:** Nitrogen mineralisation rate, organic inputs, Nitrogen mineralisation kinetics.

## Soil Zinc transformations as affected by soil test crop response under maize-wheat cropping system in an acid *Alfisol* in north-western Himalayas

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### ABSTRACT

The importance of micronutrients was realized in the last three decades when widespread micronutrient deficiencies were observed in most of the soils of India, where intensive agriculture was practiced. An experiment with three replications and eight treatments (control, general recommended dose (GRD), soil test based, farmers' practice, target yield of 25 and 35 q ha<sup>-1</sup> with FYM & without FYM) was carried out during 2017-18 in an ongoing experiment initiated in 2007 at CSK HPKV, Palampur. Results of the study revealed that the application of fertilizers and FYM for 10 years significantly influenced non-specifically adsorbed exchangeable Zn (Zn-NS), Specifically adsorbed exchangeable Zn (EX-Zn), Organically bound Zn (OR-Zn), Manganese oxide bound Zn (Mn-Ox Zn), and Al and Fe oxide bound Zn (Al-Fe-Ox Zn). The prescription-based application of fertilizers increased the DTPA extractable Zn to the extent of 26.3- 34.7 % compared to control. The correlation analysis between Zn- DTPA and zinc fractions revealed that the order of magnitude of the positive contribution of the zinc fractions towards the zinc availability pool (DTPA-Zn) was: OR-Zn > EX-Zn > Zn-NS > Mn-Ox-Zn > total Zn. The coefficient of correlation ( $r = 0.967^{**}$ ) was significant at  $p = 0.01$  level of significance between EX-Zn and OR-Zn. The highest correlation was observed between ORZn and DTPA Zn ( $r = 0.848^{**}$ ). The order of percent contribution of Zn fractions towards the sum total of all the fractions was: RS-Zn > Al-Fe-Ox Zn > OR-Zn > Mn-Ox Zn > EX-Zn > Zn-NS. Moreover, significantly higher Zn uptake by the wheat crop under target yield 35 q ha<sup>-1</sup> with FYM (435 g ha<sup>-1</sup>) as compared to GRD (217 g ha<sup>-1</sup>) and STB (235 g ha<sup>-1</sup>). The results of this study will be useful in regulating the Zn availability in soil.

**Keywords:** Correlation, Micronutrients, Soil test crop response, Target yield, Zinc transformation



## Management of Anthracnose Rot (*Colletotrichum* Spp.) of Tomato using ethanol based plant extracts

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### ABSTRACT

Tomato (*Solanum lycopersicum* L.), a member of the *Solanaceae* family is a widely grown warm season crop worldwide. In India, tomato is a major cash crop. Tomato is a 'functional food' as it reduces the risk of cancer and cardiovascular diseases due to its high nutritional value. Among various fungal diseases of tomato, anthracnose fruit rot caused by *Colletotrichum* species is a devastating fungal disease affecting tomatoes mainly after harvest. An estimated annual loss of about 29.5 per cent had been reported from India due to anthracnose disease. The fungal pathogen causing anthracnose fruit rot of tomato was isolated and identified as *Colletotrichum truncatum* based on morphological characters and sequencing of DNA region coding for internal transcribed spacer (ITS) region. The *in vitro* experiment was conducted to evaluate the effectiveness of ethanol based biopesticides *viz.*, *Azadirachta indica* (Neem), *Melia azedarach* (Darek), *Cannabis sativus* (Hemp), *Eucalyptus citriodora* (Safeda), *Tagetes erecta* (African marigold) and *Ocimum tenuiflorum* (Holy basil) at four different concentration *i.e.*, 1,2,3 and 4 per cent using poisoned food technique. Ethanol based extract of *Eucalyptus citriodora* resulted in maximum average mycelial growth inhibition of the pathogen.

**Keywords:** Tomato, anthracnose rot, fungal pathogen, ethanol based biopesticides

**Effect of Fe-fortified humic acid and humic substances on growth and yield of groundnut (*Arachis hypogaea* L.) grown in a calcareous Vertisol**

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**ABSTRACT**

A pot culture experiment was conducted to study the effect of foliar application of Fe-fortified humic substances (HS) and humic acid (HA) on the growth and yield of groundnut (*Arachis hypogaea* L.) var. TMV 2 in a calcareous Vertisol. The experiment was conducted in a completely randomized design and replicated thrice. The groundnut plants were given 16 treatments *viz.*, Absolute control (T<sub>1</sub>), RPP which includes RDF + FYM @ 7.5 t + FeSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> + ZnSO<sub>4</sub> @ 25 kg ha<sup>-1</sup> (T<sub>2</sub>), only RDF (T<sub>3</sub>), RDF + Foliar FeSO<sub>4</sub>.7H<sub>2</sub>O @ 0.5% (T<sub>4</sub>), and for the treatments T<sub>5</sub> to T<sub>16</sub>, two different concentrations *i.e.*, 0.25 and 0.50 % of HS (Humic acid + Fulvic acid) and HA were fortified separately with 250, 500 and 750 ppm Fe. Among the treatments, higher values of growth parameters like plant height, dry matter yield plant<sup>-1</sup>, number of branches plant<sup>-1</sup> and yield parameters *viz.*, number of pods plant<sup>-1</sup>, pod weight plant<sup>-1</sup>, kernel yield plant<sup>-1</sup>, and shelling % were observed in the treatment RDF + Foliar Fe-fortified HS (0.5% HS + Fe @ 500 ppm) (T<sub>9</sub>) followed by treatment with RDF + Foliar Fe-fortified HA (0.5% HA + Fe @ 500 ppm) (T<sub>15</sub>) over control. The results showed the positive effects of HS and HA in improving yield and productivity of groundnut.

**Keywords:** Groundnut, Calcareous Soil, Humic Substances, Integrated Nutrient Management, Sustainable Agriculture



**Antifungal potentiality of *Aspergillus niger* isolates as a bio-control agent against *Fusarium* wilt of guava**

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**ABSTRACT**

Guava wilt is considered a National problem of India, which is accountable for significant economic loss. *Fusarium* species mainly cause the disease, *F. oxysporum* f. sp. *psidii* (FOP) has been the dominant one. Management using fungicides is not successful due to complex etiology, biological control is the effective alternate strategy for successful disease management. The present study is carried out to screen eleven *Aspergillus niger* isolates for their antagonistic against guava wilt pathogen (FOP) under both *in-vitro* and *in-planta* conditions. Isolates were identified morphologically and molecularly using the ITS (Internal transcribed spacer) region. The isolates were evaluated through volatile, non-volatile and dual culture methods under an *in-vitro* study. AN-11, AN-6, and AN-2 inhibited the pathogen (FOP) 67.16%, 64.01%, and 60.48%, respectively. *In-planta* study conducted in greenhouse conditions using air layered guava plants of 6 months old (var. Allahabad Safeda) by pre and post-inoculation of FOP. Isolates (AN-11 and AN-6) were found most effective under pre- and post-inoculation trials. The plants exhibited maximum recovery from wilting and lower wilt incidence, respectively. These selected isolates could be further carried to multi-location trails to confirm the robustness and potentiality in guava wilt disease management.

**Keywords:** Guava wilt, *Aspergillus niger*, Bio-control, Volatile, *Fusarium oxysporum* f. sp. *psidii*, ITS



## **Growth and Yield of Gobhi Sarson as Influenced by Irrigation and Nutrient Management Practices under Conservation Tillage**

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### **ABSTRACT**

This study was conducted during *rabi* 2017-18 using gobhi sarson (*Brassica napus* L.) to examine the effect of three irrigation levels (no irrigation, 50% of recommended irrigation water (25 mm depth) and 100% of recommended irrigation water (50 mm depth)) and four nutrient management practices (25 t ha<sup>-1</sup> FYM, 50% NPK+20 t ha<sup>-1</sup> FYM, 75% NPK+10 t ha<sup>-1</sup> FYM and 100%NPK) in split plot design. The irrigation at 100% recorded highest plant height (124.4 cm) and no. of primary (4.58) and secondary branches (7.92) which was at par with 50% irrigation and whereas application of 75% NPK+10 t ha<sup>-1</sup> FYM recorded highest growth parameters. Interaction effect was significant in case of no. of primary branches per plant. The yield attributes recorded were significantly highest under 100% irrigation and application of 75% NPK+10 t ha<sup>-1</sup> FYM. The 1000 seed weight (g) and harvest index was non-significant under all treatments. Irrigation applied at 50 mm significantly improved seed (13.83 q ha<sup>-1</sup>) and stover (44.92 q ha<sup>-1</sup>) yield which was at par with 25 mm irrigation application. Whereas, significantly highest seed (13.50 q ha<sup>-1</sup>) and stover (43.18 q ha<sup>-1</sup>) yield was obtained under 75% NPK+10 t ha<sup>-1</sup> FYM.

**Keywords:** Canola, Irrigation levels, Integrated nutrient management, Yield, Gobhi sarson

## Effect of application of organic and naturally fermented nutrient sources and chemical fertilizers on plant nutrient content and uptake by French bean

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### ABSTRACT

A field experiment was conducted at research farm of the Department of Soil Science and Water Management, College of Horticulture and Forestry, Neri (H.P.). Different combinations of jivamrit, Ghanjivamrit, FYM, Vermicompost and chemical fertilizers were compared. The experiment comprised of nine treatments, replicated thrice in randomized complete block design. The application of organic nutrient sources resulted in significant increase in the plant macro and micronutrients content. Maximum nitrogen (2.64 per cent), phosphorous (0.80 per cent), potassium (1.14 per cent), sulphur (0.41 per cent), iron (117.93 ppm), copper (6.47 ppm), zinc (19.10 ppm) and manganese (16.31 ppm) contents were recorded with application of vermicompost @ 5t/ha +jivamrit @ 5% at weekly interval (T6). Nutrient uptake (N, P and K) by french bean plant varied significantly with application of organic nutrient sources. Maximum nitrogen and phosphorous uptake was also recorded in T6. It was concluded that combined application of jivamrit with vermicompost gave better results than sole application of jivamrit.

**Keywords:** French bean, Jivamrit, Nutrient uptake, Organic.

## Relationship of yield of okra with plant growth parameters and soil properties

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### ABSTRACT

A field experiment was conducted at experimental farm of Department of Soil Science and Water Management, College of Horticulture and Forestry, Neri (Hamirpur), Dr. YSP University of Horticulture and Forestry, Nauni, H.P. In this experiment, nine different treatments were used which were replicated thrice, each of which contained various combinations of jeevamrit, ghanjeevamrit, vermicompost and farmyard manure. Results of the study showed that growth and yield of okra as well as soil nutrient status were improved by the application of jeevamrit in combination with vermicompost or farmyard manure. Further, yield showed a positive and significant relationship with plant height, number of leaves per plant, number of fruits per plant, available N, P and K, total viable microbial population and microbial biomass carbon and nitrogen. Also, application of jeevamrit in combination with vermicompost recorded highest B: C ratio over all other treatments. Conclusively, integration of jeevamrit with vermicompost can be used as an alternative to modern chemical agriculture.

**Keywords:** Jeevamrit, Vermicompost, Farmyard manure, Yield, Okra

## Effect of Nano Fertilizers on Nutrient Uptake by Maize (*Zea mays* L.) Crop

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### ABSTRACT

Biofortification is a method to increase micronutrient content of cultivated crops such as cereals and legumes through use of fertilizers. Nano fertilizers have high absorption feature and high surface to volume ratio that allow slow release of nutrients and promote efficient uptake of nutrients by the crop. The aim of the present investigation is to study the effect of nano fertilizers (N, Zn and Cu) on nutrient uptake by maize grain and stover (*Zea mays* L.) in Southern Rajasthan. The field experiment was conducted in *Kharif* 2020 at the Instructional Farm of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur. The field was designed in RBD design with 12 treatments which were replicated thrice. The treatments including the various combination of conventional and nano fertilizers and it was found that the combination of 50% recommended dose of N&Zn plus 100% PK through conventional fertilizers along with two spray of nano N ( $4 \text{ ml L}^{-1}$ ) + nano Zn ( $1.25 \text{ ml L}^{-1}$ ) + nano Cu ( $2 \text{ ml L}^{-1}$ ) at 21 and 42 days after sowing (DAS) i.e., T<sub>12</sub> (100% PK + 50% N Zn + two sprays of nano N + nano Zn + nano Cu) significantly enhanced the N, K, Zn and Cu uptake by maize grain and stover (82.30 and 54.65 kg ha<sup>-1</sup>, 24.43 and 118.01 kg ha<sup>-1</sup>, 162.30 and 188.49 g ha<sup>-1</sup> and 38.36 and 38.69 g ha<sup>-1</sup>, respectively) over control. The result showed that the two foliar sprays of nano fertilizers reduced the 50 % recommended dose of conventional fertilizers at the same time increasing the nutritional quality of crop.

**Keywords:** Biofortification, Conventional fertilizers, Maize, Micronutrient, Nano fertilizers, Nutrient uptake





**Soil and Water Conservation plan for Watershed Development and Management in Northern Transitional zone of Belavadi Subwatershed**

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**ABSTRACT**

Soil and water are the most valuable gifts of nature therefore conservation of these resources is important for sustainability of both agriculture and environment. But in this era of ever increasing water needs and speedily depleting water resources coupled with overpopulation, it has become necessary to develop the watershed by management plans. Hence, the soil and water conservation plan is given to the Belavadi sub-watershed by conducting the Land Resource Inventory (LRI) and by preparing the various thematic layers in Arc GIS 10.1 software. The sub-watershed contains surface soil textures of clay (2143.99 ha), sandy clay (1012.30 ha) and sandy clay loam (886.94 ha). The slope varies from very gently sloping (1-3%) to gently sloping (3-5%) and erosion was moderate to slight in condition. Based on rainfall data, drainage, soil texture, slope and soil erosion, the soil and water conservation plan was prepared. In the subwatershed, contour trenches (2821.05 ha), graded bunds (2143.81 ha) and contour bunds (264.90 ha) were suggested. In addition to that form ponds, recharge pits, agro-forestry and agro-horticulture could also be implement to enhance the productivity of both water and yield.

**Keywords:** Sub-watershed, Land Resource Inventory, Soil texture, Erosion, Arc.GIS.

## Assessment of Spatial Variability of Sulphur Fractions Using Geostatistical Approach in Soils of Agro climatic Zone II (Sub-Humid Mid Hills) of Himachal Pradesh

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### ABSTRACT

Soil fertility management has been declared as one of the important keys to sustain world agriculture. Simultaneous deficiencies of nutrients involving Nitrogen (N), Phosphorus (P), Potassium (K), Sulphur (S), Zinc (Zn), and Boron (B) have been reported in intensive cropping systems from different agro-ecological regions. According to recent estimates, about 39.0 per cent of Indian soils are deficient in S. Developing spatial distribution maps of S is incredibly necessary for the “diversified cropping” regions of which agro climatic zone-II of Himachal Pradesh is one. Spatial variability of soil sulphur fractions and their influencing factors were explored using traditional statistics and geostatistics. The correlations among sulphur fractions and other soil properties and normality test were performed using the XLSTAT software. The GIS platform was used to perform geostatistical analysis with the “Geostatistical Analyst” tool. To construct prediction maps for the calculated Sulphur fractions, the ordinary kriging (OK) interpolation technique was used. A cross-validation approach was used to assess the efficiency and error of the of the prediction maps for soil sulphur fractions. Soil organic carbon concentration was significantly and positively correlated with all fractions of sulphur. The Quantile – quantile (Q-Q) plot showed that pH, EC, OC, WS-S, Ex-S, Av-S, Org-S, NS-S and Total-S exhibited a normal distribution. The Gaussian, Stable and Exponential were the best fit models for soil pH, EC and sulphur fractions.

**Keywords:** Spatial variability, Sulphur fraction, Geostatistics

## Impact of zinc foliar scheduling and graded soil application rates on wheat productivity and nutritional quality

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### ABSTRACT

Zinc (Zn) supplementation is one of the supportive therapeutic strategies to deal with the heftiest challenge of the century i.e., COVID-19. It has been established that low Zn levels in COVID patients were associated with more complications, prolonged hospitalization and increased mortality. Wheat is a crop of global significance and a staple food for millions. Therefore, biofortified wheat can be considered as the potential carrier of Zn to humans. Keeping this in view, an experiment was conducted to evaluate the impact of Zn application rates and foliar application scheduling on productivity and nutritional quality of wheat. Four soil application rates (0, 2.5, 5, and 10 kg ha<sup>-1</sup>) were tested in conjunction with foliar application timings at 0, 30, 35, 40, 45, and 50 days after sowing (DAS) through 0.5% ZnSO<sub>4</sub>·7H<sub>2</sub>O. Zn application at 2.5, 5.0 and 10 kg ha<sup>-1</sup> registered an increase of 8.9, 13.3 and 17.4% in grain yield and 7.7, 14.6, 21.1% in Zn content over the control, respectively. Whereas, foliar application at 50 DAS was found to be the best spray time registering maximum grain yield (3.09 t ha<sup>-1</sup>) of superior quality (52.5 mg kg<sup>-1</sup> Zn). To conclude, application of Zn @ 10 kg ha<sup>-1</sup> in conjunction with 0.5% ZnSO<sub>4</sub> foliar spray at 50 DAS will enhance the production and nutritive quality of wheat grown on an acid *Alfisol*.

**Keywords:** Zinc, Wheat, Productivity, Nutritional quality, Rates

**Development of fertilizer prescription equation for rice (ADT 45) and prediction of post-harvest soil test values in rice based cropping system in *Typic Ustropept***

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**ABSTRACT**

To develop fertilizer prescription equation and predict the post-harvest soil fertility status of *kharif* rice (ADT 45), field experiment was carried out at farmer's holding in Karikalampakkam village, Nettapakkam, Pondicherry of *Typic Ustropept*. The experiment comprised of 24 treatments with four levels each of N (0, 50, 100 and 150 kg ha<sup>-1</sup>), four levels of P<sub>2</sub>O<sub>5</sub> (0, 25, 50 and 75 kg ha<sup>-1</sup>) and four levels of K<sub>2</sub>O (0, 25, 50 and 75 kg ha<sup>-1</sup>); where three levels of farm yard manure (0, 6.25 and 12.5 t ha<sup>-1</sup>) are superimposed. Grain and straw yields were recorded plot wise at maturity. Plant and grain samples were analysed for their NPK contents and uptake values were computed. It was observed that nutrient requirement for producing one quintal of rice grain (ADT 45) was 1.25 kg of N, 0.73kg of P<sub>2</sub>O<sub>5</sub> and 1.01 kg of K<sub>2</sub>O. The per cent nutrient contribution from the soil, fertilizer and organic manure (FYM) was 13.48, 40.46 and 34.26 for N; 15.81, 44.64 and 19.89 for P and 10.48, 58.60 and 41.51 for K. Fertilizer prescription equation for a definite yield was developed for both chemical mode and integrated plant nutrient system. The post-harvest soil test values from prediction equation thus developed were in good agreement with the observed value (R<sup>2</sup> >0.76).

**Keywords:** Soil test, Fertilizer prescription, Prediction equation, Integrated plant nutrient system



**Growth and nutrient uptake of black pepper cuttings as positively affected by arbuscular mycorrhizal fungi under nursery conditions**

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**ABSTRACT**

Arbuscular mycorrhizal (AM) fungi have symbiotic associations with most vascular plants. Their association benefits the host plant by improving nutrient uptake, providing the increased capability to cope with biotic and abiotic stress conditions. The present study used healthy single node black pepper (*cv. Sreekar*) cuttings with three leaves stage and even thickness. Results showed that the black pepper cuttings inoculated with AM had significantly higher root length and dry biomass as compared to the uninoculated plants. Nutrient uptake was positively correlated with the mycorrhizal treatments in black pepper plants. On 120 days after inoculating AM, nitrogen uptake was observed to be significantly higher in AM inoculated plants ( $34.72 \text{ g plant}^{-1}$ ) compared to uninoculated ( $25.2 \text{ g plant}^{-1}$ ). As expected, P uptake was significantly increased by AM inoculated plants from 90 days after inoculation onwards. Apart from N and P, AM fungi can increase the potassium, magnesium, zinc and iron uptake under inoculated treatments. Soil enzymes play significant roles in improving soil health and its environment. The present investigation observed the highest acid phosphatase and dehydrogenase activity at 120 days in AM inoculated soil samples. In turn, alkaline phosphatases,  $\beta$  glucosidase and urease activities were not significantly enhanced under AM inoculated soil samples. Thus, AM symbiosis mainly regulates nutrient cycling and plays a vital role in the growth and biomass of the black pepper cuttings under nursery conditions.

**Keywords:** Arbuscular mycorrhizal fungi, Black pepper, Biomass, Nutrient uptake, Soil enzymes



## Identification of new sources of resistance to MYMV and powdery mildew in green gram

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### ABSTRACT

Green gram (*Vigna radiata* (L) Wilczek) is an important food legume and is a rich source of easily digestible protein. Because of its short duration and availability of photo-thermo-insensitive cultivars which can be grown throughout the year especially in southern parts of India. Mungbean Yellow mosaic virus (MYMV) and powdery mildew diseases are the major constraints in mungbean cultivation in most parts of India. The development and use of resistant cultivars are the most effective and economic strategies against these diseases. Total 78 accessions of mungbean evaluated under natural field conditions against MYMV and powdery mildew during *Kharif*/spring summer season-2020-21. Out of seventy-eight accessions screened against powdery mildew and mungbean yellow vein mosaic virus (MYMV) disease under natural field conditions, the accessions such as EC-398885, EC-398891, IPM-604-1-7, Bari mung-2, Coll.no NR/18-57 and Coll.no NR/18-79 were identified as resistant against powdery mildew and the accessions such as IC-296672, IPM-604-1-7, V1002195AG, Coll.no NR/18-06, IPM-312-394-1, IPM-14-10, IPM-2-14, IPM-410-3, IPM-430-4 and IPM-205-7 were found to be resistant against mungbean yellow vein mosaic virus and these identified potential genotypes could be used for disease resistance breeding in mungbean.

**Keywords:** Mungbean, MYMV, Powdery mildew, Germplasm, resistance sources.

## Profiling of Non-volatile Secondary Metabolites of *Chaetomium globosum* and *In-vitro* evaluation for potential antifungal activity against soil borne fungi

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### ABSTRACT

Recently biological management has drawn more attention to soil-borne pathogens. *Chaetomium sum* Kunze: Fr., a saprophytic ascomycete, is thought to be a potential antagonist for a number of plant diseases. The goal of the current study is to profile different bioactive secondary metabolites and evaluate their potential efficacy against soil-borne phytopathogens. Four isolates of *C. globosum* have been tested against *Sclerotinia sclerotiorum*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* by dual culture technique. Among them production of potential isolate (CG-5157) has been carried out in Potato Dextrose medium. Culture filtrate was sequentially extracted by cold extraction with petroleum ether, followed by ethyl acetate and methanol. Extracted solvents were evaporated under reduced pressure below 40°C in a rotary evaporator to obtain various concentrates. Profiling of ethyl acetate and methanolic concentrates were initially subjected to HPLC analysis to separate various compounds with the mobile phase of ACN: H<sub>2</sub>O (60:40) at a flow rate of 0.6 mL/min, which revealed similar peaks at  $\lambda_{max}$  254 nm. UPLC-QTOF-MS analysis of ethyl acetate concentrate resulted in several peaks corresponding to various metabolites like chaetomin (733.6152), chaetominin (696.0980), parietin (284.0674), chaetoviridins A, C, E (432.1339), chaetoquadrin (425.1821), chaetominone (284.2967), chaetomugilin I (406.1532) and chaetomugilin J (390.1599), which was identified by their accurate molecular mass and mass fragmentation pattern. Similarly methanolic concentrate exhibited several peaks corresponding to chaetoglobosins A (229.2630), chaetoglobosins B (229.2630), chaetoglobosins C (229.2630), chaetoglobosins D (266.9), chaetoglobosin N (543.2763), chaetoglobosin Q (546.2717), chaetoglobosin W (532.2937), chaetoglobosin I (483.2951), Prochaetoglobosin II (497.2621), prenisatin (216.0941), globosuxanthone (3572,305.0535) and chaetominine (338.1451). The fungicidal activity was carried out *in-vitro* against the above mentioned fungi using the poisoned food technique to determine the percent inhibition (%). Ethyl acetate concentrate showed 100% inhibition against *S. sclerotiorum* (EC<sub>50</sub> 112.1 µg/mL) was highly effective against *S. sclerotiorum*. Comparative antifungal activity of ethyl acetate concentrate of *C. globosum* with respect to *T. harzianum* A28 suggested similar percent growth inhibition of *S. sclerotiorum*. A suitable microbial spore-based formulation may be developed for efficient control of *S. sclerotiorum*.

**Keyword:** Secondary metabolite, HPLC, UPLC-Q-TOF/MS, *In-vitro*

## **Boron application impact on yield and micronutrient uptake by broccoli crop grown on B deficient Typic Hapludalfs soil**

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### **ABSTRACT**

Boron (B), being the second most deficient soil micronutrient worldwide, adversely affects the quality and quantity of broccoli crop. Keeping this in mind, a three way factorial experiment was conducted during 2020-21 on B deficient soil of Himachal Pradesh. The three factors were method of boron application (soil application and soil plus foliar application), rate of B foliar feeding (0.017, 0.034, and 0.051 %), and frequency of foliar application (2 and 3 sprays), with one control (no boron). Overall, B application registered an increase of 20.18 % in head yield of broccoli as compared to control. Soil plus three foliar sprays of B at 0.051% registered the highest broccoli head yield. Foliar application at 0.051% B resulted in highest micronutrient uptake, i.e., iron (Fe), manganese (Mn), copper (Cu), and zinc (Zn), however, the same treatment was at par with foliar application rate of 0.034% B. On an average, B application recorded an increase of 9.59, 9.56, 10.51, and 9.8% in Fe, Mn, Cu, and Zn uptake by broccoli head compared to control, respectively. The present study thus concluded that B application significantly influence the quantity and quality of broccoli head, with best result registered with soil plus foliar application (2.0 kg B ha<sup>-1</sup> as basal plus 0.051% B three foliar sprays).

**Keywords:** Broccoli, Foliar application, Nutrition, Three way factorial.



**Assessment of soil fertility status of Kaithal and Siwan Block of District Kaithal for better fertilizer and soil management**

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**ABSTRACT**

Timely access of soil fertility is an important soil property, that is to be studied to access the correct management practices and amount of fertilizers needed to maintain soil nutrients status. A study is conducted on the two blocks of Kaithal district to access the soil fertility status. Fifty soil samples were collected from each block using hand-held GPS. The results revealed that available nitrogen content in both blocks was in the low category, which could be due to high volatilization and runoff losses. The phosphorous content in soils of both blocks fall under medium category, while the potassium is in medium to high range, probably due to potassium-rich parent material like feldspar and illite present in soil. Sulphur in both the blocks lied under the high category. A maximum number of samples in both the blocks fall in the adequate category for zinc and iron, the high category for copper and in latent deficient category for manganese. Continuous use of excessive nitrogenous fertilizer, intensive rice-wheat cropping, insufficient use of organic manures, an antagonistic reaction between some plant nutrients in soils could be some of the reasons that explain the declining soil fertility status of the area.

**Keywords-** Soil fertility, Macronutrients, Micronutrients, Kaithal, Fertilizer, Nutrient

**Development, conformation and evaluation of antifungal efficacy of Sodium-Alginate based nano-carbendazim formulation against *Colletotrichum capsici* and *Alternaria alternata* under *in-vitro* conditions.**

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**ABSTRACT**

An ionotropic gelation method was used to develop polymer encapsulated nano-carbendazim formulations of finest sizes by encapsulating active compound carbendazim with natural polymer Na-alginate of various concentrations (0.25, 0.20 and 0.15 %) in presence of cross linking agent calcium chloride (CaCl<sub>2</sub> at concentration of 0.10 and 0.05 %). The yield and encapsulation efficiency of the bio-polymer Na-alginate based carbendazim formulations ranged from 64.5 to 82.5 % and 60.2 to 79.1 %. The conformation and particle size estimation of developed formulations were done by HPLC, FTIR, DLS and auto-fluorescence microscopy. The average particle size of Na-alginate based nano-capsules ranged from 273 to 972 nm. It was observed that the carbendazim nano-formulation exhibited higher growth inhibition against *Colletotrichum capsici* and *Alternaria alternata* than pure carbendazim and commercial formulation. The alginate based nano-formulations showed  $25.3 \pm 1.69$  to  $76.4 \pm 2.78\%$  growth inhibitions at against *Colletotrichum capsici* and  $21.1 \pm 2.03$  to  $78.6 \pm 2.46\%$  against *Alternaria alternata* while pure carbendazim exhibited growth inhibition  $26.4 \pm 3.21$  to  $74.4 \pm 2.03$  % and for conventional formulations and  $22.8 \pm 2.29$  to  $70.3 \pm 1.90$  % inhibitions. Sodium-alginate based nano-formulations showed an excellent fungicidal activity against *C. capsici* and *A. alternata*. The ED<sub>50</sub> values of sodium-alginate based nano-formulations varied from 0.733 to 1.345 µg/mL for *C. capsici* and 0.729 to 1.38 µg/mL for *A. alternata* respectively. The effectiveness of the prepared formulations was found at par against *C. capsici* and 1.5 times more active to control *A. alternata* fungi when compared with pure compound and conventional formulation.

**Keywords:** Nano-formulation, Carbendazim, Sodium alginate, *Colletotrichum capsici*, *Alternaria alternata*



## Plant defense inducers for the management of *Alternariaster* leaf spot and Sunflower necrosis disease

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### ABSTRACT

Plants are infected by various microbial organisms such as fungus, virus, and bacteria which threaten their survival or reduce the growth of plants. In response to pathogen attack, plants have evolved several strategies to counteract pathogen infection. There are changes in plants physiology of plants after microbial attack results in active induced defense mechanisms. These active defense mechanisms refer to induced resistance, which occurs after the infection of plants by the pathogen and protects against the subsequent attack of the pathogen. Systemic acquired resistance (SAR), is induced by inoculation of virulent or non virulent pathogen and Salicylic acid dependent. Therefore, the present experiment aimed to use plant defence inducers to manage *Alternariaster* leaf spot and Sunflower necrosis disease. Our results indicate that Seed treatment with salicylic acid @ 100 ppm followed by foliar spray of salicylic acid @ 100 ppm at 30 and 45 days after sowing have contributed more yield 1576 kg/ha and B:C ratio of 1.54 with least *Alternariaster* leaf spot 20.93% and necrosis diseases 6.37% followed by Seed treatment with salicylic acid @ 50 ppm followed by foliar spray of salicylic acid @ 50 ppm at 30 and 45 days after sowing have contributed more yield 1413 kg/ha and B:C ratio 1.28 with least *Alternariaster* leaf spot 26.43% and necrosis diseases 11.16%. Whereas the highest *Alternariaster* leaf spot 57.19% and necrosis diseases 19.89% were recorded in control.

*Keywords:* *Alternariaster* leaf spot, Induced resistance, Systemic acquired resistance

### **Effect of NPS compost and foliar application of humic acid on yield, quality and nutrient uptake by Safed musli**

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#### **ABSTRACT**

The present investigation was conducted during kharif, 2019-20 at Research Farm, Nagarjun Medicinal Plants Garden, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, and medium in available phosphorus and high in available potassium. The experiment was laid out in Randomized Block Design with nine treatments replicated in three replications. The treatments comprised of absolute control, Vermicompost @ 5 t ha<sup>-1</sup>, NPS compost @ 3 t ha<sup>-1</sup>, Vermicompost @ 2.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid, Vermicompost @ 5.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid, Vermicompost @ 7.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid, NPS compost @ 1.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid, NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid, NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid. The results indicated that the application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid at 60 and 90 DAP was recorded significantly highest fresh root and dry root yield which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid. The significant improvement in quality i.e saponin, protein and fiber were recorded with application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid. The application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid were recorded significantly highest nutrient uptake by safed musli which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid.

**Key word:** NPS compost, Humic acid, Protein



**Antagonistic activity of yeasts and botanicals against the post-harvest rot caused by  
*Penicillium digitatum* in Kinnow mandarin**

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**ABSTRACT**

Citrus is a flowering tree and shrub belonging to the family Rutaceae. Citrus trees are evergreen grown in tropical to subtropical climates worldwide. Citrus fruits rank third in terms of production among the fruit crops in India. Kinnow mandarin, a hybrid of two cultivars 'King' (*Citrus nobilis*) and 'Willow leaf' (*Citrus deliciosa*) is one of the most important crops belonging to the citrus group, due to its high productivity (21 mt./ha). This crop is easily prone to many fungal, bacterial and viral pathogens. Among these losses, post-harvest pathogens contribute more than 25 percent of total yield loss. In addition, *Penicillium digitatum* causing green mould fruit rot, is the economically important pathogen leading to the 30 percent loss in the fruit yield. At present, chemical fungicides are in use for the management of this disease. However, fungicide residues have been reported in edible fruits which are bound to have adverse effects on the health of the consumers. There are effective alternatives to chemical fungicides which either alone or in combination can effectively manage diseases in citrus crops. In such efforts, the locally available botanical extracts and yeast isolates with antifungal properties were promising against *Penicillium digitatum*. As the result of the evaluation of those locally available eco-friendly treatments, curry leaf, karvaya and peppermint and yeast strains isolated from raisins, chickpea and grapes were found to have more promising efficiency in inhibiting pathogen growth.

**Keywords:** Kinnow, *Penicillium digitatum*, yeast isolates, botanicals, eco-friendly

**Development of bio-formulation based on botanicals and yeasts against  
*Alternaria* spp. causing leaf spots in cauliflower**

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**ABSTRACT**

Characteristic symptoms of *Alternaria* leaf spot are the presence of yellow, dark brown to black circular leaf spots with a target like concentric rings. The objective of the study was the development of bio-formulation based on botanicals and yeasts for biocontrol of *Alternaria brassicicola*. Antagonistic yeasts were isolated from the phylloplane. The cultural study indicated that the yeasts produced white; creamy pigmentation, oblong/ eclipse colony with cell length of 2-8  $\mu$ m and cell breadth of 2-5  $\mu$ m and attained a full growth of 90 mm on Yeast Peptone Dextrose Agar medium at  $25\pm 1$  °C in 3-4 days. A total of 6 yeast isolates were screened *in vitro* to determine their antagonistic effect against *A. brassicicola*. Among six yeasts, BK5 and BK7 showed the greatest antagonistic activity *in vitro* against *A. brassicicola*. These yeast isolates were evaluated singly and in combination with different formulations of effective botanicals. The study indicated that individual treatment with yeast-BK5 and mancozeb among different treatments were found most effective, followed by buttermilk in mycelial growth inhibition of the pathogen in comparison to control. Minimum per cent growth inhibition was reported in Field formulation 1 (in water). The interesting part of the study is that the making of bio-formulations by combining other treatments with yeast-BK5 and buttermilk did not enhance the efficacy of the combinations. Instead, the effectiveness of such treatments was reduced, indicating that the active ingredients in Field Formulations 1 and 2 (in cow urine) may have exerted an inhibitory effect on the active ingredients of yeasts present in yeast-BK5 and Buttermilk. Due to their antagonistic ability, easy cultivation requirements, and safe use, many of these unicellular fungi have been considered for biocontrol applications. Antagonistic yeasts can be effectively included in the integrated disease management strategies to improve the biocontrol efficacy against different plant pathogens.

**Keywords:** bio-formulation, yeasts, botanicals, *Alternaria*, buttermilk



***In vitro* evaluation of chemicals against *Xanthomonas campestris* pv. *mangiferaeindicae*  
causing Bacterial canker in Mango**

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**ABSTRACT**

Mango (*Mangifera indica* L.) is India's most important commercial fruit crop, with over 30 tropical fruit tree species. It is one of the most popular tropical fruits and is known as the "King of Fruits." Mango bacterial leaf spot disease is caused by *Xanthomonas campestris* pv. *mangiferaeindicae* is also known as mango canker, bacterial spot, bacterial canker, black spot, mango blight or bacterial black spot. This is one of the most damaging bacterial diseases of mango worldwide, causing 10 to 70 percent fruit drop, 10 to 85 percent loss in fresh output, and 5 to 100 percent loss in storage worldwide. Various chemicals (Bordeaux mixture, copper oxychloride, copper hydroxide, chitosan, captan, cuperous oxide and streptomycin) were tested *in vitro* against the bacterium using the paper disc method at different concentrations. Chitosan (high, medium and low molecular weight), streptomycin, Bordeaux mixture, copper hydroxide, and copper oxychloride were found to be more efficient than the control in suppressing bacterial growth. The maximum inhibitory zone was observed in the case of high molecular weight chitosan. In the case of captan, however, the minimal inhibition zone was observed.

**Keywords:** Mango, Bacterial canker, Chitosan, Captan

**Recombinase polymerase amplification assays for *Pythium* spp. and *Ralstonia pseudosolanacearum* detection in ginger**

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**ABSTRACT**

Ginger (*Zingiber officinale* Rosc.) is a tropical and subtropical spice representing the family *Zingiberaceae*. Soft rot caused by *Pythium* spp. and bacterial wilt caused by *Ralstonia pseudosolanacearum* (earlier *R. solanacearum*) are the major production constraints in ginger. Effective and sensitive techniques are required for reliable and accurate diagnosis of these pathogens, which are transmitted primarily through ginger rhizomes. In the present study, uniplex and duplex recombinase polymerase amplification (RPA) assays were developed for specific and sensitive detection of *Pythium* spp. and *Ralstonia pseudosolanacearum* by manipulating magnesium acetate concentration, incubation time and temperature. The duplex RPA assay was 10-100 times more sensitive than the duplex PCR assay. The developed assays did not show any cross-amplification with other rhizome-borne pathogens of ginger such as *Fusarium* spp., *Macrophomina phaseolina* and *Sclerotium rolfsii*. In addition, the assays could be performed under isothermal conditions at a temperature ranging from 37-40°C in a heating block. In validation tests, these pathogens could be successfully detected using crude DNA extracted from ginger rhizome samples collected from the field, storage and market. This is the first report of simultaneous detection of fungal and bacterial pathogens using duplex RPA assay in ginger.

**Keywords:** RPA, Ginger, Rhizomes, Soft rot, Bacterial wilt





**Influence of weather parameters on the incidence of mango anthracnose (*Colletotrichum gloeosporioides* Penz and Sacc.) in South Chhattisgarh**

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**ABSTRACT**

The present has been conducted at Horticulture Nursery, S. G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur mango mother orchard of variety Langra during 2019-20, 2020-21 and 2021-22. Anthracnose incidence was recorded on a weekly basis and disease incidence was calculated based on the total number of leaves and panicles observed on a tree and the number of leaves having disease symptoms. Minimum temperature, morning soil temperature (5 cm and 10 cm), rainfall, rainy days and afternoon relative humidity, morning and afternoon vapor pressure showed a positive correlation between anthracnose disease incidence, the relationship between these weather parameters and disease incidence was found to be prevalent during the rainy season, which is privileged by warm temperature with the advancement of the summer season, an abundance of water for the pathogen to germinate and favorable humid condition during the period of June to September. The severity of the disease is strong positive linear relationship with minimum temperature with  $r = 0.75$  and equation,  $y = 1.57x - 17.61$ ; morning soil temperature also showed a positive linear relationship having coefficient  $r=0.62$  and  $r= 0.54$ , respectively and equation justifies as,  $y = 1.67x - 27.27$  and  $y = 1.61x - 28.35$  and soil temperature respectively.

**Keywords:** Disease incidence, severity, minimum temperature, soil temperature

**Identification of novel multi-race resistance in Lentil germplasm against seven races of  
*Fusarium oxysporum* f. sp. *lentis***

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**ABSTRACT**

Fusarium wilt caused by *Fusarium oxysporum* f. sp. *lentis* (*Fol*) is the most devastating disease of lentil present worldwide and in India. Identifying novel sources for resistance against prevalent races can be utilized in devolving multi-race resistant cultivars. In the present study, the potential of a hundred lentil germplasms belonging to *Lens culinaris* subsp. *culinaris* (70), *L. c.* subsp. *tomentosus* (2), *L. c.* subsp. *orientalis* (7), *L. c.* subsp. *odemensis* (5), *L. lamottei* (3), *L. nigricans* (6) and *L. ervoides* (7) were evaluated against seven races of *Fol* for two consecutive seasons. The pot evaluation of germplasms was carried out in ICAR-NBPGR, New Delhi during 2020-21 and 2021-22. The performance of disease pressure was compared with a resistant check (PL639) and a susceptible check (L-9-12). Disease incidence (DI) was recorded every week until the late flowering stage and a scale of 1-9 was used to categorize and identify resistance accessions. The germplasm showed varying disease resistance to races of the pathogen. The accessions exhibiting high resistance (HR) responses included 24, 26, 39, 27, 17, 39 and 26 in 2020 and 24, 38, 26, 17, 38 and 25 in 2021 against races 1 to 7, respectively. Wild species, *L. c. subsp. odemensis* showed resistance to all the races of *Fol* in both seasons. Accessions of *L. culinaris* sub sp. *culinaris* and *L. culinaris* sub sp. *orientalis* showed the most diverse reaction with scale of 1-9 and mean disease incidence (DI) of 4.85-7.20±0.29-0.32 and 3.00-6.67±1.2-1.9 respectively in 2020 and 4.88-7.22±0.28-0.36 and 3.00-6.67±1.2-1.9 in 2021 to all the races of *Fol*. All the accessions belonging *L. c.* sub sp. *tomentosa* were highly resistant to Race 3 (RJ-8) and 7 (BR-27) with mean DI of 1.00 0.0 during both seasons. All the accession of *L. lamottei* were highly resistant to Race 3 (RJ-8) with mean DI 1.00±0.0 during 2020 and 2021. Contrastingly, it showed moderate susceptible to susceptible reaction with mean DI of 7.67±0.6 to race 5 (CG-5) and race 7 (BR-27). The differential reaction of species to races is probably due to the heterogeneous genome structure of germplasm within single species and the differential interaction of resistant genes towards a particular race. The wild species were found to be more resistant than cultivated species probably due to a broad genetic base. The present study has explored the potentiality of all species and subspecies of lentil against existing races of *Fol* providing an excellent source of multi-race resistance breeding.

**Keywords:** Lentil, *Fusarium oxysporum* f. sp. *lentis*, Resistance screening

## Morphological and molecular screening of different wild *Ipomoea* sp. and sweet potato

### (*Ipomoea batatas* (L.) Lamarck for sweet potato weevil resistance

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### ABSTRACT

Sweet potato (*Ipomoea batatas* (L.) Lamarck is ranked as the seventh most important crop in the world. Despite the high economic significance, the cultivation of sweet potatoes is mostly affected due to the sweet potato weevil (*Cylas formicarius* (Fabricius) infestation. It is the major pest of sweet potato, causing tuber yield loss of up to 80%. Hence identification of host plant resistance genes against sweet potato weevil is one of the alternative pest control strategies. These genes have an important role in the management of the pest. The present work deals with a morphological screening of different *Ipomoea* sp. viz (*Ipomoea batatas*, *I. obscura*, *I. palmata*, *I. triloba* and *I. mauritiana*) using choice and no choice assay method for insect preference/feeding. Among the different *Ipomoea* sp. the sweet potato weevil preference for *Ipomoea mauritiana* was significantly less compared to *I. batatas*, *I. triloba*, *I. obscura*, *I. palmata*. Mortality of weevils was also observed during the choice assay test by feeding leaves, vines and tubers of *Ipomoea mauritiana* by the third day. Further, the methanol extract of the tubers of sweet potato and *I. mauritiana* was prepared for the bioassay study and the weevils showed a repellent effect for the solvent extract from *I. mauritiana* compared to sweet potato root extract which shows the difference in the semiochemical composition. The root extract will be used for GC-MS analysis to identify compounds responsible for the repellent effect of weevils. A cysteine protease inhibitor, proteinase inhibitor, and kunitz trypsin inhibitor genes specific primers were used for the molecular screening of wild *Ipomoea* sp. The PCR conditions of all the gene specific primers were standardized for all the *Ipomoea* sp. The results of the study show *I. mauritiana* as a resistance source of genes against sweet potato weevil.

**Key words:** *Ipomoea*, sweet potato weevil, proteinase inhibitor, screening



**Prevalence and distribution of *Euphorbia* (*Euphorbia heterophylla*) rust (*Melampsora euphorbiae*) in Western Maharashtra**

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**ABSTRACT**

*Euphorbia heterophylla* also called ‘Dudhi’ in the marathi language, is a widespread weed species found in all cultivated fields across ‘Western Maharashtra’ highly susceptible to rust. This plant was brought as an ornamental to South and Southeast Asia, since then it has become a weed in India where it has infested the agricultural lands. Many herbicides failed to suppress it and have spread fast worldwide. During December 2020, This weed plant was found heavily infected with rust disease in the catchment area of the Bheema river in the Solapur district. Therefore, an intensive survey was conducted from Feb 2021 to Feb 2022 to watch over the incidence and spread of rust on euphorbia weed. It was noticed that a substantial prevalence of euphorbia rust disease was found spread in all districts of Western Maharashtra on this euphorbia weed. The symptoms were yellow orange rust pustules, observed on the lower side of infected leaves with yellow-orange spore masses. While the necrotic areas appeared on the upper leaf surface. The rust pustules were initiated on capsules (fruits) in later stages. The heavy infection killed the plant in its advanced stages before the seed set. Under laboratory tests *Melampsora euphorbiae* was identified as the causative agent based on morphology. As the pathogen (*Melampsora euphorbiae*) is not found to be associated with any crop disease, it can be used as a potential biocontrol agent in weed management practices against *Euphorbia* spp.

**Keywords:** *Euphorbia*, Dudhi, Rust, Weed, *Melampsora*, Biocontrol.



## Effect of native *Trichoderma* spp. on *Fusarium* wilt disease of Banana

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### ABSTRACT

Banana (*Musa* spp.) is seriously threatened by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense*, also known as panama disease. A total of 33 *Trichoderma* isolates were isolated from the soil samples collected from the banana growing areas. The isolates were identified as *Trichoderma harzianum*, *Trichoderma asperellum* and *Trichoderma longibrachiatum* through microscopic and molecular characterisation. *In vitro* evaluation of *Trichoderma* spp. showed that all the isolates significantly inhibited the growth of *Fusarium*. The inhibition zone ranged from 43.3 to 71.55 per cent by the different *Trichoderma* isolates. The species *Trichoderma asperellum* showed the highest inhibition level followed by *Trichoderma harzianum*. The isolates MNF-3 was superior and showed 71.55 per cent inhibition, followed by CKF- 4 (68.28 %). Further, in the potential bioagents screened under pot conditions, the isolate *T. asperellum* (MNF-3) showed the least wilt incidence and internal discolouration compared to the control. In addition to suppressing *Fusarium* wilt, *T. asperellum* (MNF-3) also showed a significant increase in the plant height, a number of leaves and pseudostem girth compared to control plants.

**Keywords:** Bioagents, Soil, *Fusarium*, Banana.

**Soil solarization along with FYM enriched *Pochonia chlamydosporia* is effective in managing root knot nematodes in organic capsicum under polyhouse**

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**ABSTRACT**

Soil solarization, a non chemical pre planting method is an important strategy for controlling soil-borne pathogens and plant parasitic nematodes in organic cultivation. The higher temperature created because of solarization and soil moisture enhances the mineralisation rate of soil organic matter and thus, promotes crop growth. Root-knot nematodes, especially *Meloidogyne incognita*, are a serious threat to protected cultivation in almost all of the country. Chemicals successfully control these nematodes, but for organic growers, this solution won't suit. A demonstration trial was laid in a farmer's one-acre polyhouse used for organic cultivation at Panipat, Haryana. The polyhouse soil was heavily infested with root knot nematode, having a population range between 7 to 8 J2 /g soil. After slight irrigation the soil was covered with a 25 micron thickness polythene sheet. Two rows were left uncovered to serve as a control. The experiment was laid in the month of May-June of 2020-2021. Simultaneously four FYM enriched biocontrol agents (4 treatments) viz. *Trichoderma viride*, *Pseudomonas fluorescens*, *Paecilomyces lilacinus* and *Pochonia chlamydosporia* were applied in polyhouse after the removal of polythene sheet i.e. 15 days before transplanting of capsicum seedlings. The plant height, nematode population, root gall index, soil temperature during the month of May-June were analysed and it was observed that after solarization and application of FYM enriched bioagents, the population levels of root knot nematode were found to be zero for all the treatments till the first harvest of crop. The maximum recovery of free living nematodes and plant height after 30 and 60 days was observed in treatment where soil was treated with *P. chlamydosporia* along with soil solarization. In addition, the maximum yield obtained for this treatment was 20.94 q/ha with the lowest root knot index (2).

**Keywords:** solarization; *Meloidogyne*, bioagents, nematode survey; polyhouse



**Physiological and molecular portraying of the saprophytic pathogen, *Macrophomina phaseolina* in Castor for developing self-effacing biological management strategies**

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**ABSTRACT**

Castor is an important indigenous non-edible oilseed crop. The consumption of castor oil in various sectors has increased at 7.32 thousand tons per year worldwide, creating demand for its large-scale cultivation. Castor is a hardy crop, with the changing weather conditions minor pathogens on the crop causing root rot (*Macrophomina phaseolina*) is attaining severity, it causes 80-100 per cent loss if not managed. The growth of the pathogen was maximum under the pH 6.0 to 6.5 (1.46mg/100ml) and a temperature 40<sup>0</sup> C (87 mm) under laboratory conditions. These edaphic factors critically affect the survival of *M. phaseolina* and influence the increase of charcoal rot. The raising temperature observed in the changing climatic condition is critical for the severity. Hence, biological strategies of resistance lines and biocontrol agents were assessed. Germplasm line BCG-2 showed absolute resistance and MI-54, 10 per cent incidence out of the 54 lines screened against *M. phaseolina* revealing addition of *Trichoderma harzianum* (GJ 16B) and *T. viride* (8) which exhibited the highest mycelium growth inhibition of 52.84 and 52.23 per cent over control under *in vitro* studies for adoption as soil application under biological crop protection strategies.

**Effect of foliar application of plant defense activators on alternaria blight and seed yield  
in radish seed crop cv. Japanese white**

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**ABSTRACT**

A field experiment was carried out in the Department of Seed Science and Technology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2017-18 and 2018-19 to study the effect of foliar application of plant defense activators on *Alternaria* disease severity and seed yield of radish cv. Japanese white. In the experiment there were 13 treatments based on various plant defense activators including control *viz.*, salicylic acid @ 50ppm (T1), salicylic acid @75ppm (T2), salicylic acid @100ppm (T3), jasmonic acid @ 55 ppm (T4), jasmonic acid @ 110 ppm (T5), jasmonic acid @ 165 ppm (T6), butyric acid @ 250 ppm (T7), butyric acid @ 500 ppm (T8), butyric acid @ 750ppm (T9), potassium nitrate @ 1% (T10), potassium nitrate @ 1.5% (T11), potassium nitrate @ 2% (T12) and untreated control (T13). Three foliar applications were given, first at the initiation of the flowering stalk, second at flowering and third at the pod development stage and their effect on disease and seed yield and quality parameters were observed. The severity of *Alternaria* blight was recorded lowest (9.44%) in the plots sprayed with butyric acid @ 750ppm (T9) followed by 11.31 % in salicylic acid @100ppm (T3). The maximum seed yield (379.71g/plot) was observed with salicylic acid @100ppm (T3), which was followed by potassium nitrate @ 2% (T12) in which the yield was 352.72 g/plot. The other seed yield and quality parameters like number of siliqua/plant, length of siliqua, number of seeds/siliqua, 1000 seed weight, seed germination, speed of germination, SVI-1 and SVI-2 were observed significantly higher *i.e.* 311, 7.28cm, 6.3, 17.1g, 93.6%, 91.8, 2248.1 and 1256.9, respectively after foliar application of salicylic acid @100ppm (T3) as compared to other treatments.

**Keywords:** *Alternaria* blight of radish, Plant defense activators, Salicylic acid, Potassium nitrate, Butyric acid and Jasmonic acid





**Evaluation of bacterial endophytes for biocontrol potential against web blight disease  
in cowpea (*Vigna unguiculata* (L.) Walp.)**

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**ABSTRACT**

Cowpea is a leguminous vegetable crop widely grown throughout the year in tropical and subtropical regions. Among various fungal diseases, web blight caused by *Rhizoctonia solani* Kuhn, has become a severe problem in cowpea growing tracts and leads to drastic yield loss. Thirty-eight endophytic bacteria were isolated from healthy root, stem and leaves of fodder cowpea var. Aiswarya (22 isolates) and bush cowpea var. Bhagyalakshmi (16 isolates). Based on the results of dual culture assay and culture filtrate assay isolates CFLE3, CBRE5 and CBSE5 were selected as promising ones for further *in vivo* studies. The species identity of isolates was confirmed through 16S rRNA analyses as *Bacillus subtilis* (CFLE3), *B. amyloliquefaciens* (CBRE5) and *B. velezensis* (CBSE5). Under green-house experiment, the lowest disease index occurred in plants treated with seed biopriming for 4 h along with foliar application (20 and 40 DAS) of *B. velezensis* CBRE5 with 54.91 % disease suppression. whereas combined seed biopriming for 4 h along with foliar application (20 and 40 DAS) of *B. amyloliquefaciens* CBSE5 and *B. velezensis* CBRE5 was the best treatment in plant growth promotion. Production of IAA, ammonia, phosphorus and siderophore were also investigated for elucidation as plant growth promoting traits. This study suggests that selected endophytic bacteria *B. velezensis* CBRE5 as putative PGPR and potent biocontrol agent against web blight disease for eco-friendly and sustainable safe-to-eat crop production.

**Keywords:** Cowpea, Endophytic bacteria, *Rhizoctonia solani*, Biological control, Plant Growth Promotion



**Sustainable management of post harvest disease fruit rot in papaya caused by  
*Colletotrichum gloeosporioides***

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**ABSTRACT**

Papaya (*Carica papaya* L.) fruits are highly perishable commodities which suffer from heavy post harvest losses and cause about 8 to 18 per cent losses during storage to marketing. These losses in papaya are caused by biotic and abiotic factors. Among different biotic factors, anthracnose is an important post-harvest disease that causes heavy loss in papaya quality. The investigations were carried out from 2018 to 2020 on the management of fruit rot of papaya through wrapping materials, botanicals and oil coating of fruit by pre inoculation of pathogens in papaya fruits. The significantly minimum disease intensity after 15 days of incubation was observed in wrapping papaya fruits with polythene bag 37.78 per cent with 57.50 per cent disease control followed by news paper 46.67 per cent. Among nine botanical extracts at 10 per cent concentration the minimum disease intensity was observed in garlic extract (28.89%) with 68.29 per cent disease control followed by neem extracts (35.56%) with 60.97 per cent disease control as well as taken 2.83 days for initiation of symptoms. Among eight different oil coatings, significantly minimum fruit rot intensity was observed in fruits treated with lemon grass oil (31.11%) and it was at par with mustard oil (33.33%) with 67.44 and 65.12 per cent disease control, respectively.

**Key words:** botanicals, pathogens, papaya, lemongrass oil



***In vitro* evaluation of different chemicals against pumpkin and bottle gourd isolate of**

***Xanthomonas cucurbitae***

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**ABSTRACT**

The “Gourd family” or the family *Cucurbitaceae* consists of many crops, which are commonly called cucurbits. The family contains 118 genera and more than 825 species. The already existing list of about 200 diseases which hamper the cultivation of cucurbits worldwide has been expanded with the severe emergence of bacterial leaf spot disease, caused by *Xanthomonas cucurbitae*. In India, it was first reported on cucumber in Bihar. In Himachal Pradesh, a bacterial leaf spot was first reported on a bottle gourd. The disease has been reported to cause 20 per cent yield loss and the disease severity at the time of storage of fruit may reach up to 50-60 per cent. Among various chemicals evaluated *in vitro* against the bacterium, the Bordeaux mixture followed by copper oxychloride and streptomycin proved effective in the case of pumpkin isolate. However, in the case of bottle gourd isolate, copper oxychloride followed by Bordeaux mixture and streptomycin proved effective. The minimum inhibition zone of both the isolates of the bacterium was recorded with captan.

**Keywords:** Pumpkin, Bottle gourd, Bacterial leaf spot, Bordeaux mixture, Streptomycin

## Effect of dolomite and calcite on growth, yield and economics of rice in strongly acidic soils of Kanyakumari district

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### ABSTRACT

Soil acidity is an important agricultural problem while evaluating the production potential of most of the crops. A field experiment was conducted in farmers field at Gananadhasapuram village of Thovalai taluk, Kanyakumari district during Pishanam (Oct-Feb) season of 2017-2018. To utilize the calcite and dolomite in different levels along with RDF + ZnSO<sub>4</sub> with ten treatments based on Lime requirement and replicated thrice in RBD design. The results revealed that significantly highest plant height (100 cm), number of tillers m<sup>-2</sup> (411), number of productive tillers m<sup>-2</sup> (375), thousand grain weight (26.6 g), grain (7.09 t ha<sup>-1</sup>) and straw (10.3 t ha<sup>-1</sup>) yield of rice were recorded with the application of dolomite @ 0.75 LR (6.36 t ha<sup>-1</sup>) along with RDF + ZnSO<sub>4</sub> (T<sub>7</sub>) compared to other treatments. The economic analysis demonstrates that dolomite @ 0.75 LR (6.36 t ha<sup>-1</sup>) along with RDF + ZnSO<sub>4</sub> treatment produced higher gross returns (INR 116662 ha<sup>-1</sup>), net returns (INR 54018 ha<sup>-1</sup>) and B: C (1.86) ratio than all other treatments. The study clearly indicated that in strongly acidic soils, the treatment T<sub>7</sub> is found to be the best for getting higher yield and higher returns per rupee invested under rice cultivation during Pishanam season.

**Keywords:** Calcite, Dolomite, Rice, Growth, Yield, B:C ratio

## Effect of enriched compost application on microbial activity under rice in an acid soil

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### ABSTRACT

Enriched compost influences many soil parameters viz; biological activity as well as soil physical properties etc. Therefore, the impact of long-term organic farming practices on microbial activity uptake under rice in an acid soil was studied. In this experiment, treatments consisted of T<sub>1</sub>; control, T<sub>2</sub>; biofertilizer consortia @ 3.5kg ha<sup>-1</sup>, T<sub>3</sub>; compost @ 5.0 t ha<sup>-1</sup>, T<sub>4</sub>; compost @ 5.0 t ha<sup>-1</sup> + biofertilizer consortia @ 3.5 kg ha<sup>-1</sup>, T<sub>5</sub>; enriched compost @ 2.5 t ha<sup>-1</sup>, T<sub>6</sub>; enriched compost @ 5.0 t ha<sup>-1</sup> and T<sub>7</sub>; azolla @ 0.5t ha<sup>-1</sup> + biofertilizer consortia @ 3.5 kg ha<sup>-1</sup>. Soil samples were collected and analyzed for different soil enzyme activities like Acid phosphatase activity ( $\mu\text{g PNP g}^{-1} \text{ soil hr}^{-1}$ ), Dehydrogenase activity ( $\mu\text{g TPF g}^{-1} \text{ soil } 24 \text{ hr}^{-1}$ ) and Beta-glucosidase activity ( $\mu\text{g TPF g}^{-1} \text{ soil hr}^{-1}$ ) were enhanced significantly in surface soil (0-15 cm) and sub-surface soil (15-30 cm), respectively under treatment T<sub>6</sub> (Enriched compost @ 5 tha<sup>-1</sup>) as compared to T<sub>3</sub> and were similar to T<sub>4</sub> treatment. It could be concluded that the dose of compost could be reduced by using enriched compost to obtain higher crop production with its quality as well as improved soil quality in term of soil microbial activity.

**Keywords:** Enriched compost, Biofertilizer, Soil quality

### A comparative Study on the dynamics of rhizosphere and non-rhizosphere Soil in a typical laterite soil

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### ABSTRACT

A study was carried out in the Department of Soil Science and Agrl Chemistry, College of Agriculture, Vellayani, Kerala Agricultural University to compare the respiratory and microbial activities between rhizosphere and non rhizosphere soil in a typical laterite soil under Integrated Plant Nutrient System. The rhizosphere and non rhizosphere samples of the test crop Okra were collected and analysed for microbial parameters and respiratory activity. The fertility index (Enzyme activity number) was also worked out. For bacteria in the rhizosphere soil, T<sub>8</sub> (P (50 %) as PSB enriched vermicompost + P (50%), N & K) recorded the maximum bacterial count while in the non- rhizosphere soil, highest value of bacterial colonies was recorded by T<sub>12</sub> (P (75%) as PSB enriched vermicompost + P (25%), N & K). Treatment T<sub>9</sub> (NPK (50 %), PGPR mix-1 enriched vermicompost + N, P & K (50%) recorded maximum number of fungal colonies in rhizosphere soil and actinomycetes in the non rhizosphere soil. In the non rhizosphere soil, maximum number of fungal colonies was observed with the application of T<sub>9</sub> and T<sub>13</sub>. Treatment T<sub>13</sub> (N, P, K, (75 %) as PGPR mix-1 enriched vermicompost + N, P & K (25 %) recorded the highest values for actinomycetes in the rhizosphere soil. The enzyme activity number is found to be higher than the rhizosphere soil. It is understood that rhizosphere, the soil adjacent to plant roots is significantly different from bulk soil in chemical, biological and microbiological properties

**Keywords:** Rhizosphere, Non-rhizosphere, Laterite soil

## Effect of plant derived essential oils against Dry Root Rot of Urdbean

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### ABSTRACT

Dry root rot of urdbean caused by *Macrophomina phaseolina* (Sclerotial stage: *Rhizoctonia bataticola*) is a major soil-borne disease, limiting yield and its quality parameters in pulses. The ineffectiveness of existing chemicals against soil borne pathogens, the emergence of fungicide resistant strains and the demand for organic products necessitate the search for effective alternatives. Safe and environment-friendly plant derived essential oils have been reported for their antifungal activity. To study the antifungal activity of plant oils, the essential oils from Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and their spent wash (by-products) at three different concentrations viz., 100ppm, 500ppm, 1000ppm along with the fungicides, carbendazim and mancozeb were tested for their efficacy against *Macrophomina phaseolina* under *in vitro* conditions using poisoned food technique both in solid and liquid media. Among the treatments, the total inhibition (100 per cent) of mycelial growth was observed in potato dextrose agar medium amended with Palmarosa oil, Citronella oil and carbendazim at all three concentrations viz., 100, 500 and 1000 ppm. With respect to mycelial biomass, the same treatments viz., the essential oils of *C. martini* (Palmarosa) and *C. nardus* (Citronella) and the fungicides, carbendazim exhibited complete inhibition of mycelial growth in liquid medium. The spent wash of *C. martini* (Palmarosa) and *C. nardus* (Citronella) recorded mean mycelial biomass of 640 mg and 671 mg, respectively as against 798 mg in control with inhibition of 19.8 and 15.9 per cent respectively. The fungicide mancozeb also recorded a complete inhibition of mycelial growth and biomass at higher concentrations of 500 and 1000 ppm. In contrast, at 100 ppm it showed lesser inhibition of radial growth (78%) and mycelial biomass (92%) of *Macrophomina phaseolina*. It is revealed from the study that both the oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) are potential alternatives to chemical fungicides for the effective management of urdbean dry root rot.

**Key words:** Urdbean dry root rot, *Macrophomina phaseolina*, Essential oil, Palmarosa oil, Citronella oil, Disease management

## Efficacy of plant oils on the management of rice brown spot

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### ABSTRACT

Brown spot caused by *Bipolaris oryzae* (Syn. *Helminthosporium oryzae*) (Teleomorph: *Cochliobolus miyabeanus*) is a serious seed-borne disease of rice worldwide and it is considered as a major constraint in rice production. Since the existing chemical control measures are costly and favour the development of resistance to the pathogen, potential alternative methods using various plant oils have been tested for management. The essential oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and their spent wash (bye-products) at three different concentrations viz., 100 ppm, 500 ppm, 1000 ppm along with the fungicides viz., carbendazim and mancozeb were tested for their antifungal activity against *Bipolaris oryzae* under *in vitro* conditions using poisoned food technique both in solid and liquid media. Among the treatments, complete inhibition (100 per cent) of mycelial growth was observed in a PDA medium amended with oils of Palmarosa (*Cymbopogon martinii*) and Citronella (*Cymbopogon nardus*) and mancozeb at all three concentrations viz., 100, 500 and 1000 ppm. Whereas the spent wash of both *C. martini* and *C. nardus* and carbendazim was not found effective (with less than 10 per cent inhibition even at 1000 ppm conc.) in inhibiting the radial growth of *Bipolaris oryzae*. With respect to mycelial biomass, the same treatments viz., oils of *C. martini* (Palmarosa) and *C. nardus* (Citronella) and the fungicide, mancozeb totally inhibited the growth under liquid medium. The spent wash of *C. martini*, *C. nardus* and carbendazim recorded a mean mycelial biomass of 727 mg, 682 mg and 586 mg, respectively, against 751 mg in control with an inhibition of 3.2, 9.2 and 22.0 per cent, respectively. It is evident from the study that both the oils of *Cymbopogon martinii* and *Cymbopogon nardus* are potential alternative to mancozeb for the management of rice brown spot.

**Key words:** Rice brown spot, *Bipolaris oryzae*, Essential oil, Palmarosa oil, Citronella oil, Disease management



## Screening of sugarcane varieties against Pokkah boeng Disease under natural condition

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### ABSTRACT

Sugarcane is one of the primary crops grown for its commercial value. Among various diseases attacking sugarcane, the Pokkah boeng disease of sugarcane caused by *Fusarium* spp. is one of the fungal disease which was previously classified as a minor disease that is becoming significant due to its increasing disease incidence. Therefore, a field trial was conducted at Norman E. Borlaug Crop Research Centre of G.B.P.U.A & T, Pantnagar, Uttarakhand, India during cropping season of 2019 and 2021. An experiment was laid out in Randomized Block Design with three replications of 26 sugarcane varieties. The experiment aimed to determine sugarcane varieties' disease reaction against Pokkah boeng disease of sugarcane. The disease status was observed based on the resistant, moderately susceptible, susceptible and highly susceptible reactions. The results revealed that among 26 cultivars, 14 showed a resistant reaction, 7 showed a moderately susceptible reaction, 4 showed susceptible reaction and only one showed a highly susceptible reaction.

**Keywords:** Pokkah boeng, Screening, Sugarcane varieties



## Effect of molybdenum application on cauliflower productivity in an acid *Alfisol*

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### ABSTRACT

Cauliflower (*Brassica oleracea* L. var. *botrytis*) is an important winter season vegetable with molybdenum (Mo) deficiency causing a significant reduction in cauliflower production and quality. Mo is an essential ultra-micronutrient, having a narrow deficiency and toxicity range. Keeping this in mind, a field experiment was conducted in the acidic soils of Palampur to assess the effect of graded Mo levels on productivity of cauliflower. The treatments comprised of recommended dose of fertilizer (RDF i.e. NPK @ 115: 75: 70 kg/ha), RDF + FYM, RDF + FYM + Mo with 8 different levels (@ 0.5, 1.0, 1.5, 2.0, 2.5, 5.0, 10, 20 kg Mo ha<sup>-1</sup>). The results showed that marketable curd yield and gross yield were highest (i.e., 237.4 and 489.5 respectively) in the treatment with Mo applied @5.0 kg ha<sup>-1</sup> along with RDF+FYM. The same treatment registered an increase of 43.2% and 25.6% over RDF and RDF+FYM in case of marketable curd yield, respectively. However, the additional of Mo over @ 5.0 kg ha<sup>-1</sup> registered a negative effect on the crop yield. To conclude, rational application of Mo (5.0 kg ha<sup>-1</sup>) had a significant effect on cauliflower productivity when grown on Mo deficient acid *Alfisol*.

**Keywords :** Molybdenum, Cauliflower, Toxicity, Productivity

## EVALUATION OF MARIGOLD FLOWER EFFLUENT- SUITABILITY AS AN ORGANIC SOIL AMENDMENT

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### ABSTRACT

With increasing industrialization with waste disposal problems and loss of soil fertility over time. Utilizing industrial wastewater would be the best answer to these core issues. Therefore, Treated Marigold Flower Effluent (TMFE) and Untreated Marigold Flower Effluent (UMFE) from Marigold processing industry were analyzed for physico-chemical characteristics. The BOD, COD and DO were high in UMFE as it had more total solids. Among the macro and micronutrients, only sodium and chlorine were reported to be highest in TMFE when compared to UMFE due to alum addition while processing. In effluents, heavy metals were under permissible limit. On computation of ionic toxicity, based on SSP, TMFE and UMFE were graded as permissible and good for irrigation. Both fall under ideal SAR category with  $< 10 \text{ mg L}^{-1}$ , non-sodic water with SAR/SCAR of  $< 5$ , medium hazardous in concern to RSC, ranging between  $1.25 - 2.50 \text{ mg L}^{-1}$ , RSC/ RSBC ratio was ideal with  $< 2.5$ , Kelly ratio with  $< 1$  and permeability index was reported to be good (75 -25%). The study provides a confirmation that MFE is suitable as organic amendment for crops directly or by diluting for better performance benefiting farmers and industry by reducing treatment and disposal costs.

**Keywords:** Effluent, Organic amendment, Ionic toxicity, Biological parameters



## **Mapping of Nutrients Status in Agadi Micro watershed of Karnataka by GIS Technique**

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### **ABSTRACT**

Preparation of large scale soil fertility maps is taken up under WDPD watershed development project to facilitate farm-level management. Because soil sampling is done at a point and the same needs to be translated into the area, the developments in modern geostatistics have made this possible. Soil samples collected on a grid of 320 x 320 m were analyzed and the maps were generated by ordinary kriging employing a spherical model using ArcGIS 10.4. In this study the soil fertility data in respect of pH, EC, OC, N, P, K, S, B, Zn, Mn, Cu and Fe for Agadi microwatershed in Dharwad district, Hubli taluk, Karnataka was attempted. The results revealed that, overall Agadi micro-watershed was low in Nitrogen and Boron whereas medium to high in Organic carbon; medium to high status in Phosphorus, Potassium and Sulphur. Micronutrients like Manganese, Copper and Iron were sufficient in the entire micro-watershed, whereas nearly half of the micro-watershed area was sufficient and remaining was deficient in case of Zinc.

**Keywords:** Soil Fertility, Kriging, Micro-watershed



**Inheritance of Mungbean Yellow Mosaic Virus (MYMV) resistance in interspecific crosses of mungbean (*Vigna radiata* (L.) Wilczek) and rice bean (*Vigna umbellata* Thunb.)**

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**ABSTRACT**

Understanding the genetics of Mungbean Yellow Mosaic Virus resistance plays a pivotal role in the development of resistant varieties to combat the worldwide threat of the MYMV epidemics. Since there is no stable source of resistance in mungbean for MYMV, it's essential to take up interspecific hybridization with rice bean in order to introgress resistant genes from rice bean which is highly resistant to MYMV. Green gram variety KKM- 3 which is susceptible to MYMV was used as a female parent and two rice bean lines KBR-1 and RBL-6 which are highly resistant to MYMV were used as male parents in generating interspecific hybrids. The inheritance of resistance to Mungbean Yellow Mosaic Virus (MYMV) in interspecific mungbean and rice bean crosses was studied. F<sub>1</sub> interspecific hybrids of the cross KKM-3 × KBR-1 were resistant and the cross KKM-3 × RBL-6 were highly resistant. The F<sub>2</sub> generations of the two crosses were screened for MYMV and Chi-square test confirmed the segregation ratio of 3:1 resistant: susceptible plants in both the interspecific crosses, indicating that the MYMV resistance in interspecific crosses of mungbean and rice bean is controlled by monogenic dominant gene.

**Keywords:** Inheritance, Interspecific, Mungbean, Ricebean, MYMV and Resistance.

### **Effect of NPS compost and foliar application of humic acid on yield, quality and nutrient uptake by Safed musli**

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#### **ABSTRACT**

The present investigation was conducted during kharif, 2019-20 at Research Farm, Nagarjun Medicinal Plants Garden, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra. The soil of the experimental site was Vertisol which was moderately alkaline in reaction, low in available nitrogen, and medium in available phosphorus and high in available potassium. The experiment was laid out in Randomized Block Design with nine treatments replicated in three replications. Application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid at 60 and 90 DAP was recorded significantly highest fresh root and dry root yield which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid. The significant improvement in quality i.e saponin, protein and fiber were recorded with application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid. The application of NPS compost @ 4.5 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid were recorded significantly highest nutrient uptake by safed musli which was found at par with application of NPS compost @ 3.0 t ha<sup>-1</sup> + 2 spray of 0.5 % humic acid.

**Keywords:** NPS compost, Humic acid, Protein

**Soil properties and enzyme activities as influenced by biochar and pig manure  
amendments in acidic soil of the northeast india.**

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**ABSTRACT**

Biochar application to soil is a sustainable approach to improve soil quality and agricultural production system, which can also affect microbial activity, diversity and enzyme activities. A field experiment was conducted in the Department of Agricultural Chemistry and Soil Science, Medziphema during the *khari* season of 2019-2020 in rice bean crop under acidic soil condition. The study was conducted to assess the response of biochar and pig manure on soil properties and enzyme activity in acidic soil of Northeast India. The treatment consisted of 2.5 and 5.0 t ha<sup>-1</sup> wood and bamboo biochar, 2 t ha<sup>-1</sup> pig manure and 20 kg N, 40 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O. The experiment was laid out in a randomized block design with 3 replicates in plots of 2.25×2.1 m<sup>2</sup>. The study demonstrated that effect of soil amendments (biochar and pig manure) significantly improved soil pH, organic carbon, NPK, CEC and base saturation. The result further acknowledged that biochar application can improve acid soils by increasing microbial biomass carbon while also having pronounced effect on soil enzyme activity in the rhizosphere.

**Keywords:** Biochar, Pig manure, Rice bean, Growth, Yield, Wood

## Management of vigna pulses diseases through host resistance and new fungicides

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### ABSTRACT

Powdery mildew (*Erysiphe polygoni*), Cercospora (*Cercospora canescence*), Anthracnose (*Colletotrichum* spp) and MYMV diseases are the major and emerging threats and cause nearly 10-15% reduction in vigna pulses production in southern Peninsular India. In this context, field experiments were conducted to identify resistance donors and suitable fungicides against major diseases of mungbean. In this study, we evaluated 348 mungbeans, 95 urdbean and 47 cowpea genotypes against four major diseases under natural conditions. Further, we tested the efficacy of nine different fungicides against major diseases of mungbean. The results of the studies indicated, that among the genotypes evaluated, mungbean genotype V1003490AG was found resistant to Cercospora leaf spot. Five mungbean entries *viz.*, VI002529B-BL, VI004145B-BLM, VI005024B-BL, VI005022 BG, and VI005030BY were identified as resistant to MYMV. Among the cowpea lines, GP-1, DC 18-1, VCP 18-013 and VCP-18-032 were resistant to PM disease. Among fungicides evaluated, two foliar sprays of fungicides *viz.*, Fluopyram (17.6%) + Tebuconazole (17.6%) or Azoxystrobin (20% W/V) + Difenconazole (12.5% W/V) at 0.1% found to be effective for PM, Cercospora and Anthracnose leafspot diseases with 41% and 36% increase in yield, respectively. The lines identified would facilitate plant breeders in developing resistant varieties and the fungicides identified would help in controlling the fungal diseases in mungbean.

**Key words:** Vigna pulses, diseases, resistance, management



**Eco-friendly Management of chickpea dry root rot disease, *Rhizoctonia bataticola* in Kalaburagi district of Kalyan Karnataka region.**

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**ABSTRACT**

Chickpea (*Cicer arietinum* L.) is an important grain legume that is attacked by the fungal pathogen, *Rhizoctonia bataticola*, responsible for dry root rot disease. The results of present improved technology, application of 1kg of *Trichoderma viride* mixed with 100kg of FYM and 20 kg of neem cake in demonstrated farmers' fields were recorded the low incidence of dry root rot disease, *ie.*, 2.50, 2.30, 4.60 per cent and in comparison, to 30.00, 13.50, 14.50 per cent in check plots during 2019-20, 2020-21 and 2021-22 respectively. Again, in addition to that above the three years, the average grain yield was higher in the demonstration plot (9.97 q/ha) than in the farmers' practice (8.23 q/ ha) only, which means a 19.44 per cent yield increase over farmers practices. Further, it was recorded that a higher gross return, net return and B: C ratio of the scientific improved management of dry root rot diseases of chickpea (52,277 Rs./ha, 35,846 Rs./ha and 3.31 Rs./ha for an average of three years) as compared to farmers practices (41,712 Rs./ha, 25,670 Rs./ha and 2.50 for average of three years).

**Keywords:** dry root rot, *Trichoderma viride*, Neem cake, chickpea, *Rhizoctonia*





## **Incidence and dispersion of plant parasitic nematodes in Tamilnadu cauliflower growing regions**

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### **ABSTRACT**

A nematode survey was conducted in the Tamil Nadu districts of Theni, Krishnagiri, Erode, The Nilgiris, and Coimbatore to investigate Plant Parasitic Nematodes (PPN) associated with cauliflower. The soil samples were analysed using a modified Baermann's funnel technique, and the root samples were analysed using an Acidfuschin lactophenol solution to identify females. The survey results revealed that the root knot nematode (*Meloidogyne incognita*), lesion nematode (*Pratylenchus penetrans*), spiral nematode (*Helicotylenchus dihystera*), lance nematode (*Hoplolaimus indicus*), dagger nematode (*Xiphinema americanum*), and *Tylenchus filiformis* were associated with the cauliflower. The highest incidence of nematode damage was observed in Krishnagiri, followed by The Nilgiris and Coimbatore districts. The root knot nematode (*Meloidogyne incognita*) was found most frequently in all of the districts surveyed, with the highest incidences in Krishnagiri, The Nilgiris, and Coimbatore.

**Keywords:** Nematode, survey, cauliflower, community analysis, *Meloidogyne incognita*



**Influence of soil types, cropping sequence and depth of inoculums on survival of  
*R. solani* under field conditions**

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**ABSTRACT**

Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* (Kuhn) f. sp. *sasakii* Exner is a widespread and destructive disease of maize in India, especially in the *tarai* region of Uttarakhand. In the present study efforts were made to know the effect of soil types, cropping sequence and depth of inoculums on the survival of primary inoculum. On soil surface and 30 cm depth of inoculum *R. solani* survived for a shorter duration than 15 cm depth of soil. Survival of inoculum reduced in fallow condition followed by maize-wheat-maize and maize-potato-maize cropping sequence. In loam soil inoculum survived for a shorter duration followed by sandy loam and silty clay loam soil.

**Keywords:** Inoculum, Survival, *R. solani* and cropping sequence

## Management of leaf blight disease in coconut

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### ABSTRACT

Coconut is an important oilseed and plantation crop in India which is cultivated in an area of 1.63 million hectares with an annual production of 12,355 million nuts. Various fungal and mycoplasma diseases are crippling this important oil yielding crop in India. Among them, leaf blight caused by *Lasiodiplodia theobromae* is an important fungal disease reducing the vigour and yield of coconut. It causes rotting and dieback in most species it infects. It infects the coconut palms causing leaf blight. Coconut palms heavily infected with leaf blight flowered relatively late than less affected ones. The leaf blight incidence is found only in older leaves of coconut palms. Young leaves (top ten leaves from spindle leaf) are free from the disease. Management of Leaf blight disease using chemicals has been one of the pragmatic options. A field experiment has been contemplated with seven treatments to arrive at the best option among the recent fungicides available. The fungicides, namely Propiconazole and Tebuconazole, have been selected for this experiment. A randomized block design was chosen for the study which involved seven treatments with three replications and the study was undertaken in the coconut garden of farmers in Puliyanandi village. The observations have been made in coconut trees before the start of the treatment and 36 months after the treatment. The results revealed that the treatment of Root feeding of propiconazole @ 5ml +100 ml water was very effective in controlling leaf blight disease compared to all the other treatments. The effect of the treatment was such that the disease incidence reduced from the PDI of 29.95 to 2.98 which was calculated to be a 26.97 percent reduction. In terms of severity of the disease, the treatment was reported to affect 66.9 percent reduction in the severity of the disease. It was reported that 139 nuts had been harvested with a benefit cost ratio of 1:1.39. The next best treatment was Root feeding of tebuconazole @ 5ml + 100 ml water which has resulted in a 21.72 percent reduction in the Leaf Blight disease and the severity was reduced to the level of 56.56 percent with the nut yield of 127/tree/year and benefit cost ratio of 1:1.28. The results of the experiment for the management of Leaf blight disease in Coconut revealed that root application of propiconazole @ 5 ml in 100 ml of water three times during January, July and October months had been found to effectively reduce the incidence of the disease by 26.97 percent after 36 months of the treatment with 139 nuts/palm/year and a benefit cost ratio of 1:1.39. This was against the yield of only 98 nuts/palm/year from the gardens which were under untreated control.

**Key words:** Coconut, Leaf Blight, Management Practices

## Integration of bioagent and fungicides for the management of foliar diseases of groundnut (*Arachis hypogaea* L.)

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### ABSTRACT

Groundnut/Peanut (*Arachis hypogaea* L.) is a major oilseed crop widely grown in major tropical and sub-tropical regions of the world. It is an important oilseed crop with high levels of proteins, carbohydrates, vitamins and minerals contained within seeds. The groundnut crop in general experiences several serious biotic and abiotic challenges that limit pod yields and increase the cost of production. Among the biotic stresses, foliar fungal diseases viz., early leaf spot (ELS) caused by *Cercospora arachidicola* Hori, late leaf spot (LLS) caused by *Phaeoisariopsis personata* and rust caused by *Puccinia arachidis* are the most widely distributed and economically important diseases of groundnut and account for more than 50% yield loss. Use of fungicide is costly approach and it is not environment-friendly also. Field experiments were conducted during kharif 2021 and rabi/summer 2022 for the management of foliar diseases in groundnut using bioagent, *Bacillus subtilis* (*B. subtilis*) Bbv57 talc formulation and fungicides. The groundnut variety Co-2 was used for the field experiments. Seeds were treated with bioagent *B. subtilis* bv57 talc formulation @ 10 g/kg or fungicide Tebuconazole 2 DS @ 1.5 g/kg. Foliar application was done with fungicides Tebuconazole 50% + Trifloxystrobin 25% @ 1 g/L or Azoxystrobin 22.9% @ 1 g/l or at 40 & 60 DAS or Tebuconazole 25.9% EC @ 1 ml/L or Difenoconazole 11.4%EC @ 1 ml/l or bioagent, *B. subtilis* @ 1 g/l. Two rounds of spraying were made at 40 DAS and 60 DAS. The late leaf spot and rust disease intensities, pod yield and haulm yield were recorded for each treatment. The plots not treated with fungicides or bioagent served as the control.

The results of the field experiment conducted during *kharif* 2021 revealed that seed treatment with *B. subtilis* talc formulation @ 10 g/kg followed by foliar spray of Tebuconazole 50% + Trifloxystrobin 25% @ 1 g/l at 40 & 60 DAS was effective in managing the foliar diseases of groundnut with the LLS (20.9 PDI) and rust (12.3 PDI) as compared to control which recorded LLS of 71.4 PDI and rust of 52.1 PDI. Seed treatment with *B. subtilis* @ 10 g/kg followed by + foliar spray of Tebuconazole 25.9%EC @ 1 ml/l at 40 & 60 DAS ranked next with LLS of 24.7 PDI and rust of 18.4 PDI respectively. The maximum pod yield of 2361 kg/ha and haulm yield of 2764 kg/ha were observed in the effective treatment; whereas minimum pod yield of 1836 kg/ha and haulm yield of 1984 kg/ha were observed in the control.

**Key words:** Groundnut, foliar diseases, IDM

## **Neem-Coated Urea: A Slow Released Nitrogenous Fertilizer**

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### **ABSTRACT**

Urea is a white crystalline substance with an important nutrient key for crop growth and development. It is also the most important nitrogenous fertilizer owing to high N content (46%N). But its high-water solubility resulted in nitrification and de-nitrification which reduces its efficiency and moreover a lot of urea applied by farmers to the crops was getting wasted leading to low nutrient efficiency, water & soil contamination and wastage of highly subsidized urea. Hence, if urea coated with neem, its loss can be minimized as coating and it makes slow release of fertilizer and make it available to plants for a longer duration. Therefore, Neem-Coated Urea is one of the fertilizers supported by the Government of India through agriculture scheme to boost the growth of crops, curb the black market and hoarding of urea. Coating of urea with neem is environmentally advantages because, it reduced solubility of urea and keeps contamination of ground water under control, it increase available nitrogen over a longer period with minimum loss of nitrogen which enhance nitrogen use efficiency, reduces ammonia volatilization and control atmospheric pollution, improve soil health and helping plants gain more nutrient and resulting in higher yields. It also preventing caking of urea and reduces the chances of powder formation during transportation & handling. Repellent action of neem also controls many insect-pests and wild animals in fields applied with neem coated urea. This environmentally friendly endeavor can be converted into economic boon for farmers also. Government of India mandated all producers to coat urea with neem seed oil and fortify urea.

**Keywords:** Fertilizer, Environmentally friendly, Fortify urea, Soil health, Yield

## NUTRIENT RICH COMPOST FROM AYURVEDIC WASTES

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### ABSTRACT

Organic manures are important in Agriculture due to its role in maintaining soil health creating a socially, environmentally, and economically sustainable food production system. Hence new raw materials which are cheaply and readily available as well as which can serve as very good substrate for conversion to more nutrient rich organic manures is the need of the hour. The study utilising the ayurvedic wastes procured from M/s Oushadhi Pharmaceuticals, ayurvedic medicine manufacturing company was carried out at Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vellanikkara. A total of 135 treatment combinations under randomised design with 3 replications were tried with different sized ayurvedic waste substrates using different level of enrichers like cowdung, quail manure and their mixtures using external biotic agents of two species of fungi and two species of earthworms. The major parameters like temperature, pH was noted at daily and fortnightly intervals respectively during the stages of the composting process. The results showed that unsieved ayurvedic waste composite samples enriched with 5% mixture of cowdung and quail manure was the best substrate for composting, and the compost maturity was attained at 48.8 days with C:N ratio stabilising to 11.4. Similarly, there was considerable reduction in the lignin, cellulose and hemicellulose content as a result of composting. The crude fibre content of 33.4% of the ayurvedic waste substrate got reduced by composting to 13.9% and similarly the crude lipid content of the substrate got reduced from 6.3% to 0.7% after composting. The crude protein content improved from 12.68% in unsieved ayurvedic waste substrate to 22.6% in the compost which revealed that the ayurvedic medicine manufacturing wastes which is highly proteinacious and with good biodegradability and can act as an ideal raw material for composting purposes which can be degraded in a very less time in a cost effective manner and can be converted into nutrient rich compost using various enrichers like cowdung-quail manure mixture.

**Keywords:** Composting ,ayurvedic wastes, cowdung, quail manure

## Role of agroforestry systems for improving soil biochemical properties

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### ABSTRACT

Conventional cropping systems impose unsustainable stresses on soil and biodiversity. There is a need of productive farming systems that also have lower environment degradation. Agroforestry systems are soil management systems that closely resemble the ecology of natural forests. Combination of trees with agricultural crops provide stable and thick cover of plant matter, making soil rich in organic carbon compounds and microbial biomass with higher biological activity. Soil enzymes act as catalysts in many reactions crucial to soil health, nutrient cycling and structure stabilization in soil, also serves as an early indicators. Quantity and quality of above and belowground inputs of plant derived organic matter influences soil microbial community composition and enzyme activity, due to their dependency on organic carbon for metabolism. Litterfall and plant roots are the sources of carbon in these soils. Accumulated organic matter is predominantly decomposed by soil microorganisms, which is influenced by the type of cropping system, management practices and seasonal changes. All these effects the size, composition, activity of enzymes and microbial communities, which in turn affects the rates of organic matter decomposition. So, it can be concluded that integration of agroforestry practices can improve the soil biochemical properties by its effect on soil C sequestration.

**Keywords:** Agroforestry, Soil, Biochemical property

### Influence of Silicon on P content, uptake and yield of Wheat in *Vertisol* of Central India

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### Abstract

Silicon (Si) plays key role in the nutrient uptake of plants. The current study was undertaken to evaluate the response of silicon on phosphorus uptake and yield of wheat cultivated in *Vertisol* of Central India. A field trial was conducted during Rabi season 2021 with seven treatments including control (No P and Si), phosphorus (Soil application @ 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>), silicon (seed priming/foliar application/both @ 1% as Na<sub>2</sub>SiO<sub>3</sub>) and their combination applications (P + Si) with three replications. Plots were arranged in randomized blocked design. There was no significant difference among the treatments on plant height at different stages of crop. The P content and uptake in grain and straw was significantly higher at P + Si priming + Si foliar application. The yield and straw biomass was also significantly higher at P + Si priming + Si foliar application. The yield increased over control and was found the order P+ Si priming + Si foliar (52%) > P+ Si foliar (47%) > P (40%) > P+ Si priming (22%) > Si Foliar (17%) > Si priming (14%). Results imply that the application of Si can enhance the P content, uptake and yield of wheat in *Vertisol*.

**Keywords:** Phosphorus nutrition, P content and uptake, wheat HI-1544

## Assessing soil quality under different land use scenario in Eastern Himalayan region of India: towards sustainable resource utilization.

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### ABSTRACT

The study was carried out in Kolasib district of Mizoram. Five major land use system prevailing in the study area was identified viz., shifting or *jhum* cultivation (JC), abandoned *jhum* (AJ), plantation crop (PC), teak plantation (TP) and settled cultivation in valley (SC) with an objective to evaluate the influence of land use on soil quality for its sustainable utilization. The fallow period in abandoned *jhum* was now reduced to 5 or less due to increase in population pressure in the area. Soil samples were collected in three replicates from the surface soil. Soil properties varied significantly across different land uses in the study area. Principal component analysis (PCA) is used to form a representative minimum data Set (MDS) from the fourteen physical as well as chemical analysed parameters. PCA generated 4 PCs with eigenvalues =1 and explained 79.35% of total variance of the data. Normalized SQI thus developed in the scale of 0-1 using weighting factor extracted from PCA, was found to varied significantly across the land uses as SC (0.65) > TP (0.57) > PC (0.52) > JC(0.51) > AJ (0.47). The SQI value thus could be separated in different classes as 'Low quality' (SQI < 0.52) in JC and AJ whereas, 'Medium quality' (0.52 = SQI > 0.65) in TP and PC and 'High quality' in SC. High quality in SC is obvious due to higher base saturation and low acidity in soils at valley as compared to elevated landscapes. Whereas, poor base status in JC as well as in AJ was reflected in poor SQI value as compared to the other land use. Further, low SQI value in surface horizon under AJ also indicates the necessity of optimum fallow cycle to regain its quality.

**Keywords:** Soil quality, *Jhum* cultivation, Kolasib, Mizoram





## Effect of commonly used pesticides on growth and development of *R. solani*

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### ABSTRACT

Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* (Kühn) f. sp. *sasaki* Exner is a widely spread and destructive disease of maize in India, especially in *tarai* region of Uttarakhand. In the present study efforts were made to know the effect of commonly used pesticides on the growth and development of *R. solani* under *in vitro* conditions. Mycelial growth of *R. solani* was completely inhibited by carbendazim and penflufen at 10 µg/ml concentration while at 50 µg/ml concentration by mancozeb. Sclerotia germination was completely arrested by carbendazim at 10 µg/ml, penflufen at 50 µg/ml while mancozeb failed even at 100 µg/ml concentration. Among insecticides chlorpyrifos, carbofuran and cartap hydrochloride and in herbicides pendimethalin, 2, 4-D ethyl ester and atrazine at 50 µg/ml concentration effectively inhibited the mycelial growth and sclerotial formation but moderately inhibited the sclerotia germination. Germination of sclerotia of *R. solani* in soil was completely inhibited by penflufen and pendimethalin. In combinations mancozeb + 2,4- D ethyl ester carbendazim + atrazine, carbendazim + cartap hydrochloride, 2,4- D ethyl ester + cartap hydrochloride, penflufen+2,4-D ethyl ester + chloropyrifos, mancozeb + 2,4-d ethyl ester + cartap hydrochloride significantly inhibited sclerotia germination in soil.

**Keywords:** Banded leaf and sheath blight, *R. Solani*, Sclerotia and Inhibition.



**Effect of different media on growth and sporulation of *Fusarium* spp. associated with wilt disease of chickpea.**

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**ABSTRACT**

Chickpea (*Cicer arietinum L.*) is the world's third most important pulse crop, but its production has hardly changed over the past few decades due to its susceptibility to wilt, caused by *Fusarium oxysporum f.sp. ciceri*. Chickpea wilt is one of the most significant factors limiting chickpea production worldwide. Due to its continuous outbreak and losses throughout the world a laboratory study was done to know the effect of different media on the growth and sporulation of the *Fusarium oxysporum f.sp. ciceri*. So that it helps in laboratory evaluation and know the ecological survival which may indirectly help in the management strategies. Keeping this view in mind, the isolated pathogen from the symptomatic plant was grown on eight different media i.e., Malachite green, Malt agar, Potato dextrose agar, V8 juice agar, Asthana and Hawker's media, Oatmeal agar, Richard agar and Czapek dox for studying their effect on growth and sporulation. It was found to be maximum radial growth on the PDA (potato dextrose agar) culture media followed by Richards agar and oatmeal agar respectively. The growth of the mycelium varied from sparse growth to dense cottony growth. Sporulation was maximum in the Czapek dox medium and lowest in the Malachite green medium.

**Keywords:** ecological, susceptibility, symptomatic, sporulation, wilt



***In vitro* antagonistic effect of endophytes against dry-root rot causing *Fusarium solani*  
in Acid lime**

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**ABSTRACT**

Acid lime (*Citrus aurantifolia* Swingle) is an important fruit crop grown worldwide. India is the largest producer of acid lime in the world. Andhra Pradesh holds the first rank in acid lime production. Endophytes are the microorganisms present in the living tissues of various plant parts and are a good source of antibiotics. Presently, most soil-borne pathogens are being managed using endophytic bio-agents. In acid lime, dry root rot caused by *Fusarium solani* is a serious threat abetting their production. In this study, 6 fungal (EFA 1-6) and 8 bacterial (EBA 1-8) endophytes were isolated and selected, from the roots of healthy acid lime plants. The *in vitro* results revealed that the isolates EFA 4 and EBA 7 exhibited antagonistic activity on *Fusarium solani* with 66.92 and 63.42 per cent inhibition over control, respectively followed by the isolates EFA 5 and EBA 8 which showed the lowest inhibition percentage of 45.68 and 48.75, respectively against the pathogen.

**Keywords:** Endophytes, antagonistic activity, *Fusarium solani*.



## Biological approaches - Biocontrol Potential of Phylloplane Microbes

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### ABSTRACT

Plants are surrounded by microorganisms whose abundance is promoted by the release of plant organic compounds and by the presence of niches favourable to microbial development and activities. The surface area of leaves constitutes phylloplane as an important habitat for various microbes, many of which play important roles in plant growth. This environmental niche supports large and complex microbial communities which are diverse and include many different genera of bacteria, filamentous fungi, yeasts, algae, and, less frequently, protozoa and nematodes. Filamentous fungi are considered transient inhabitants of leaf surfaces, present predominantly as spores, whereas rapidly sporulating species and yeasts colonize this habitat more actively. Bacteria are by far the most abundant inhabitants of the phyllosphere. Epiphytic bacterial populations differ sharply in size among and within plants of the same species, in close proximity, over short time scales, and over the growing season. These considerable variations in population sizes are greatly caused by the large fluctuations in the physical and nutritional conditions characteristic of the phyllosphere. Reflective of marked differences in the physicochemical environments of above-ground versus subterranean plant surfaces, the leaf bacterial flora differs substantially from roots. For example, pigmented bacteria, which are rarely found in the rhizosphere, dominate leaf surfaces, presumably because solar radiation influences the ecology of the phyllosphere. The microbial ecology of the phyllosphere has been viewed mainly through the biology of gram-negative bacteria such as *Pseudomonas syringae* and *Erwinia (Pantoea) spp.*, two of the most ubiquitous bacterial participants of phyllosphere communities. Phylloplane microfungi have the ability to decompose cellulose by producing cellulases. In addition, pectinases, cutinases, and proteases have also been estimated in many fungi e.g. *Alternaria alternata*, *Aureobasidium pullulans*, *Botrytis cineria*, *Cladosporium herbarum*. Phyllosphere microorganisms, predominantly bacteria and fungi, can act as mutualists promoting plant growth and tolerance of environmental stressors, using the leaf habitat for their growth and reproduction, or as antagonistic pathogens. Biocontrol is provided by antibiotic production, hydrolytic enzyme production, siderophores production, induced systemic resistance (ISR) and exopolysaccharide production.

## Secondary Metabolites of Microbes: A source of novel agrochemicals

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### ABSTRACT

The microorganisms produce a mixture of various structurally related compounds. These structurally related compounds are classified as primary or secondary metabolites. Microorganisms have a wide range of secondary metabolites like antibiotics, hormones, enzymes, pigments, mycotoxins etc. Among these secondary microbial metabolites, antibiotics produced by various bacteria, actinomycetes and fungi are now proving to be a new source of potential biopesticides. These antibiotics are low molecular weight compounds that are lethal to the growth or capable of suppressing the metabolic activities of other microorganisms. The use of these secondary metabolites of microbial origin is gaining incentive in crop protection and such metabolites may become an alternative to chemical control. These secondary microbial metabolites can be used for the synthesis of plant protective chemicals that are called agrochemicals. These microbial pesticides can be categorized according to their main use as microbial insecticides, microbial fungicides, bactericides and bioherbicides. Among these, various microbial fungicides and bactericides are used to manage different diseases of plants. Microbial fungicides are natural products and analogues from the cultures of bacteria, actinomycetes and fungi which can be used as fungicides. Among these, the most important ones are strobilurins, blasticidin, kasugamycin, and validamycin. Whereas bactericides are natural products and analogues from bacteria cultures, actinomycetes and fungi can be used to manage phyto-bacteria. Among these, the most important ones are Streptomycin, and Tetracyclines. Although several microbial secondary metabolites have been developed, only a few are available in commercial forms due to several constraints in formulation, production and commercialization. These microbial pesticides emerge as a potential option for pest management. Hence, they can be exploited as a skeleton for synthesising new strategies and chemicals for managing different diseases.

**Key Words:** Secondary Metabolites, Antibiotics, Agrochemicals, Microbial Fungicides, Bactericides.

## Impact of precision nutrient management alongwith tillage and residue management on mineralization of soil organic carbon in Indo-Gangetic Plains

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### ABSTRACT

The aim of this study was to assess mineralization of soil organic carbon (SOC) under a CA-based maize (*Zea mays*)-wheat (*Triticum aestivum*) system in the IGP. Soil samples from surface layer (0-5cm) were collected from an on-going CA field experiment established in 2016-17 at the research farm of Indian Agricultural Research Institute (IARI), New Delhi; laid in a split-plot design having four tillage and residue options in the main plots (CTNR: conventional tillage; CTCR: conventional tillage with residue retention @ 3 t ha<sup>-1</sup>; ZTNR: zero tillage; ZTCR: zero tillage with residue retention @ 3 t ha<sup>-1</sup>), and four nutrient management options in the sub-plots (STB: soil test-based recommendation, NE: nutrient expert based, STB+GS: soil test-based recommendation with green seeker and NE+GS: nutrient expert and green seeker). The soil order is Typic Haplustept. Results indicated ZT treatments having greater cumulative carbon mineralization (Ct) compared with CT after 32 days incubation (bulk soil) at 27°C, while at 37°C, CTCR had the highest Ct (82.8 mg C/100 g soil). The NE had highest Ct at 27°C, while NE+GS had highest Ct at 37°C. At 27°C, CTNR treatment had highest Kc value (decay rate) which was 21.4% higher than ZTCR. CTCR had highest decay rate at 37°C which was 51% and 75.5% higher than ZTNR and ZTCR treatments, respectively. Nutrient management practices had no significant impact on decay rates at higher temperature (37°C). Interaction effect of tillage, residue and nutrient management was significant. This study suggested that under CA-based maize-wheat cropping system in the IGP, appropriate nutrient management with tillage and residue management is crucial for carbon sequestration.

**Key words:** Carbon sequestration, Balanced nutrient management, Nutrient expert, Green seeker, Decay rate



## **Nano Science and Technology: Role of Nano fertilizers on Crop Productivity and Sustainability**

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### **ABSTRACT**

Environmental degradation and its conservation are likely to be the foremost global issues in the farming sector and it played an important role in sustainable agriculture. The use of nanotechnology in agriculture in recent years has attracted much attention. The current study entitled “Nano Science and Technology: Role of nano fertilizers on crop productivity and sustainability” was done by analyzing the secondary data. With the advancement of technologies in farming sector it is very essential to select the right amount and type of fertilizers for achieving the maximum yield with minimum adverse effects on environment. Plants and human health are intertwined, especially when using natural treatments like chemical fertilizers, composts and nanoparticles. The manufacturing of fertilizers with the required chemical composition can be tailored effectively by using nanotechnology. Precision farming makes agriculture more sustainable by reducing the waste and energy demand. Nano fertilizers increase the effectiveness of nutrient use, which could have a positive influence on the environment and it also helps in increasing the plant output. As a result, this study is to provide a complete overview of various nano fertilizer including their composition and their impact on fertility and productivity of soil. Scientific gaps to be overcome and fundamental questions to be answered

for safe and effective development and deployment of nanotechnology are addressed. This

review also aims to highlight the smart and precise agriculture farming based on nanotechnology.

**Keywords:** Nanotechnology, Sustainability, Productivity, Environment.

## Effect of innovative organic and inorganic fertilizers on maize productivity and nutrient optimization in an acid *Alfisol* of Lesser Himalayas

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### ABSTARCT

Integrated Nutrient Management (INM) results in maximum crop productivity by maintaining adequate supply of nutrients throughout the crop growth period. To study the impact of locally available new products namely, Sagarika (bio-stimulant), NPK Consortia (biofertilizer) and Water-Soluble Fertilizer (18:18:18) on maize yield and nutrient optimization, a field experiment was conducted using Randomized Block Design with 10 treatments, viz. 100% NPK, 75% NPK, 75% NPK + foliar spray of Sagarika, 75% NPK + soil application of Sagarika, 75% NPK + foliar spray of Water Soluble Fertilizers (18:18:18), 75% NPK + seed treatment with NPK Consortia, 75% NPK + foliar cum soil application of Sagarika, 75% NPK + foliar spray of Sagarika and Water Soluble Fertilizer (18:18:18), 75% NPK + foliar cum soil application of Sagarika + foliar spray of Water Soluble Fertilizers (18:18:18) and 50% NPK + foliar cum soil application of Sagarika + foliar spray of Water Soluble Fertilizers (18:18:18) + seed treatment with NPK Consortia during *kharif*, 2019 in an acid *Alfisol* of mid hills subhumid zone of Lesser Himalayas. The integrated use of inorganic fertilizers (120:60:40) and Farm Yard Manure (10 t FYM ha<sup>-1</sup>) is generally recommended to sustain maize productivity in this agro-ecosystem. Highest grain (57.2 q ha<sup>-1</sup>) and stover yield (87.9 q ha<sup>-1</sup>) and lowest grain (42.6 q ha<sup>-1</sup>) and stover yield (72.1 q ha<sup>-1</sup>) were obtained with 75% NPK + foliar cum soil application of Sagarika + foliar spray of Water Soluble Fertilizers (18:18:18) and 75% NPK, respectively. Total N, P and K uptake ranged from 116.0 to 153.9, 26.9 to 40.0 and 107.8 to 139.5 kg ha<sup>-1</sup>, respectively. The treatment comprising of foliar applications of Sagarika and Water Soluble Fertilizer (18:18:18) at knee-high and tasseling stages along with 75% NPK having B:C ratio 2.44 resulted in significantly higher yield of maize than that with 100% NPK having B:C ratio 2.42, which indicated saving of 25 % NPK with foliar applications of Sagarika and Water-Soluble Fertilizer. Keeping in view the yield, nutrient uptake and B:C ratio, it is advisable to apply 75% NPK along with soil cum foliar applications of Sagarika and foliar application of Water Soluble Fertilizers (18:18:18) to maize crop.

**Keywords:** Lesser Himalayas, Integrated Nutrient Management, Bio-stimulant, NPK Consortia, Water Soluble Fertilizer



## **Bioactivity And Morphology Of Banana Roots As Influenced By Humic Substances Extracted From Various Organics**

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### **ABSTRACT**

The present investigation entitled, “Bioactivity and morphology of banana roots as influenced by humic substances extracted from various organics” was undertaken during 2020-21 at Biotechnology unit, JISL, Jalgaon (Maharashtra). The experiment was laid out in Randomized Block Design with nine treatments and three replications. The results of the present experiment revealed that, the bioactivity of secondary hardened banana plantlets was significantly influenced by various humic substances. Drenching of vermicompost extracted humic acid shows the higher root acidification in aqueous medium. Higher root CEC was observed with foliar spray of vermicompost extracted humic acid. Root acid phosphatase activity was significantly influenced by foliar spray of NPS extracted humic acid while root oxidase activity was significantly influenced by FYM extracted humic acid. Morphological parameters like root length, root volume, dry weight of root, root: shoot ratio and dry matter accumulation and growth parameters like number of leaves and plant height were significantly influenced by foliar spray of vermicompost extracted humic acid. However dry weight of shoot and girth of pseudostem were significantly influenced by NPS extracted humic acid. From this study it can be concluded that bioactivity of secondary hardened banana root was significantly influenced by various humic substances. Vermicompost extracted humic substances found to be significant for morphological and growth parameters. Drenching of NPS extracted humic substances significantly increased the NPK content.

**Keywords:** Bioactivity, Root length, Root volume, Dry matter accumulation, Vermicompost

## Role of micronutrients in wheat production and quality

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### ABSTRACT

Green revolution helped in increasing the food production thereby greatly reduced starvation, calories and protein malnutrition. Micronutrients deficiencies in different cropping system are becoming increasingly important globally. Intensive cultivation of high-yielding cultivars with heavy applications of high analysis N, P, and K fertilizers leads to the occurrence of micronutrient deficiencies especially Zn, Fe and Mn. Deficiency of these nutrients may arise or emerge when these nutrients are supplied in fewer amounts as compared to their removal through crop harvest which in turns limits the crop productivity and deterioration of soil health. Due to the continuous mining of micronutrients and use of micronutrient free fertilizer, content of these nutrients have declined over the last decade. The quantity of these nutrients depend on different factors such as ability of soil to supply these nutrients, rate of absorption of nutrients to functional sites and nutrients mobility within the plants. Now micronutrients have mostly been addressed as one of the soil problems but micronutrients deficiency and their complexities have now been observed abundantly in crops produced from micronutrient deficient soils and these in turn produce nutrient deficient foods and fodder. Hence Basal application and/or foliar sprays of micronutrients Zn, Fe and Mn have been recommended as the most suitable methods for correcting such deficiencies in crops.

**Keywords:** Agriculture, Cropping system, Micronutrients, Deficiency, Soil

## Irrigation impact of domestic sewage effluent on soil properties and nutrient availability

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### ABSTRACT

The present investigation was conducted during 2019-20 in Hisar, Panipat and Karnal district of Haryana. Effect of regular use of sewage water on the nutrient status of soils and nutrient availability was studied at three different experimental sites viz. Hisar, Panipat and Karnal districts of Haryana. A substantial surge in available N, P, K and organic carbon content was noticed in the soil samples collected from sewage water irrigated sites. The EC value of sewage water irrigated soil was higher as compared to the non-sewage. Higher value of EC ( $0.83 \text{ dSm}^{-1}$ ) was observed in sewage water irrigated soil of Hisar in pearl millet crop. The OC of the soil irrigated with sewage water was found significantly higher (0.85 %) as compare to non-sewage water irrigated soil at Karnal in wheat crop. Higher value of N ( $182.35 \text{ kg ha}^{-1}$ ), P ( $26.14 \text{ kg ha}^{-1}$ ) and K ( $321.75 \text{ kg ha}^{-1}$ ) was observed in sewage water irrigated soil. The DTPA extractable Fe, Mn, Cu, and Zn of sewage irrigated soil was more as compared to non-sewage irrigated soil. Sewage irrigated soil had higher Fe range ( $15.75$  to  $20.34 \text{ mg kg}^{-1}$ ) than the non-sewage irrigated soil ( $4.85$  to  $9.87 \text{ mg kg}^{-1}$ ) during 2019-20 at 0-15 cm depth. Irrigation sewage water resulted in the conglomeration of heavy metals in surface soil. The mean contents of micronutrients and heavy metals viz., Fe, Zn, Mn, Cu, Pb, Cd, Cr, and Ni in the soils irrigated with sewage and industrial effluents was significantly higher as compared to tube-well or canal water.

**Keywords:** Sewage water, Nutrients, Heavy metals, Soil and plant, Irrigation

## Effect of Nutrient Enriched Compost and Zinc Application on Nutrient Uptake by Maize (*Zea mays* L.) Crop

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### ABSTRACT

The aim of the present investigation is to study the interactive effect of nutrient enriched compost and zinc levels on nutrient uptake by maize seed (*Zea mays* L.). The field experiment was conducted in *Kharif* 2020 at the Instructional Farm (Agronomy), Rajasthan College of Agriculture, MPUAT, Udaipur. The treatments including the four levels of nutrient-enriched compost (NEC) viz., control (NEC<sub>0</sub>), 2.0 t NEC ha<sup>-1</sup> (NEC<sub>1</sub>), 4.0 t NEC ha<sup>-1</sup> (NEC<sub>2</sub>), and 6.0 t NEC ha<sup>-1</sup> (NEC<sub>3</sub>) and four levels of zinc application viz., Control (Zn<sub>0</sub>), 10 kg basal ZnSO<sub>4</sub> + foliar spray of 0.5% ZnSO<sub>4</sub> (Zn<sub>1</sub>), 15 kg basal ZnSO<sub>4</sub> + foliar spray of 0.5% ZnSO<sub>4</sub> (Zn<sub>2</sub>) and 20 kg basal ZnSO<sub>4</sub> + foliar spray of 0.5% ZnSO<sub>4</sub> (Zn<sub>3</sub>) taken in factorial RBD with three replication. The result of the study showed that the increasing level of nutrient enriched compost and zinc upto 4 t ha<sup>-1</sup> (NEC<sub>2</sub>) and 15 kg ZnSO<sub>4</sub> + foliar spray of ZnSO<sub>4</sub> 0.5% ha<sup>-1</sup> (Zn<sub>2</sub>), respectively significantly increased (P=0.05) nitrogen (68.59 kg ha<sup>-1</sup>), phosphorus (18.72 kg ha<sup>-1</sup>), potassium (21.55 kg ha<sup>-1</sup>) and zinc (119.33 kg ha<sup>-1</sup>) uptake by maize seed.

**Keywords:** Nutrient enriched compost, Nutrient uptake, Maize, Zinc

**Response of biochar and pig manure on soil properties and rice bean [*Vigna umbellata* (thunb) ohwi and ohashi] in the foothill condition of northeastern India.**

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**ABSTRACT**

A field experiment was conducted in the Department of Agricultural Chemistry and Soil Science, Medziphema during the *kharif* season of 2019-2020 in rice bean crop under acidic soil condition. The study was conducted to assess the response of biochar and pig manure on soil properties and rice bean [*Vigna umbellata* (thunb) ohwi and ohashi] in the foothills condition of Northeastern India. The treatment consisted of 2.5 and 5.0 t ha<sup>-1</sup> wood and bamboo biochar, 2 t ha<sup>-1</sup> pig manure and 20 kg N, 40 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O. The experiment was laid out in a randomized block design with 3 replicates in plots of 2.25×2.1 m<sup>2</sup>. The Growth, yield attributes and post cropping soil analysis were determined. Soil pH, organic carbon, soil nitrogen, calcium, magnesium, potassium, sodium and CEC significantly increased. The result revealed that with increasing levels of biochar from 2.5 to 5t ha<sup>-1</sup> significantly increased growth, yield attributes and improved soil physico-chemical properties. This study showed the potential role of combined biochar and pig manure in improving soil fertility and rice bean yield.

**Keywords:** Biochar, Pig manure, Rice bean, Growth, Yield, Wood

## Vineyard Soils of Karnataka- Pedological study

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### ABSTRACT

Twenty grapes-growing areas of Karnataka were characterized, classified and suitability was evaluated in four major agro climatic zones of Karnataka. Soil site characteristics were studied along with the analysis of soils and petioles. Twenty soil profiles were excavated as study site based on the dominance of area falling under grapes production and existing spatial variability of soils. The detailed information of profiles and horizon wise soil samples were collected to study the morphological, physical, chemical and fertility characteristics. Doddaballapur (*Bangalore Blue* and *Wine grapes*), Bangalore North (GKVK Farm, Rajankunte and IIHR Farm), Devanahalli, Magadi, Hoskote, Chikkaballapur (*Dilkush* and *Red globe*), Yelaburga, Hagari Bommanahalli, Bagalkot (UHS farm) and Indi profiles fall under the soil order, Alfisol. Vijaypur pedon of northern dry zone was keyed out as Vertisols whereas, Jamkhandi and Athani as Inceptisols. Properties of Aridisols were observed in B. Bagewadi (*Manikchaman* and *Thompson Seedless*) and Afzalpur. Soil fertility status and its mapping using GIS technique revealed the adequacy of plant nutrients except for nitrogen, potassium, zinc, iron and boron which indicated the need for application. Varieties differed among themselves in yield and plant nutrients composition depending on their age, climatic, soil and management requirements. Bangalore North (GKVK farm) and Jamkhandi are having medium soil organic carbon stocks of 6.21 and 6.55 kg m<sup>-3</sup>, respectively. Soils of Bangalore North (Rajankunte) were highly suitable (S1) for grapes cultivation. Under northern Karnataka, Vijayapura, B. Bagewadi, Indi and Afzalpur vineyards were good performers despite the limitations of fertility and free lime content.

**Keywords:** Characterization, Suitability Evaluation, Soil Orders, Soil Organic Carbon Stock

**IMPACT OF WEED MANAGEMENT PRACTICES ON WEED DIVERSITY,  
PRODUCTIVITY AND ENERGETICS OF ORGANICALLY MANAGED MAIZE  
BASED CROPPING SYSTEM IN NORTH-WESTERN HIMALAYAN REGION**

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**ABSTRACT**

A field experiment was carried out for 2 years in a continuing experiment under AICRP-WM (All India Coordinated Research Project on Weed Management) during 2017-19 at Agronomy farm, Chaudhary Sarwan Kumar Krishi Vishwavidyalay Palampur, H.P. with three replications in a randomized complete block design. The effect of different cultural weed management practices were found to be different for pea and maize in each cropping year as weed species composition changed from those observed during the previous year 2017-18. The common weeds prevalent during *rabi* 2017-18 and 2018-19 were *Phalaris minor* (L.), *Anagallis arvensis* (L.), *Euphorbia helioscopia* (L.), *Vicia sativa* (L.), *Coronopus didymus* (L.) and *Tulipa sp.* The maximum pea pod yield was obtained with intensive cropping followed by chemical check in *rabi* 2018-19. Chemical check treatment gave highest green cob yield (10323 kg/ha) of maize and RSSB + hoeing (9208 kg/ha green cobs yield) was statistically on par with chemical check. Higher productivity (maize equivalent yield of 11420 kg/ha) was realized under the chemical check which was at par with RSSB + hoeing (10160 kg/ha). The B:C followed the trend of intensive cropping > intercropping > chemical check > RSSB + hoeing > RSSB + mulch. Significantly higher energy use efficiency (12.3%) was recorded with crop rotation treatment followed by RSSB.

**Keywords:** weed species, organic farming, weed management, yield



**RHIZOSPHERIC MANIPULATIONS TO PROMOTE AGRONOMIC  
FORTIFICATION IN GROUNDNUT (*ARACHIS HYPOGAEAE* L.)**

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**ABSTRACT**

A field experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh during *kharif*, 2018 to study rhizospheric manipulations to promote agronomic fortification in groundnut (*Arachis hypogaeae* L.). The experiment consisted of four levels of nitrogen with ammonium sulphate as source (0, 30, 60 and 90 kg N ha<sup>-1</sup>) and four spacings (30x10 cm, 25x10 cm, 20x10 cm and 15x10 cm) replicated thrice. Application of 90 kg N ha<sup>-1</sup>, recorded higher N, P and Zn content, while 60 kg N ha<sup>-1</sup> recorded greater K and Fe content. Significant acidification in rhizosphere pH was observed with 90 kg N ha<sup>-1</sup> which was on par with 60 kg N ha<sup>-1</sup>. Closer spacing resulted in higher nutrient content and lower rhizospheric pH. Ammonium sulphate @ 60 kg N ha<sup>-1</sup> recorded 51.0 per cent and 18.0 per cent higher yield over 0 and 30 kg N ha<sup>-1</sup>, respectively. Closer spacing of 15x10 cm recorded significantly higher yield when compared to other spacings.

**Key words:** Ammonium sulphate, Nutrient content, Rhizosphere pH





**RADIATION INTERCEPTION, EXTINCTION COEFFICIENT AND RADIATION  
USE EFFICIENCY OF RICE CROP AT TWO GROWING SEASONS IN ODISHA  
STATE OF INDIA**

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**ABSTRACT**

A field experiment was conducted at ICAR-IIWM, Deras farm, Bhubaneswar, Odisha State. Which situated in 20°17' N latitude, 85°41' E longitude and elevation 86.6 m above sea level. To study the IPAR, extinction coefficient and Radiation use efficiency in rice during *kharif* in two growing seasons (2018 to 2019). The PAR values of incident PAR and transmitted PAR at the field were measured after (30 DAS) canopy development at 15 days intervals till maturity from 8 am to 5 pm in a day with a line quantum sensor instrument. LAI was linearly related to IPAR for all growth stages and highest interception of PAR noon hours but lowest interception morning and sunset hours may be due to the increase path length of the sun from earth surface. Extinction coefficient describe the capacity of the canopy of light interception and indicator of PAR distribution within the plant canopy. RUE values were recorded higher in second growing season (0.28g/MJ IPAR) due to the different amount of radiation interception because of variation in canopy surface and the LAI.

**Key words:** Rice, Intercepted photosynthetically active radiation, extinction coefficient, Radiation use efficiency, LAI.



## DIVERSIFICATION OF TRADITIONAL RICE-WHEAT SYSTEM FOR IMPROVED PROFITABILITY AND SUSTAINABLE PRODUCTION

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### ABSTRACT

A study to diversify the rice-wheat system in North-Western Himalaya was carried out during the year 2017-18 at the research farm of CSK HPKV, Palampur. Eight cropping systems were evaluated for system's productivity and profitability. At the end of crop cycle rice-palak-cucumber was found to have significantly high rice grain equivalent yield (16.48 t/ha), productivity (63.62 kg/ha/day) and harvest index. In terms of economics also this system was found to be most profitable with highest returns (net returns Rs 219828/ha) and benefit-cost ratio. Rice-pea-summer squash was most efficient in terms of energy. Maximum carbohydrate (5146 kg/ha) and protein yield (640.6 kg/ha) was observed in rice-wheat. Nutrient uptake was also maximum by rice-wheat sequence compared to other diversified cropping systems. Most of the cropping systems involving vegetables remained superior over rice-wheat in terms of returns, productivity and profitability.

**Keywords:** Crop diversification, food security, sustainable, rice grain equivalent yield



## EVALUATION OF DIFFERENT GENOTYPES OF PADDY FOR SEED YIELD AND ITS RELATED TRAITS UNDER NATURAL FARMING CONDITIONS

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### ABSTRACT

To identify suitable Paddy genotypes under natural farming system, totally 15 genotypes were evaluated in RBD, replicated thrice following all principles and 4 pillars of SPNF that is *jeevamrita*, *beejamrita*, mulching and *whapasa* at Zero Budget Natural Farm, CSKHPKV Palampur H.P. for two years (2020 and 2021). The analysis of variance revealed that all the traits under study had significant variation. Days to maturity ranged from 99.33 to 106.83 days with overall mean of 102.22 days. Kalighini (99.33) was observed to be significantly early maturing than that of other genotypes. Plant height ranged from 85.16 to 147.00 cm with a mean value of 104.71 cm. Number of tillers ranged from 5.98 to 8.42 with overall mean of 7.08. Seeds/panicle ranged from 101.03 to 136.06 with a mean value of 119.86. Seed yield ranged from 13.47 q/ha to 35.56 q/ha with overall mean of 23.69 q/ha. The genotypes HPR 2720 (35.56 q/ha), HPR 1068 (32.95 q/ha) and HPR 1156 (29.72 q/ha) were at par with each other and significantly higher than remaining genotypes. On the basis of mean performance over the two years it was observed that among fifteen genotypes of paddy HPR 2720, HPR 1068 and HPR 1156 as higher yielders and thus suitable for natural farming system.

**Key words:** Paddy, natural farming, mean, range, seed yield

## STANDARDIZATION OF SPRAYING TECHNIQUE FOR PRE-EMERGENCE HERBICIDES IN ZERO-TILLAGE WHEAT WITH SURFACE RESIDUE COVER

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### ABSTRACT

The present investigation was conducted at the research farm of CCSHAU, Regional Research Station (RRS), Karnal during winter seasons of 2019-20 and 2020-21. In this experiment, ZT-wheat (var. HD 2967) was sown with happy seeder under surface residue mulch of 6 t/ha (chopped) on 18<sup>th</sup> November, 2019 and 25<sup>th</sup> November 2020. Fourteen weed control treatments including PRE herbicide (pendimethalin 1500 g/ha), sequential application of PRE *fb* POE (pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha), weedy check and weed-free checks were arranged in a randomised block design with three replications. PRE herbicides were applied on the top of rice residues using two water volumes (500 and 1000 L ha<sup>-1</sup>) and three types of nozzles (flat-fan, flood-jet and air-injection). Among weed species, *Rumex dentatus* (L.), *Phalaris minor* (L.) showed greater suppression under residue mulch. *Medicago denticulatas* (L.) showed least suppression. Pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) with Flood-jet was statistically similar to weed-free in terms of grain yield, net returns and B-C ratio in both the years followed by pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) with Air-injection and pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) with Flat-fan. Recommendations generated through present investigation will facilitate proactive management of herbicide resistant weeds through synergistic integration of PRE and POE herbicides through appropriate spray technologies in wheat grown with rice residue retention on soil surface.

**Keywords:** Rice residue, weeds, herbicides, nozzle, water volume



## ROLE OF INTEGRATED FARMING SYSTEM IN SUSTAINABLE TRANSFORMATION IN AGRICULTURE

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### ABSTRACT

Integrated Farming System (IFS) is a system that combines two or more farming system i.e.Cropping systems, horticulture, livestock, fishery, forestry, poultry and the means available to the farmers to raise them for profitability. A lot of efforts have been made to increase the productivity of different components of farming systems but there is lacking in their integration by following farming system approach. The heavy investment in the initial years and non-availability of labour were observed as the major constraints in adopting integrated farming system. The development of this system is very important, because it has many advantages including regional development. It can be a solution for the various problems that arise due to various factors. The integration is made in such a way that product of one component should be the input for other enterprises with high degree of complimentary effects on each other. The farmers can realize that doubling of their income by adding livestock in the farming system and reap the consequent social and ecological benefits. It is a combined approach to increase income and decreasing risk for the farmers. The farming system will help in different ways to lift the economy of agriculture and standard of living of the farmers.

**Keywords:** integrated, farming, economy, income, livestock.

**GROWTH AND YIELD OF GOBHI SARSON AS INFLUENCED BY IRRIGATION  
AND NUTRIENT MANAGEMENT PRACTICES UNDER CONSERVATION  
TILLAGE**

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**ABSTRACT**

This study was conducted during *rabi* 2017-18 using gobhi sarson (*Brassica napus* L.) to examine the effect of three irrigation levels (no irrigation, 50% of recommended irrigation water (25 mm depth) and 100% of recommended irrigation water (50 mm depth)) and four nutrient management practices (25 t ha<sup>-1</sup> FYM, 50% NPK+20 t ha<sup>-1</sup> FYM, 75% NPK+10 t ha<sup>-1</sup> FYM and 100%NPK) in split plot design. The irrigation at 100% recorded highest plant height (124.4 cm) and number of primary (4.58) and secondary branches (7.92) which were at par with 50% irrigation and whereas application of 75% NPK+10 t ha<sup>-1</sup> FYM recorded highest growth parameters. Interaction effect was significant in case of no. of primary branches per plant. The yield attributes recorded were significantly highest under 100% irrigation and application of 75% NPK+10 t ha<sup>-1</sup> FYM. The 1000 seed weight (g) and harvest index was non-significant under all treatments. Irrigation applied at 50 mm significantly improved seed (13.83 q ha<sup>-1</sup>) and stover (44.92 q ha<sup>-1</sup>) yield which was at par with 25 mm irrigation application. Whereas, significantly highest seed (13.50 q ha<sup>-1</sup>) and stover (43.18 q ha<sup>-1</sup>) yield was obtained under 75% NPK+10 t ha<sup>-1</sup> FYM.

**Keyword:** Canola, irrigation levels, integrated nutrient management, yield, gobhisarson



## STANDARDIZATION OF SPRAY TECHNIQUE FOR PRE HERBICIDES IN ZT-WHEAT WITH RICE RESIDUE RETENTION

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### ABSTRACT

The present investigation entitled Standardization of PRE herbicide spray in ZT-wheat with rice residue retention was conducted at the research farm of CCSHAU, Regional Research Station (RRS), Karnal during *rabi* of 2019-20 and 2020-21. In the experiment, ZT-wheat (var. HD 2967) was sown with happy seeder under surface residue mulch of 6 t/ha (chopped) on 18<sup>th</sup> November, 2019, and 25<sup>th</sup> November 2020. Fourteen weed control treatments including PRE herbicide (pendimethalin 1500 g/ha), sequential application of PRE *fb* POE (pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha), weedy check and weed-free checks were arranged in a randomised block design with three replications. PRE herbicides were applied on the top of rice residues using two water volumes (500 and 1000 L ha<sup>-1</sup>) and three types of nozzles (flat-fan, flood-jet and air-injection). Among weed species, *Rumex dentatus* and *Phalaris minor* showed greater suppression under residue mulch and *Medicago denticulate* showed least suppression. Pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) (Flood-jet) was statistically similar to weed-free in terms of grain yield, net returns and B-C ratio in both the years followed by pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) (Air-injection) and pendimethalin 1500 g/ha *fb* pinoxaden 50 g/ha (1000 L ha<sup>-1</sup>) (Flat-fan). Recommendations generated through present investigation will facilitate proactive management of rice crop residues in wheat crop by controlling herbicide resistant weeds through synergistic integration of PRE and POE herbicides through appropriate spray technologies in wheat grown with rice residue retention on soil surface.

**Key words:** Crop residue, zero-tillage, rice-wheat system, weeds, herbicides

**EFFECT OF PRE-AND POST-EMERGENCE HERBICIDES ON WEED DYNAMICS  
AND SEED YIELD OF IRRIGATED LINSEED (*LINUM USITATISSIMUM* L.) IN  
WESTERN HIMALAYAN REGION**

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**ABSTRACT**

A field study was conducted during the *rabi* season of the year 2019-20 at Research Farm, Department of Agronomy, CSK HPKV, Palampur, Himachal Pradesh. The experiment was laid out in a randomized complete block design with ten treatments replicated thrice. Treatments comprised of weedy check, two hand weedings at 21 and 45 DAS, metribuzin + oxyfluorfen @ 250 + 125 g ha<sup>-1</sup> as pre-emergence, pendimethalin @1 kg ha<sup>-1</sup> as pre-emergence *fb* metsulfuron-methyl @4 g ha<sup>-1</sup> as post-emergence, imazethpyr 10 EC @75 g ha<sup>-1</sup> as post-emergence, oxyfluorfen @125 g ha<sup>-1</sup> as pre-emergence, metsulfuron-methyl @4 g ha<sup>-1</sup>, post-emergence clodinafop @60 g ha<sup>-1</sup>, clodinafop + metsulfuron-methyl @60 + 4 g ha<sup>-1</sup> as post-emergence and oxadiargyl @80 g ha<sup>-1</sup> as pre-emergence. The highest weed control efficiency of 84.47 percent was observed with the post-emergence application of an herbicide combination of clodinafop + metsulfuron-methyl @60 + 4 g ha<sup>-1</sup>. The highest grain yield of 1681 kg ha<sup>-1</sup> was observed under clodinafop + metsulfuron-methyl @60 + 4 g ha<sup>-1</sup> and which is at par with two hand weedings (1541 kg ha<sup>-1</sup>). In monetary terms, clodinafop + metsulfuron-methyl @ 60 + 4 g ha<sup>-1</sup> was found to be significantly superior to all other treatments with a benefit-cost ratio of 2.38 followed by pendimethalin @1 kg ha<sup>-1</sup> *fb* metsulfuron-methyl @4 g ha<sup>-1</sup> and clodinafop @60 g ha<sup>-1</sup> (1.98 and 1.97, respectively).

**Keywords:** Economics, herbicide combinations, seed yield and weed dynamics.





## EVALUATION OF DIFFERENT WEED CONTROL TREATMENTS IN SPRING PLANTED SUGARCANE

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### ABSTRACT

The present study was carried out on spring planted sugarcane during 2018-19 at Regional Research Station, Uchani, Karnal of CCS Haryana Agricultural University, Hisar (Haryana). The experiment was conducted on sugarcane variety CoH 167 in randomized complete block design with eighteen treatments replicated thrice. The major weed flora recorded in the experimental field were *Cyperusrotundus*, *Dactylocteniumaegyptium*, *Echinochloacolona*, *Brachiariareptans*, *Amaranthusviridis*, *Portulacaoleracea*, *Convolvulus arvensis*, *Euphorbia microphylla* and *Ipomoea purpurea*. *Cyperusrotundus* was the major weed constitutes 87.6 to 93.4 per cent weed density at different stages of crop growth. The treatments Metribuzin + halosulfuron (TM) PoE, Metribuzin PRE fbhalosulfuronPoE, Atrazine PRE fbhalosulfuronPoE, Sulfentrazone as PRE fb hoeing at 45 days fb 2,4-D at 60 DAP gave the excellent control of complex weed flora of sugarcane and hence, lower weed count, weed dry weight and higher weed control efficiency was recorded from these treatments compared to rest of the treatments. Except Metsulfuron + carfentrazone, none of the applied herbicide alone, in combination and in sequence had any phytotoxic effect on sugarcane plant crop.

**Keywords:** Sugarcane, weed control, Metribuzin, Halosulfuron-methyl, weed control efficiency, phytotoxicity.



## EFFECT OF WATER SOLUBLE FERTILIZERS AND PGPR ON SOIL MICROBIAL POPULATION IN BLACK GRAM UNDER RAINFED CONDITION IN SOUTHERN TRANSITION ZONE OF KARNATAKA

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### ABSTRACT

. Field experiment was conducted on effect of water soluble fertilizers and PGPR application on soil microbial population were studied under rainfed condition during *khari*-2019 at the College of Agriculture, Shivamogga. The field experiment was laid out in randomized complete block design and replicated thrice with thirteen treatments t combination of 19:19:19 and monopotassium phosphate with or without PGPR application. Therresults revealed that foliar application of 19:19:19 and Mono potassium phosphate (0:52:34) @ 1 per cent at 30 and 45 days after sowing + PGPR along with a package of practice recorded significantly higher microbial count such as N fixers (53.73, 57.31 and 47.02) P-solubilizers (35.25, 40.32 and 35.58) and K- solubilizers (25.03, 31.18 and 26.30)  $\times 10^5$  CFU  $g^{-1}$  soil at 30, 60 DAS and at harvest respectively over the package of practice and mean population of N-fixer's, PSB and K-solubilizing microorganisms was observed more in treatments receiving PGPR when compared to without PGPR at different growth stages.

**Keywords:** PGPR, water soluble fertilizers, microorganisms, blackgram, microbial count



## IMPACT OF NATURAL STRESSES ON PERFORMANCE OF UPLAND RICE VARIETIES IN DISPLACED SOIL UNDER ORGANIC PRODUCTION SYSTEM

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### ABSTRACT

The field experiment was conducted at College of Agriculture (CAU-I), Kyrdemkulai, Meghalaya in displaced soil due to erosion and human traffic in *kharif* season of 2021. The objective of experiment was to study impact of different abiotic and biotic stresses on the performance of upland rice varieties. All six rice varieties (XRA 77922, XRA 87925, XRA 87928, XRA 752PJ6, XRA 37923 and XRA 38967) are affected significantly due to different stresses. This can be seen from low fertility percentage of panicle (44.1 to 44.4 %), very low grain and straw yield of 184.3–188.7 kg/ha to 671.3–676.0, respectively as well as non-significance of varieties in both growth and yield attributes. The stresses affecting varietal performance are large number of weed flushes, low soil fertility, shallow soil depth, high proportion of graves and stones in soil, susceptibility of plants to blast disease due to shy crop growth, low water holding capacity and termite infestation. These stresses affect the crop physiology in terms of less tillering, lower values for all yield attributes and low fertility percentage of panicles, poor root growth leading to uprooting of plants, poor vegetative growth and drying of leaves towards the flowering and grain filling stage leading to shortage of photosynthates and reflected in to lower yield of rice. These stresses and their momentous effect on performance of rice varieties signifies the need of additional attempts along with crop management practices for realizing the potential as well as varietal variation in growth and yielding ability in displaced soil under upland condition.

**Keywords:** Rice, abiotic stress, soil erosion, XRA 87928

## WEED MANAGEMENT USING NEW GENERATION POST-EMERGENCE HERBICIDES IN CHICKPEA

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### ABSTRACT

A field experiment was conducted during winter season of 2019-21 at ICAR-Directorate of Weed Research, Jabalpur-482004. The treatments comprised of different post-emergence herbicide viz., sodium acifluorfen+clodinafoppropargyl, imazethapyr+ imazemox, propaquizafop+imazethapyr, topramezone at its 50, 75 and 100 per cent of recommended dose, haloxifop-R-methyl at 135 g/ha, imazethapyr at 50 g/ha, weed free and unweeded. All the herbicides were applied at 25 days after sowing. Among the tested herbicides haloxifop-R-methyl had not any phytotoxic effect on chickpea plant and topramezone 12.5 to 25.2 g/ha had very little phytotoxic effect. However, application of sodium acifluorfen+clodinafop had initial phytotoxic effect on newly emerged leaves but chickpea plant recover and produced profuse branching after that. Whereas, application of imazethapyr+imazemox, propaquizafop+imazethapyr and imazethapyr had severe effect on plant, the top leaves become hypoplasty and smaller in size due to application of these herbicides. In context of weed management aspect, application of topramezone at 18.75 and 25.2 g/ha and sodium acifluorfen+clodinafoppropargyl at 245 and 184 g/ha effectively controlled the weeds in chickpea. Among the various herbicides topramezone produced higher seed yield of chickpea crop.

**Keywords:** Topramezone, broad leaf weed, no phytotoxicity, chickpea, yield.



## ZERO BUDGET NATURAL FARMING-THE FUTURE OF FARMING

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### ABSTRACT

Zero Budget Natural Farming (ZBNF) is one of the most significant efforts to ecology at scale because it addresses these issues by presenting an alternative to conventional practices and providing farmers with more autonomy and freedom from debt. ZBNF contributes to important planned goals such as socio-economic development, including enhanced incomes and women's empowerment, as well as environmental effects (increased soil health, climate change mitigation). The practice originally consisted of four core elements: jeevamrutham; beejamrudana, mulching; and whapasa, soil aeration, as a result of the previous three principles. These practices address a broad-range of goals, including stimulating microbial activity, increasing soil carbon, fixing nitrogen through green mulching, and accelerating the availability of existing nitrogen in the soil. A farmer must embrace at least one of the ZBNF core wheels and not utilize chemical fertilizers/genetically modified seeds to be classed as a ZBNF farmer. There are also gaps in the literature on how ZBNF affects foodscapes, ecological health, and farmer's well-being. However, government support, such as comprehensive-research funding, formal certification systems for ZBNF crops, to policy reform, and more targeted-resource allocation to aid with the financial hardship of the transition, could all be beneficial in effectively scaling up ZBNF.

**Keywords:** Zero Budget Natural Farming, Jeevamrutham, Beejamrudana, Acchadana, Whapasa

## **EFFECT OF CROPPING SYSTEMS ON PRODUCTIVITY, ECONOMIC VIABILITY AND ENERGETICS UNDER NATURAL FARMING IN MID HILL CONDITIONS OF HIMACHAL PRADESH**

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### **ABSTRACT**

The study was carried out in a continuing experiment under the natural farming at CSK HPKV, Palampur. Nine cropping systems *viz.* maize – wheat, black gram - wheat + gram, soybean - wheat + lentil, cowpea - wheat + sarson, okra - wheat + pea, maize + black gram – gram, maize + soybean – lentil, maize + cowpea – sarson, maize + okra – peas were evaluated for crop productivity, profitability and energetics. Among different cropping sequences, maize + okra – pea was more benefitting in term of wheat grain equivalent yield (WGEY), net returns, energy productivity and energy profitability followed by okra – wheat + pea. Vegetable based cropping system *viz.* maize + okra – pea and okra – wheat + pea increased WGEY by 2.54 and 2.43, net return by 3.34 and 2.96, energy productivity (kg WGEY/MJ) by 2.5 and 2.5, energy productivity (kg/ha/day) by 2.74 and 2.51 and energy profitability by 3.62 and 3.05 times, respectively over the mono cropping system *viz.* maize – wheat cropping system. However, maize – wheat had higher energy output, net energy, energy output: input, and energy intensity both in term of MJ/kg and MJ/rupee.

**Key words:** Cropping systems, Energetics, Economics, Natural farming



## BIOFORTIFICATION IN VEGETABLE CROPS

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### ABSTRACT

Around 690 million people are hunger but millions of people especially children under five are suffering from micronutrient malnutrition in the world. Malnutrition of iron, zinc, iodine and vitamin A are major concern. To overcome this health issue, the most advisable solution at present is bio-fortification. Through this technology we can add the essential micronutrient to the vegetable crops. As vegetable crops are important in our daily diet, that's why bio-fortifying vegetables can contribute alleviating human malnutrition deficiency. Bio-fortification become successful in targeted crops like potato, cassava, sweet potato, cowpea, beans and yam. This process can be done through three strategies- Agronomical bio-fortification, conventional breeding and genetic engineering. By these strategies pro-vitamin concentration has increased in orange sweet potato (OSP), iron concentration has increased in crops- potato, cowpea, beans and zinc, vitamin A and E, protein contents increased in cassava. In addition to adding nutrients, bio-fortification also helps in disease resistance in crops like beans. However, bio-fortification of vegetables is relatively a new concept in India, it is the best option to reduce nutrient deficiencies by the addition of the desired minerals to the food stuffs.

**Keywords:** bio-fortification, malnutrition, vegetables, genetic engineering, deficiency, breeding.

**BIOSTIMULANT: THE NEW ENTRANT IN THE FERTILIZER CONTROL ORDER****1985**

V.K.Gupta and Abhijit Pujari

*Ross Life Science Pvt. Ltd. Pune***ABSTRACT**

Ministry of Agriculture, Cooperation & Farmer Welfare has issued an Order Dated 23rd February 2021, regarding the addition of Biostimulants in the Fertilizer Control Order 1985. This Order may be called the Fertiliser (Inorganic, Organic or Mixed) (Control) Amendment Order, 2021. Biostimulant means a substance or microorganism or a combination of both whose primary function when applied to plants, seeds or rhizosphere is to stimulate physiological processes in plants and to enhance its nutrient uptake, growth, yield, nutrition efficiency, crop quality and tolerance to stress, regardless of its nutrient content. It is proposed to discuss the role of Biostimulant, as an important agrochemical for the sustainable growth, the various categories allowed, its functions, the market business potential and the market dynamics, related to its growth and business. The details of the testing requirement, and the application process to meet the requirements of the said Order will also be discussed.

**Impact of micronutrients (zinc and iron) and Farm yard manure (FYM) on soil physico-chemical properties under direct seeded basmati rice**

Priyanka Sanwal, R. S. Gharwal, and Shabnam

*Department of Soil Science, CCS Haryana Agricultural University, Hisar- 125004***ABSTRACT**

DSR is better alternative method than transplanting due to lesser demand of water but also have some constraints such as nutrient availability and nutrient deficiency. The current study aimed to study the impact of micronutrients and FYM on soil physico-chemical properties under direct seeded basmati rice variety CSR-30. The experiment was performed on clay loam soil with bulk density  $1.34 \text{ Mg m}^{-3}$ , pH 8.66, electrical conductivity  $0.11 \text{ dS m}^{-1}$ , OC 0.54%, available nitrogen  $105 \text{ kg ha}^{-1}$ , available phosphorus  $21.47 \text{ kg ha}^{-1}$ , available potassium  $360 \text{ kg ha}^{-1}$  and DTPA extractable micronutrient Zn, Fe, Cu and Mn were 1.8, 14.75, 1.34 and 2.95  $\text{mg kg}^{-1}$  respectively. Treatments of experiments were such as control ( $T_1$ ), RDF ( $T_2$ ), 75% RDF + FYM @  $15 \text{ t ha}^{-1}$  ( $T_3$ ), 50% RDF + FYM @  $15 \text{ t ha}^{-1}$  ( $T_4$ ), RDF + two sprays of 0.5%  $\text{ZnSO}_4$  ( $T_5$ ), RDF + two sprays of 0.5%  $\text{FeSO}_4$  ( $T_6$ ), RDF + two sprays of 0.5%  $\text{FeSO}_4$  + two sprays of 0.5%  $\text{ZnSO}_4$  ( $T_7$ ) and replicated three times. The application of FYM along with RDF or micronutrients failed to give significant impact on physico-chemical properties like soil pH, bulk density and electrical conductivity however had significant impact on soil OC.

**Key word:** Micronutrients, Farm yard manure, Direct seeded basmati rice, Physico-chemical



## EFFECT OF ENRICHED COMPOST APPLICATION ON MICROBIAL ACTIVITY UNDER RICE IN AN ACID SOIL

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### ABSTRACT

Effect of enriched compost application on microbial activity under rice in an acid soil was studied. Treatments consisted of T<sub>1</sub>; control, T<sub>2</sub>; biofertilizer consortia @ 3.5kg ha<sup>-1</sup>, T<sub>3</sub>; compost @ 5.0 t ha<sup>-1</sup>, T<sub>4</sub>; compost @ 5.0 t ha<sup>-1</sup>+ biofertilizer consortia @ 3.5 kg ha<sup>-1</sup>, T<sub>5</sub>; enriched compost @ 2.5 t ha<sup>-1</sup>, T<sub>6</sub>; enriched compost @ 5.0 t ha<sup>-1</sup> and T<sub>7</sub>; azolla @ 0.5t ha<sup>-1</sup> + biofertilizer consortia @ 3.5 kg ha<sup>-1</sup>. Soil samples were collected and analyzed for different soil enzyme activities like Acid phosphatase activity ( $\mu\text{g PNP g}^{-1} \text{ soil hr}^{-1}$ ), Dehydrogenase activity ( $\mu\text{g TPF g}^{-1} \text{ soil 24 hr}^{-1}$ ) and Beta-glucosidase activity ( $\mu\text{g TPF g}^{-1} \text{ soil hr}^{-1}$ ) were enhanced significantly in surface soil (0-15 cm) and sub-surface soil (15-30 cm), respectively under treatment T<sub>6</sub> (Enriched compost @ 5 tha<sup>-1</sup>) as compared to T<sub>3</sub> and were similar to T<sub>4</sub> treatment. It could be concluded that the dose of compost could be reduced by using enriched compost to obtain higher crop production with its quality as well as improved soil quality in term of soil microbial activity.

**Key Word**-Enriched compost, Biofertilizer and Soil quality *etc.*



## **EFFECT OF POST EMERGENCE HERBICIDES ON WEEDS AND PRODUCTIVITY OF DIRECT SEEDED RICE**

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### **ABSTRACT**

Rice is the most significant food crop cultivated in over 100 countries, mainly in Asia. The global human population derives 21% of energy and 15% of protein from rice populations (Depra *et al.*, 2011). Direct seeded rice (DSR) has been established as more popular than transplanted rice in many ways as it provides advantages *viz.* faster and easier planting, reduced labour and drudgery, earlier crop maturity by 7-10 days, more efficient water use, higher tolerance of water deficit, fewer methane emission and often higher profit in areas with an assured water supply. However, Weeds are one of the major limiting factors in direct-seeded rice which are known to reduce the yield by up to 28- 80% (Sunil *et al.*, 2010). Therefore, it is essential to control weeds during the critical period of crop weed competition to obtain full yield potential, hence; the present experiment was conducted.



## INTRODUCTION OF NEW CONSERVATION TILLAGE TECHNOLOGIES FOR MANAGING RICE RESIDUE IN THE INDO-GANGETIC PLAINS

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### ABSTRACT

The rice-wheat cropping system of the Indo-Gangetic Plains is critical for food security in the region. Productivity of rice and wheat has recently plateaued and dropped significantly owing to climate change and reduced soil productivity, posing a serious threat to the sustainability of this cropping system. Hence, the main challenge is to improve the productivity to serve the increasing food demand without negative impacts on the environment. Combine harvesters have recently been introduced for harvesting of wheat. The main challenge in these combine harvested areas is managing enormous loads of rice residues. Farmers burn rice residue since it is a cheap and quick way to manage residue, however this results in air pollution, losses of soil organic matter and nutrients. Therefore, there is an urgent need of technologies for direct drilling of wheat into combine-harvested rice residues. The happy seeder approach has considerable potential agronomic benefits, in addition to reducing air pollution, by avoiding stubble burning. But there is problem of non uniform germination and initial plant establishment in happy seeder sowing. Therefore, to address this issue, smart/strip seeder is developed. It incorporates the residue present in the seed row zone and create favourable conditions for initial seedling establishment.

**Keywords:** Residue, Burning, Happy seeder, Smart seeder

**TO STUDY THE EFFECT OF POST-EMERGENCE APPLICATION OF QUIZALOFOP-P-TEFURYL (4.41 % EC) ON GROWTH & YIELD OF GROUNDNUT**

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**ABSTRACT**

A field experiment entitled Effect of post-emergence application of quizalofop-p-tefuryl (4.41 % EC) on groundnut (*Arachis hypogaea* L.) was conducted during *kharif* 2011 at ARS, Chintamani. The soil of the experimental site was red sandy loam in texture, neutral in reaction and medium in available nitrogen, low in available phosphorus and medium in potassium. The experiment consisted of 12 treatments laid out in RCBD with three replications. The predominant weed flora observed in the experimental field were, *Cyperus rotundus* (L.), *Digitaria marginata* (L.), *Dactyloctenium aegyptium* (L.), *Cynodon dactylon* (L.), *Commelina benghalensis* (L.), *Celosia argentea* (L.) and *Amaranthus viridis* (L.). The results revealed that pre-emergence application of pendimethalin @ 1.0 kg a.i. ha<sup>-1</sup> followed by post emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha<sup>-1</sup> at 15 DAS recorded significantly growth parameters *viz.*, plant height (24.97 cm), number of branches (10.3 plant<sup>-1</sup>). No. of nodules per plant (77.70) leaf area (1221.0 cm<sup>2</sup> plant<sup>-1</sup>), LAI (4.07), total dry matter production (38.41 g plant<sup>-1</sup>), total number of pods (27 plant<sup>-1</sup>) and kernel weight (1004 kg ha<sup>-1</sup>), haulm yield (2188 kg ha<sup>-1</sup>) and harvest index (0.38) when compared to other treatments.

**Key words:** Groundnut, quizalofop-p-tefuryl, growth and Yield

## INFLUENCE OF CHEMICAL WEED MANAGEMENT PRACTICES ON QUALITY OF INDIAN MUSTARD

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### ABSTRACT

The study was conducted to determine the influence of chemical weed management practices on quality of mustard (*Brassica juncea* L.). Among the different treatments, application of pendimethalin 1kg *a.i.* /ha (P.E.) + HW 30 DAS recorded the highest oil content being statistically on a par with other treatments involving pendimethalin 1kg *a.i.*/ha (P.E.), pendimethalin 0.5kg *a.i.*/ha (P.E.) and Pendimethalin 0.5kg *a.i.*/ha (P.E.) +HW 30 DAS whereas application of pendimethalin 1kg *a.i.*/ha (P.E.) + HW 30 DAS, produced significantly highest oil yield as compared to the other weed management practices. The lowest oil content was recorded in case of control which, remained significantly on a par with the lone pre-emergence application of Oxadiargyl 0.045kg *a.i.*/ha, lone post emergence applications of Clodinafop 0.03 and 0.06kg *a.i.*/ha at 30 DAS, and Clodinafop 0.030 kg *a.i.*/ha (30 DAS)+ HW 60 DAS. Most of the weed management practices recorded significantly high protein content as compared to weedy Check, which recorded the lowest protein content. Numerically, highest protein content was recorded with application of Pendimethalin 1kg *a.i.*/ha (P.E.) + HW 30 DAS and this treatment also recorded the significantly highest protein yield among all the treatments.

**Key words:** Herbicide, Mustard, Oil, Protein

## YIELD, ECONOMICS AND QUALITY OF GRAIN AMARANTH (*AMARANTHUS HYPOCHONDRIACUS* L.) INFLUENCED BY INTEGRATED WEED MANAGEMENT

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### ABSTRACT

A field experiment to find out yield and quality of grain amaranth (*Amaranthus hypochondriacus* L.) influenced by integrated weed management was conducted during *rabi* season of 2020-21 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The result of experiment indicated that higher values of growth attribute *viz.*, plant height at harvest and yield attribute *viz.*, length of inflorescence were recorded under weed free treatment which remained at par with oxyflurofen @ 50 g a.i./ha (PE) and interculturing *fb* hand weeding at 4 WAS. Significantly the highest grain yield per plant and grain yield were recorded under weed free treatment as compared to rest of other treatments. However, among the integrated weed management treatments oxyflurofen @ 50 g a.i./ha (PE) and interculturing *fb* hand weeding at 4 WAS gave significantly higher grain yield per plant and grain yield as compared to other treatments. Significantly higher straw yield was recorded under weed free treatment which was at par with oxyflurofen @ 50 g a.i./ha (PE) and interculturing *fb* hand weeding at 4 WAS treatment. The maximum net realization was obtained under weed free treatment and it was closely followed by oxyflurofen @ 50 g a.i./ha (PE) and interculturing *fb* hand weeding at 4 WAS. Whereas, the highest B:C ratio was obtained by treatment of oxyflurofen @ 50 g a.i./ha (PE) and interculturing *fb* hand weeding at 4 WAS which was closely followed by weed free treatment.

**Keywords:** Grain amaranth, interculturing, oxyflurofen, weed free and integrated weed management

## LEGUMES VERSUS RHIZOBIA: AN ESTIMATION OF THE COST-TO-BENEFIT OF RHIZOBIAL SYMBIOSIS WITH LEGUMES

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### ABSTRACT

Legumes have the ability to fix atmospheric nitrogen (SNF) through the establishment of a symbiotic association with specific soil-borne rhizobia, thus meeting the majority of their nitrogen (N) needs. However, this symbiosis can become particularly costly for legumes if the rhizobia fails to fix the adequate amounts of N or if the nodulation becomes too important. So, an optimal regulation of this symbiosis is necessary to achieve a maximum return on carbon investment into nodules. To assess this symbiosis we analyzed collected data on three major legumes (common bean (*Phaseolus vulgaris* L.), chickpea (*Cicer arietinum* L.) and faba bean (*Vicia faba* L.)) from multilocation farm trials in the Mediterranean area. This data was used to measure the efficiency in use of rhizobial symbiosis (EURS) which is estimated using the slope of the regression function between plant growth (SDW) and nodule biomass (NDW). SDW was highly correlated with NDW for the three species and the thorough analysis of the EURS allowed the determination of thresholds for optimal nodulation. Our approach allowed the formulation simple assessment guidelines to assist professionals in optimizing nodulation and N<sub>2</sub> fixation which will ultimately improve yields and subsequent benefits of integrating legumes in the farming system.

**Keywords:** Legume, Nitrogen, Nodulation, Symbiotic nitrogen fixation, Efficiency in use of the rhizobial symbiosis

## NUTRIENT RICH COMPOST FROM AYURVEDIC WASTES

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### ABSTRACT

The study utilising the ayurvedic wastes procured from M/s Oushadhi Pharmaceuticals, a Kerala Govt owned ayurvedic medicine manufacturing company was carried out at Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vellanikkara. A total of 135 treatment combinations under CRD design with 3 replications were tried with different sized ayurvedic waste substrates using different level of enrichers like cowdung, quail manure and their mixtures using external biotic agents of two species of fungi and two species of earthworms. The influence of substrates and the enrichers at mesophilic and thermophilic stages of composting were studied and the results showed that unsieved ayurvedic waste composite samples enriched with 5 per cent mixture of cowdung and quail manure was the best substrate for composting. By avoiding sieving of the substrate, huge labour could be avoided and the compost maturity was attained at 48.8 days with C:N ratio stabilising to 11.4. Similarly there was considerable reduction in the lignin, cellulose and hemicellulose content as a result of composting. The crude fibre content of 33.4 per cent of the ayurvedic waste substrate got reduced by composting to 13.9 per cent and similarly the crude lipid content of the substrate got reduced from 6.3 per cent to 0.7 per cent after composting. The crude protein content improved from 12.68 per cent in unsieved ayurvedic waste substrate to 22.6 per cent in the compost which revealed that the ayurvedic medicine manufacturing wastes which is highly proteinacious and with good biodegradability and can act as an ideal raw material for composting purposes which can be degraded in a very less time in a cost effective manner and can be converted into nutrient rich compost using various enrichers like cowdung-quail manure mixture.

**Keywords:** Composting, ayurvedic wastes, cowdung, quail manure



**PRODUCTIVITY OF CHIA (*SALVIA HISPANICA* L.) AS INFLUENCED BY SPACING, ORGANIC NUTRIENT MANAGEMENT AND JEEVAMRUTHA**

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**ABSTRACT**

A field experiment was conducted during *kharif* 2020 to study the effect of spacing, organic nutrient management and jeevamrutha in chia at ZARS, V. C. Farm, Mandya. The experiment was laid out in Factorial RCBD comprising two factors *viz.*, two spacings (45 cm × 15 cm and 60 cm × 15 cm) and six organic nutrient management practices (application of 75 and 100% RDN equivalent compost + application of jeevamrutha at the time of sowing and 30 DAS). Among spacing, 60 cm × 15 cm recorded maximum plant height and number of leaves plant<sup>-1</sup> of 99.55 cm and 113.54, respectively. Whereas, higher seed yield (842 kg ha<sup>-1</sup>), haulm yield (2633 kg ha<sup>-1</sup>), N uptake (57.59 kg ha<sup>-1</sup>), P uptake (9.78 kg ha<sup>-1</sup>) and K uptake (42.90 kg ha<sup>-1</sup>) was recorded with 45 cm x 15 cm. Among organic nutrient management practices, 100% RDN equivalent compost + application of jeevamrutha at the time of sowing and 30 DAS recorded significantly higher plant height (110.87 cm), number of leaves plant<sup>-1</sup> (126.31), seed yield (971 kg ha<sup>-1</sup>), haulm yield (3047 kg ha<sup>-1</sup>), N uptake (63.41 kg ha<sup>-1</sup>), P uptake (11.84 kg ha<sup>-1</sup>) and K uptake (49.49 kg ha<sup>-1</sup>).

**Key words:** Compost, Jeevamrutha, Organic Nutrient Management Practices, Spacing, Seed and haulm yield.

**STUDY ON *IN VITRO* ESTABLISHMENT OF PURPLE NUTSEDGE  
(*CYPERUSROTUNDUS*L.)**

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**ABSTRACT**

*Cyperus rotundus* L. (Purple nutsedge) is one of the world's worst weeds based on its occurrence in 52 crops in 92 countries and its capacity to cause substantial yield losses. It is a grass-like herb with fibrous root system and reproduces extensively by rhizomes and tubers. The tubers contain inert buds and function like the seeds of annuals. The lateral rhizomes will produce primary, secondary and tertiary sprouts, and so on. These chains like underground tubers acting as the primary dispersal units and reproduction. Till now, temporary control can be possible by the application of chemicals. As well *C. rotundus* leaves have waxy surface and its composition would likely have a greater effect on herbicide. The addition of more surfactants to the spray solutions applied improves the herbicide activity. But the success of weed control is mainly depends on the behaviour of sprouting, tuber and nature of chemical compounds, usage of surfactants and uptake pattern of weeds. Based on these circumstances the study was conducted to establish *C. rotundus* under *in vitro* condition by using different media and nutrient composition. MS (Murashige and Skoog) medium fortified with BAP ( $3 \text{ mg L}^{-1}$ ) was found to be optimal in producing more number of shoots ( $3.38 \pm 0.38$ ) per explant and maximum shoot length of  $4.68 \pm 0.18$  was observed in the same medium. Similarly, Kinetin ( $0.5 \text{ mg L}^{-1}$ ) showed  $3.53 \pm 0.44$  shoots per explant and shoot length of  $7.06 \pm 0.26$  cm was observed. The *in vitro* grown plants used for leaf anatomy study and translocation pattern of foliar herbicides with nano composites in tubers of *Cyperusrotundus*.

**Key words:** *Cyperus rotundus*, *In vitro* establishment, Tubers, BAP, Kinetin

## FODDER GRASS STRIPS AN AFFORDABLE TECHNOLOGY FOR SUSTAINABLE RAINFED AGRICULTURE

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### ABSTRACT

To make rainfed agriculture an economically viable enterprise for improving livelihood and welfare of farming community contributing around 40 percent of total food production in India, it is vital to implement best management practices to keep soils healthy, conserve agronomic inputs, minimize environmental impacts, and produce adequate yields. Increase in sudden down pour of rain invites high soil loss from the agricultural field leading to erosion of uppermost soil layer. Permanent fodder grass strips can be effective at checking nutrient removal and trapping sediment visa-a- vice meet the green fodder demand of small ruminants. However, Nutrients removed by erosion create a limitation to land productivity. It was being observed that grass system is useful for the improvement of other soil properties (soil physical and biological properties for example) related to soil erosion control, slope stabilization, and food production. Hence this study brought out the impact of grass strip based cropping system on sustainability of a rainfed farming. The field with grass strip improved in their soil quality from 0.39 to 0.52 in four years of time. This concept of growing grasses on both side of the field (in a strip of one meter) in loamy fine sand to sandy loam textured soils, improves soil health and significantly reduces runoff from the cropped field. A permanent belt of *Brachiariaruziziensis* and *Stylosantheshamata*, two-meter width, was established at every fifteen meters across the direction of slope reduced soil loss by 65-70 percent. This mechanization friendly technology provides sufficient green fodder for the small ruminants. Castor-Redgram rotation with fodder grass strips (especially *Brachiariaruziziensis*) on upper and lower side of the slope fetched better crop productivity thus total returns increased from 1,37,022 rupees/ ha to 1,78,689 rupees/ha. Use of grass strips is low-cost measures for soil conservation especially for slowing down run-off at sudden down pour with high intensity. This study may help researchers and its managers to help farmers with this low cost and viable technology.

**Keyword:** Grass strip, soil quality, surface runoff



**OPTIMIZATION OF EFFICIENT *AGROBACTERIUM TUMEFACIENS* MEDIATED  
TRANSFORMATION IN  
*ALOE VERA***

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**ABSTRACT**

*Agrobacterium*-mediated genetic transformation has become a crucial research tool for the functional characterization of genes and the production of genetically improved cultivars in the area of plant sciences. Effectually, a precocious assessment of genetically modified traits necessitates towering transformation efficiency. Howbeit, the genetic transformation of *aloe vera* is indeed very infrequent and hasn't been widely reported previously. The present study introduces an efficient protocol for *Agrobacterium*-mediated transformation in *Aloe vera* by optimizing a number of parameters, including explant selection, the degree of explant injury during infection, *Agrobacterium* concentration, co-cultivation pH, duration and desiccation of plant tissue. This study accorded an infection efficiency of about 92% by suspending the *Agrobacterium* cells at a concentration of OD<sub>600</sub>: 0.4 in co-cultivation media at pH-5.6 to infect the shoot base of *aloe vera* by desiccation followed by 3 days of co-cultivation. Thereupon, the authenticity of positive transgenic plants was confirmed using the GUS histochemical assay, PCR analysis, and southern blotting. Transformation efficiency of over 7% was obtained, which is higher than the previous reports. This study bestows an improved *Agrobacterium*-mediated transformation protocol based on desiccation in *aloe vera*, which might help in facilitating various gene expression studies and regulation in the aloe vera plant, eventually allowing the modification of aloe species in an effective medicinal manner.

**Keywords:** *Aloe vera*, GUS assay, Southern blotting, Transgenic, Transformation.

**STRUCTURE ANALYSIS AND MOLECULAR SIMULATION STUDY OF ACC  
DEAMINASE MUTANTS FROM *PSEUDOMONAS* SP. AN ENDOPHYTE IN  
REDUCING ABIOTIC STRESS IN PLANTS**

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**ABSTRACT**

Cellular stressors are abiotic or biotic conditions, such as drought, salinity, acidity, and infections, that induce plant damage or disease, as well as an increase in ROS and ethylene production. Endophytes are microorganisms which reside within plants, and share an endosymbiotic relationship with their host to protect the plant from cellular stress. The bacterial endophytes under stress conditions produce ACC deaminase from the *acdS* gene to break down ACC, a precursor of ethylene, which, in high concentrations hinder and retard growth of the plant. ACC deaminase from *Pseudomonas* sp. (PDB ID: 1TYZ) was used for the mutation study and it's the possible effect of single amino acid substitutions using the PredictSNP tool. The mutant E295G (glutamic acid convert to glycine at position 295) was considered, and a simulation for 100ns was run on the E295G mutated ACCD docked with ACC (Compound CID: 535) using GROMACS 2019 version. The average values of the molecular simulation analysis were: MMPSBA= -8.9047, RMSD= 0.2093058013, RMSF= 0.1089223565, SASA= 149.3414, RG= 1.961965. This work indicates the enhancing activity of the ACC deaminase enzyme from the bacterial endophytes rather would aid the mitigation of stress in the plants.

**Keywords:** ACC deaminase, Bacterial endophytes, Abiotic stress, Ethylene, *Pseudomonas* sp., Molecular simulation.

## BIOACTIVITY PREDICTION OF MICROBIAL-DERIVED NATURAL PRODUCTS USING MACHINE LEARNING ALGORITHM

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### ABSTRACT

Microbes synthesize a plethora of natural products which serve as inspirations for designing of agrochemicals. However, due to its huge diversity and hardship in systematic purification, this resource is not yet comprehensively explored. Advance computational techniques such as artificial intelligence can be leveraged to expedite the exploration of microbial-derived natural compounds and their inhibitory bioactivity. In this study, we have developed a quantitative structure-activity relationship (QSAR) model for predicting the bioactivity of microbial-derived natural compounds using machine learning algorithms. Compounds with bioactivity data on pIC<sub>50</sub> were collected and compiled for three categories of microbes, viz. bacteria, fungi, and viruses. The structure of the molecules was represented in a one-dimensional simplified molecular input line entry system (SMILES) format. The symbols used in SMILES notation signify the presence of particular molecular fragments which makes it a simple yet well-equipped representation to describe the essential molecular characteristics related to the activity of the compound. Results from various machine learning algorithms and different data split suggested that random forest was the best performing model in all the three aforementioned categories. The correlation coefficient ranged from 0.57 to 0.63, indicating the structure-activity relation was captured well. The developed model can contribute to automate the process of discovering the biologically active compound of natural origin that can further accelerate the development of eco-friendly agrochemicals.

**Keywords:** Natural product, microbes, machine learning, pIC<sub>50</sub>, QSAR, SMILES



**OVEREXPRESSION OF BANANA *GDP-L-GALACTOSE PHOSPHORYLASE (MAGGP)*  
GENE ENHANCES THE ASCORBIC ACID BIOSYNTHESIS IN *ARABIDOPSIS*  
*THALIANA***

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**ABSTRACT**

L-Ascorbic acid (AsA) is a powerful antioxidant and essential micronutrient for the growth and development of plants and animals. In plants, the Smirnoff-Wheeler (SW) pathway, where the *GDP-L-galactose phosphorylase (GGP)* gene encodes the rate-limiting step, play prominent role in synthesis of AsA. It is a promising candidate to increase the AsA content in crops because the expression of *GGP* is controlled by the interaction of conserved upstream open reading frame (uORF) at the translation stage. In the present study, AsA content was measured in twelve cultivars of banana and where the Nendran cultivar contain the highest AsA content. Five *MaGGP* genes were identified from the banana genome database and based on bioinformatics analysis, three *MaGGP* genes were identified for cloning and then overexpressed in the *Arabidopsis thaliana* (Col-0) to characterize their functional role. Further, a complementation assay was also performed in *A. thaliana* mutant lines carrying vitamin-C mutants (*vtc5-1* and *vtc5-2*). Functional characterization of the *MaGGP* genes afforded a significant enhancement of AsA in the transgenic lines confronting *MaGGP2*. Hence, *MaGGP2* can be considered as a potential candidate for the AsA biofortification in plants. This study lends strong affirmation towards the development of AsA biofortified plants, particularly the staples that sustain the personages in developing countries.

**Keywords:** Ascorbic acid, Complementation, *GDP-L-galactose phosphorylase*, Smirnoff-Wheeler pathway, Vitamin C



## ASSESSMENT OF THE IMPACT OF GENETICALLY MODIFIED COTTON (BT COTTON) ON SOIL MICROBIAL ECOSYSTEM

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### ABSTRACT

Bt cotton which confers resistance to important insect pests of cotton, occupy around 86% of total cotton area in India. Since, GM plants (Bt cotton) have expressing crystal protein gene constitutively, crystal protein produced all the plant parts and its whole life cycle. So it may be considered that GM plants (Bt cotton) has potential to significantly change the functions such as nutrient mineralization, carbon turnover and plant growth through the products of introduced genes or modified rhizosphere chemistry. This study was conducted to observe the effect of Bt cotton (presence of Cry protein in root exudates) on soil enzymes activities (dehydrogenase and urease) at different growth stages and also to assess the impact of Bt protein present in the root exudates of Bt cotton on the functional activity (antagonistic efficiency) of beneficial microbes such as *Trichoderma viride* and *Pseudomonas fluorescens* against *Rhizoctonia solani*. Results showed that dehydrogenase and urease enzymes activity were high in Bt-cotton rhizosphere as compared to non-Bt rhizosphere. Statistically urease enzymes was not significantly differed between Bt and non Bt cotton, but dehydrogenase activity was significantly high ( $P < 0.05$ ) in the Bt cotton rhizosphere as compared to non Bt cotton rhizosphere. Results of *Trichoderma viride* and *Pseudomonas fluorescens* isolated from Bt and non Bt cotton rhizosphere antagonistic study by dual culture method revealed that some variation was observed in the pathogen inhibition percentage between isolates obtained from Non Bt and Bt cotton rhizosphere. Some of the isolates obtained from Bt rhizosphere showed better inhibition than its counterpart. However, the efficiency did not significantly vary between Bt and Non Bt isolates indicating, Bt protein does not have any impact on microbes.

**Key words:** Bt cotton, Crystal protein, Root exudates, Functional enzymes and Antagonistic activity



**ANTI-HYPERGLYCEMIC EFFICIENCY OF THE AQUEOUS SEED EXTRACTS  
OF *MUCUNA PRURIENS* IN NICOTINAMIDE STREPTOZOTOCIN-INDUCED  
DIABETIC *WISTAR* RATS.**

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**ABSTRACT**

This study was undertaken to evaluate the remedial effect of the aqueous seed extract of *Mucuna pruriens* (ASEMP) on the endocrine region of pancreas of nicotinamide-streptozotocin-induced diabetes in *Wistar* rats. The anti-hyperglycemic efficiency of two varieties of *Mucuna pruriens var utilis*; IIHR Selection 3 and Arka Dhanvantari was investigated. Oral administration of ASEMP against the nicotinamide-streptozotocin-induced diabetes in the *Wistar* rats showed anti hyperglycemic effect on the blood glucose level ( $94 \pm 0.2$  mg/dl ASEMP 400 mg/kg) when compared with the control group ( $92 \pm 0.2$  mg/dl glibenclamide 5 mg/kg), ( $248 \pm 0.3$  mg/dl Diabetic control) and ( $90 \pm 0.3$  mg/dl Normal control). Significant reduction in creatinine level of the nicotinamide-streptozotocin-induced diabetic rats treated with ASEMP was also recorded. Histopathology examination of the endocrine region of pancreas of the rats revealed restoration of pancreatic islet cells in the diabetic-ASEMP treated rats as the beta cell mass increased and necrotic changes was reduced significantly in contrast with the diabetic control group which showed degenerated pancreatic islet cells. Therefore, this study supports and recommends the exploration of the aqueous seed extract of *M. pruriens* as a complementary medicine for the management of type-2 diabetes.

**Keywords:** *Mucuna pruriens*, Glibenclamide, Type-2 diabetes, Anti-hyperglycemic activity, Histopathology.

**PLANT GROWTH PROMOTING *BACILLUS FLEXUS* M2 IMPROVES *BRASSICA NIGRA* ARCHITECTURE UNDER CADMIUM STRESS**

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**ABSTRACT**

Contamination of agricultural land by Cadmium (Cd) is a worldwide risk that has increased noticeably since the beginning of the industrial revolution. Hence, there arises the demand to conserve agricultural soil. Considering agronomical issues due to Cd pollution, the present study is designed to study about the efficiency of Cd tolerant plant growth-promoting rhizobacterial strain *Bacillus flexus* strain M2 (MT459138). The rhizobacterial strain M2 exhibited strong tolerance to Cd (250, 500, 750 and 1000 $\mu$ M) along with NaCl (5%). FTIR analysis on the rhizobacterial strain M2 revealed changes on its cell surface during Cd interaction and TEM analysis on Cd stressed M2 cells showed intracellular Cd accumulation. The rhizobacterial strain M2 produced 37.59  $\mu$ g/mL of IAA, 56.94  $\mu$ g/mL of ammonia and 20.89  $\mu$ g/mL of EPS. In addition, the rhizobacterial strain M2 showed positive results on phosphate solubilization as well as siderophore, protease, amylase and catalase production under Cd stress. The rhizobacterial strain M2 stimulated the growth of test crop *Brassica nigra* under Cd stress by improving the root, shoot systems and photosynthetic pigments. Thus, the present findings strongly suggest that the rhizobacterial strain M2 could be a better alternative source for enhancing food crop productivity even under Cd polluted agricultural soil.

**Keywords:** Plant growth promoting rhizobacteria, Cadmium, FTIR, IAA, Ammonia

## PHYTOREMEDIATION CAPABILITY OF THE UNDERUTILIZED AQUATIC LEGUME OF MANIPUR: NEPTUNIA OLERACEA LOUR.

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### ABSTRACT

North Eastern region of India is recognized as the biodiversity hotspot due to its enormous diversity in flora, fauna and a great diversity has also been observed in aquatic plants growing in this region. *Neptunia oleracea* Lour. commonly known as water mimosa or water sensitive plant which is underutilized wild aquatic legume in Manipur. In India, the plant is distributed in Assam, Manipur and Tripura in North-East India. In Manipur, this plant is used as a vegetable by the Meitei's and the distinct feature of this plant is that it has the ability to accumulate heavy metal. From the study of phytoremediation potentiality it has the capability to remove of about sixty percent of the arsenic present in water which might be useful to develop suitable technology to remove excess arsenic in freshwater systems as well as underground in major contaminant area. *Neptunia oleracea* Lour. also has high crude protein, potassium, calcium, ash content, low crude fat and high content of some important minerals, such as potassium and calcium making it nutritionally superior aquatic plant.

**Keywords:** *Neptunia oleracea* Lour. Phytoremediation, Arsenic.

## EFFECT OF TOPRAMEZONE ON WEED DENSITY, YIELD ATTRIBUTES AND YIELD OF IRRIGATED MAIZE

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### ABSTRACT

Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2020 to find out the effect of Topramezone on weed density, yield attributes and yield of irrigated maize. The experiment was laid out in a Randomized Complete Block Design (RCBD) with the following treatments *viz.*, T<sub>1</sub> – Weedy check, T<sub>2</sub> – Weed free check, T<sub>3</sub> – Atrazine 1kg/ha (PE) *fb* HW at 25 DAS, T<sub>4</sub> – Atrazine 0.75kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T<sub>5</sub> – Atrazine 0.75kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T<sub>6</sub> – Atrazine 1kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T<sub>7</sub> – Atrazine 1kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T<sub>8</sub> – Topramezone 25.2 g/ha + Atrazine 0.75kg/ha at 15 DAS and T<sub>9</sub> – Tembotrione 120 g/ha + Atrazine 0.75kg/ha at 15 DAS and replicated thrice. Experimental results revealed that weed management practices evinced significant influence on grassy weeds and broad leaved weeds (BLW). Application of Topramezone at 25.2 g/ha + Atrazine at 0.75kg/ha on 15 DAS (T<sub>8</sub>) recorded lesser grassy weed count of 25.7 No/m<sup>2</sup> which was on par with T<sub>6</sub>, T<sub>4</sub> and T<sub>9</sub> but was superior to T<sub>7</sub> and T<sub>5</sub>. With respect to sedges, there was no significant influence of treatments. Nevertheless, application of Atrazine at 0.75kg/ha (PE) *fb* Tembotrione at 120 g/ha on 25 DAS (T<sub>5</sub>) and Atrazine at 1kg/ha (PE) *fb* Tembotrione at 120 g/ha on 25 DAS (T<sub>7</sub>) recorded lesser count of 0 and 0.3 No/m<sup>2</sup>, respectively. Both the post emergence herbicides *viz.*, Topramezone and Tembotrione were highly effective in controlling BLW. Weed management practices exerted significant influence on yield attributes of maize except grain rows/cob and 100 seed weight. In respect of herbicides, application of Topramezone at 25.2 g/ha + Atrazine at 0.75kg/ha on 15 DAS (T<sub>8</sub>) recorded higher yield (7764 kg/ha), net return (Rs. 74,840 ha<sup>-1</sup>) and B: C ratio (2.38) in maize.

**Keywords:** Maize, Topramezone, effect, weed density, yield.



## SEMANTIC VEGETATION SEGMENTATION USING VISIBLE SPECTRAL COLOUR INDICES AND COLOUR MODELS

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### ABSTRACT

Semantic segmentation of vegetation from the soil background in field images is of great importance for crop weed identification for spot spraying. As detection sensor a Logitech webcam was used. The lower and upper threshold values of excess green index (ExG), excess green minus red index (ExGR) and CIELAB colour model were found to be 20 and 200, 0 and 190, and 0 and 120, respectively. The classification accuracy of ExG, ExGR and CIELAB colour model with finalized threshold values were tested on several plant images captured at fixed illumination intensity. The average precision, recall and F1-score were found to be 0.70, 0.87 and 0.77 for ExG, 0.84, 0.86 and 0.84 for ExGR, 0.96, 0.93 and 0.94 for CIELAB colour model. The CIELAB colour model showed highest classification accuracy than other colour indices. The results of study act as basis for several tasks such as identification of crop rows and crop-weed identification etc.

**Keywords:** Colour indices, Image processing, Semantic segmentation, Vegetation segmentation, Weed detection sensor

## EFFECT OF GASEOUS OZONE TREATMENT ON THE QUALITY OF CHICKPEA GRAINS

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### ABSTRACT

Pulses are high source of vegetarian protein as compared to cereal proteins and majorly consumed in India and other countries with a paucity of high-quality animal protein availability. Among the pulses, chickpea is the second most significant pulse crop, and it is grown in about thirty-five nations worldwide. Ozone as a potential chemical-based fumigant to control stored-grain insects and has attracted attention recently owing to its advantages of easy generation at the treatment site and no chemical residues. Understanding the effect of ozone gas in the mass of grains is essential for the development of a protocol for its use as a fumigant. The gaseous ozone treatment of varying doses (500-1000 ppm) was given to chickpea grains. The qualitative analysis and quantitative analysis of the ozone-treated, as well as control samples, were evaluated. The major changes were observed in many nutritional aspects (protein, amino acid, fatty acids, structural properties, rheological, phytochemicals) and changes were seen by ozone treatment. Considering all the benefits from ozonation concerning the improvement in the nutritional status, this technology may be implemented at the industrial level for treating the crops like chickpea.

**Keywords:** pulses, chickpea, ozone, protein, structural property

## STORAGE STUDIES OF SORGHUM IN CHITOSAN COATED BAGS

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### ABSTRACT

Chitosan is the most abundant and biodegradable biopolymer derived from chitin, which is the second largest renewable resource after cellulose in the world. It has been considered generally recognised as safe (GRAS) by the US FDA since 2005. It is a new avenue in the storage of food grains as it acts as a bio-degradable packaging material. Food grains, namely sorghum, was selected for the purpose of determining the effectiveness of the chitosan coating on insect infestation during storage. The dip and pad cure method was employed for the chitosan coating of packaging materials. The optimised chitosan concentration and viscosity used for coating were 2% chitosan in 2% glacial acetic acid solution and  $78 \pm 0.3$  cp, respectively. Packaging materials used were hessian jute fabric, cloth, and jute laminated PP fabric. It was observed that all the coated bags had lower water vapour permeability, good mechanical properties, and improved gas barrier properties. Sorghum was stored for 90 days in coated and uncoated bags of 500 g capacity with an artificial infestation of lesser grain borer and rice weevil. In Sorghum after 90 days of storage with artificial infestation, it was found that the best packaging material was chitosan coated jute bags with lower cumulative grain damage ( $2.51 \pm 0.01$  %), weight loss ( $1.52 \pm 0.02$  %), and powder residue ( $1.56 \pm 0.01$  %) and with biochemical properties viz protein  $9.87 \pm 0.02$  %, total phenols  $30.01 \pm 0.02$  mg/100 g, tannins  $28.9 \pm 0.06$  mg/100 g and antioxidant activity  $375.02 \pm 0.02$   $\mu$ g/g and achieved faster mortality of insects. The cumulative grain damage (10.94%), weight loss (6.84%), and powder residue (3.74%) were found to be the highest in the uncoated cloth bags with sorghum. The best results were found in coated bags, and the poorest treatment was found in uncoated. The findings showed that chitosan coated Jute bags can prevent storage losses even in infested sorghum without the use of insecticide, with physiochemical stability.

## INDIGENOUS BACTERIA AS POTENTIAL BIOREMEDIATORS FOR SOILS CONTAMINATED WITH HEAVY METALS

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### ABSTRACT

Heavy metal pollution is one of the most serious environmental problems facing our planet today, and immediate solutions are needed. Heavy metals such as Lead, Mercury, and Cadmium have no biological function and are highly toxic even at a low concentration. Unlike organic pollutants, heavy metals are not converted to simpler forms by chemical or biological methods, they can only be transformed into less toxic species. In this context, the current work investigates the use of *Paenibacillus* sp. in a non-toxic, environmentally acceptable method for the degradation of heavy metals. This study describes the enrichment isolation method and in-depth characterization of the *Paenibacillus* strain, designated as A10, that was isolated from soil samples from industrial areas of SIDCUL, Pantnagar, Uttarakhand, India (28.9787° N, 79.3851° E). The strain A10 was rod-shaped, Gram-stain-positive, endospore-forming, aerobic, and catalase positive. Strain A10 was isolated from diluted soil samples that were inoculated in Luria Bertani media and seeded with heavy metal granules as a carbon source. The biodegradation of heavy metals by the selected strain during enrichment was confirmed by the AAS analysis of both the control and treatment. The growth pattern of the bacterial isolate in presence of heavy metals at different intervals is also exhibited using UV-Vis Spectrophotometer at 600nm.

**Keywords:** Heavy metal, Indigenous bacteria, Bioremediation, Soil contamination



## DEGRADATION OF DIESEL OIL BY INDIGENOUS BACTERIA ISOLATED FROM CONTAMINATED SOILS

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### ABSTRACT

With the increasing demand for oil, and oil products, in various fields, petroleum hydrocarbon pollution (PHP) is becoming more serious. Such pollution damages both marine, and terrestrial ecosystems and has attracted much attention. Petroleum hydrocarbons include alkanes, cycloalkanes, polycyclic aromatic hydrocarbons, and many other organic pollutants which are considered as carcinogenic, mutagenic & potential immunotoxicant. Compared with various traditional physico-chemical treatments, biodegradation is more environmentally friendly, cost-effective, and efficient, hence gaining increased acceptance for the remediation of oil polluted soils. In this regards, the present study attempts to determine the petroleum hydrocarbon degrading potential of indigenous bacteria strain designated as D-12, isolated from diesel oil contaminated soils collected from automobile workshops in Haldwani, Uttarakhand (29.2183° N, 79.5130° E). According to the 16S rRNA sequences analysis, isolated strain D-12 was identified as *Rhodococcus spp.* Isolated bacteria was inoculated into the nutrient broth medium supplemented with 1% (v/v) diesel oil and incubated at 30°C & 120 rpm for 7 days in rotary shaker incubator. The growth of bacteria was determined spectrophotometrically by taking OD at 600 nm & its degradation potential was determined gravimetrically. FTIR analysis of fresh & biodegraded diesel oil was also performed to determine the change in the composition of diesel oil after being subjected to bacterial degradation.

**Keywords:** Diesel oil, Bioremediation, Soil Contamination, Indigenous bacteria

**ETHNOBOTANICAL AND COMMERCIAL VALUE OF *CYNODON DACTYLON* (L.) AND *OCIMUM SANCTUM* (L.) FOR THE SUSTENANCE OF LIVELY HOOD OF FARMERS**

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**ABSTRACT**

*Cynodon dactylon* (Linn.) popularly known as Dub grass which belongs to the family Poaceae and *Ocimum sanctum* is commonly known as *holy* basil which belongs to the family Lamiaceae. *Ocimum sanctum* is known as Queen of herbs plant for beneficial effects of its different parts. These species are cosmopolitan in nature and predominantly exists in terrestrial ecosystem. These herbal plants are locally popular and important plants for its medicinal and religious importance. In the present conditions like scarcity of rainfall, increased pest and disease incidence in food crops and labor shortage, the introduction of these herbal plants in the small farm holdings will increase the income of poor and marginal farmers. In addition, thulsi and cynodon plants are highly demanding medicinal plants in Ayurveda for curing many common diseases of human beings and animals and also economical plants of garland value. Based on the concepts, the observation was made in the herbal plants available in the medicinal park of this college. Among the herbal plants, Tulsi and Cynodon plants were found to be the best growing perennial plants throughout the year. Based on the above growth habits, the phyto chemical constituents of the plants were analyzed and found that the plant extracts of *C. dactylon* and *Ocimum sanctum* contains alkaloids, cardiac glycosides, terpenoids and steroids, saponins, phenolic compounds and flavonoids, tannins, carbohydrates and proteins. The result of survey with *C. dactylon* and *Ocimum sanctum* garland sellers in the important temples in this region indicated that the revenue was higher during religious auspicious days in addition to daily selling normal income.

**Keywords:** Plant biology, photomedicine *Cynodon dactylon*, *Ocimum sanctum*, sustainable lively hood



## WASTE-TO-WEALTH, TOWARDS A SUSTAINABLE ZERO-WASTE IN A CIRCULAR ECONOMY: AN OVERVIEW

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### ABSTRACT

Wastes, mostly is regarded as unwanted and harmful materials, produced as a result of man's interaction with nature in an unsustainable manner. Wastes, is mostly regarded as unwanted and harmful materials, are produced as a result of man's interaction with nature in an unsustainable manner. There are few things certain in life – one is death, second is change and the other is waste.” No one can stop these things to take place in our lives. But with better management we can prepare ourselves. Each of us has a right to clean air, water and food. This right can be fulfilled by maintaining a clear and healthy environment. The industrial revolution and rapid population growth have put immense pressure on natural resources, leading to waste accumulation and contamination of the environment. Nature presents a well-defined notion of cycling as in an ecosystem nothing is waste. The concept of waste is actually introduced by inducing anthropogenic activities to the natural environment through the principles of the linear economy. In human perception, waste is anything that is unwanted and/or unusable. This leads the World Bank to predict an increase (about 70%) in the global waste generation by 2050, if not managed. The circular economy can provide a revolutionary opportunity to manage the production, consumption, and utilization of goods, products, natural resources, and assets in a sustainable manner. The circular economy includes recycling, thereby eliminating the waste and introducing the generation of “wealth from waste.” Different strategies can be applied to achieve the successful application of a circular economy in solid waste management. These include most commonly 3R (reduce-reuse-recycle) to innovative business models, eco-design, and energy-efficient products. Therefore, the concept of a circular economy provides a dynamic sector, which continuously develops in a way to achieve the zero-waste generation economy. The present article aims to map the idea of circular economy in waste management and also seeks to explore the complexities and problems associated with the multiple cycling and material downcycling.

**Keywords:** Sustainability, Waste, Circular economy, Zero waste



## **IDENTIFICATION AND CHARACTERIZATION OF ANTIMICROBIAL PEPTIDES DERIVED FROM URINE AND ITS PUTATIVE CLINICAL APPLICATION AGAINST PATHOGENIC MICROBES**

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### **ABSTRACT**

Antimicrobial resistance problems are currently the biggest challenge in the globe. Antibiotic overuse and abuse leads to the emergence of numerous drug-resistant bacterial strains. Hence the urgent necessity for a different therapeutic approach. Compared to cattle, the buffalo (*Bubalus bubalis*) is considered to have higher disease resistance. Certain urinary peptides possess antimicrobial properties due to their distinct amino acid composition and physicochemical properties. In an attempt to check the activity of urine-derived antimicrobial peptides; urine from heifer, pregnant and lactating groups were collected to study the physiology driven changes in the peptide repertoire. Small endogenous peptides were concentrated by ultrafiltration with 10 kDa molecular weight filter followed by Solid Phase Extraction. LC MS/MS analysis of the peptide fraction from the three groups were conducted; high score 300, 523 and 1110 peptides were identified using Trans Proteomic Pipeline from lactating, pregnant and heifer group respectively. Upon challenging *Staphylococcus aureus* and *Escherichia coli* with the urinary crude peptide isolate of each group by Kirby's Disc Diffusion method, wide zone of inhibition were observed. The study ensures the antimicrobial effect of urine-derived peptides and can be further explored for its therapeutic application.

**Keywords:** Buffalo, Antimicrobial peptides, Urine peptides, Antimicrobial resistance, Antimicrobial, Therapeutic

**A COMPARATIVE STUDY ON ANTI-OXIDANT PROPERTIES OF AQUEOUS, METHANOLIC AND CRUDE HESPERIDIN EXTRACT OF MANDARIN ORANGE PEEL (*CITRUS RETICULATA*) WITH A FLAVANONE COMPOUND HESPERIDIN**

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**ABSTRACT**

The role of antioxidant is indispensable to protect the cellular damage owing to different stress factors. This is associated with impairing the immune system and growth in animal husbandry. The usage of synthetic antioxidants in the feed may show a carcinogenic effect, so the present experiment focused on the natural antioxidant considering the eco-friendly and health safety organic substances. The wastage of orange peel (OP) can be a potential source of organic antioxidant, which is evaluated with FRAP and DPPH in-vitro assay at different concentrations compared to flavanone compound Hesperidin. The experiment resulted with aqueous extract has shown better antioxidant activity than that followed with methanol extract and crude hesperidin extract.

**Keywords:** Antioxidant, Orange peel extract, Hesperidin, FRAP, DPPH



## **INTEGRATED RESOURCE MANAGEMENT FOR SUSTAINABLE AND QUALITY FOOD PRODUCTION**

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### **ABSTRACT**

Food shortage is due to a lack of access to water, energy, protection from floods, rights, and recognition. Among the lines by which agricultural research can increase rural prosperity, natural resources management deals with a multifarious nexus of issues, with trade-offs is among issues that are in several stages of recognition, innovation, scenario synthesis, and creation of need for policy changes. There are issues associated with intensive cultivation, deforestation, and soil erosion and soil fertility decline, water shortage, livestock feed, and fuelwood crisis. The acts of improper farming and management practices are creating major challenges to the sustainability of the natural resources and for maintaining ecological balance. These factors often interact with each other leading to a re-enforcing cycle of the shortage, food insecurity and natural resources degradation issues. To tackle these issues, a sustainable natural resources management, which makes an organized effort to enhance soil and land productivity; agroforestry development and other rural energy sources; livestock improvement, low-cost rainwater harvesting system, and expanding the livelihood base within the non-farm sector. A key element approach is the presence of co-operative based organizations, which might play a key role in the empowerment of local people and supply greater incentives to manage and utilize their natural resources sustainably.

**Key words: Agriculture, Sustainability, food production**



## ACUTE AND CHRONIC TOXICITY OF MERCURY IN FISH

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### ABSTRACT

Acute and chronic toxicity of mercury (mercuric chloride, HgCl<sub>2</sub>) were determined in Zebra fish. For acute toxicity study; twenty-four fish were divided in 4 groups, with each group consisted of six fish. Group 1 (Normal Group) which served as control, was not administered with mercury (tested drug). However, groups 2 to 4 (Drug Toxicity Groups) were administered with mercury @ 250 µg, 500 µg and 750 µg/L, respectively. No mortality was observed in the group from 1 to 3 up to 96 hrs. However, there was 50 % mortality in group 4 observed up to 96 hrs. For chronic toxicity study; twenty-four fish were divided in 4 groups, with each group consisted of six fish. Group 1 (Normal Group) which served as control, was not administered with mercury (tested drug). However, groups 2 to 4 (Drug Toxicity Groups) were administered with mercury @ 300 µg, 350 µg and 400 µg/L, respectively. No mortality was observed in the fish group from 1 to 4 up to 30 days. The results indicate that the toxicity of mercury is dose and time dependent, suggesting that mercury at higher dose for prolonged period causes more toxicity.

**Keywords:** Fishes, Toxicity, Mercury, Mortality



**EFFECT OF DIETARY SUPPLEMENTATION OF PEB-1 FORMULATION  
CONTAINING PHYTOCOMPOUNDS FROM *PHYLLANTHUS NIRURI*,  
*ASPARAGUS RACEMOSUS* AND *ANDROGRAPHIS PANICULATA* ON GROWTH,  
FEED CONVERSION RATIO (FCR) AND SURVIVAL OF *HYPSELOBARBUS  
PULCHELLUS* FINGERLINGS**

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**ABSTRACT**

Antimicrobial Resistance (AMR) is a global concern arising due to unscrupulous usage of antibiotics and other chemical-based growth promoters in the dairy, poultry and aquaculture sector for better growth and productivity. In the present study PEB-1 formulation containing phyto-compounds in the ratio of *Phyllanthus niruri*-50 %, *Asparagus racemosus*-25 % and *Andrographis paniculata*- 25 % was prepared and its prebiotic properties were evaluated in *Hypselobarbus pulchellus* fingerlings. The pelleted feed with 30 % protein was prepared with incorporation of prebiotic @ of T1=9 %, T2=6 %, T3=3 %, T4=1 %, T5= 0 % (V/W). Feeding experimental trial was conducted for 90 days in cement cisterns (16 m<sup>2</sup>) with the stocking density @ 1 fish/m<sup>2</sup>. After feeding trial, the treatment fed with pre-biotic @ 6 % (T2) and 3 % (T3) showed better weight gain and FCR than other treatments. The outcome suggests that the PEB-1 formulation may be an alternative to antimicrobial based growth promoters use in freshwater aquaculture.

**Keywords:** Antimicrobial Resistance, Phytochemicals, PEB-1 formulation, Growth promoter, *Hypselobarbus pulchellus*



## DEVELOPMENT AND COMPARISON OF REGRESSION MODELS FOR DETERMINATION OF STARCH IN CHICKPEA USING NIR SPECTROSCOPY

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### ABSTRACT

Crop quality characteristics are rapidly and efficiently assessed using near infrared spectroscopy. Over the last several decades, the advent and broad application of NIR spectroscopy has been a huge success story in analytical technology development. NIR spectroscopy is frequently used in agriculture and food goods to identify and quantify an almost unlimited number of analytes. The near infrared area has a wavelength range of 800 to 2500 nm. Machine learning approaches have proven to be extremely successful at predicting various agricultural crop components. The concentration of starch component in Chickpea (*Cicer arietinum* L.) whole grain flour was determined using NIR spectroscopy data and machine language algorithms in this work. The Artificial Neural Network (ANN), Linear Regression (LR), Decision Tree Regression (DTR), Partial Least Squares Regression (PLSR), and Support Vector Regression (SVR), as well as Random Forest (RF), were used in this investigation. The created models were validated using the Root Mean Square Error (RMSE) and Coefficient of Determination ( $R^2$ ). When all six models are compared, the PLSR and RF models come out on top in terms of accuracy and prediction ability in the shortest amount of time.

**Keywords:** Support Vector Regression, Artificial Neural Network, Chickpea, Near Infrared Spectroscopy, Random Forest, Linear Regression, Partial Least Squares Regression



**ASSOCIATION AND MULTIVARIATE REGRESSION ANALYSIS OF GRAIN  
YIELD AND YIELD CONTRIBUTING TRAITS IN MAIZE (*ZEA MAYS* L.)**

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**ABSTRACT**

In order to effectively carry out a breeding program, one needs to take into account the direction and magnitude of correlation between yield and its attributes, as well as the relative importance of each attribute. The interrelationships of 11 quantitative traits in 25 genotypes of maize (days to 50 per cent tasseling, days to 50 per cent silking, days to 75 per cent dry husk, plant height, ear height, number of kernel rows per cob, number of kernels per row, cob girth, cob length, hundred grain weight and grain yield) were analyzed. First two principal components with more than one eigenvector were identified by Principal Component Analysis (PCA), explaining cumulatively 73.0 % of the total variance. Results from the association study showed that, there is a significant correlation between cob length, hundred grain weight, number of kernels per row, and number of kernel rows per cob and grain yield, both genotypically and phenotypically. The stepwise regression analysis showed hundred grain weight, cob length and number of kernels per row had considerable effect of grain yield. Hence, it would be rewarding to lay emphasis on these while selecting for higher yield.

**Keywords:** Maize, PCA, Correlation, Stepwise Regression.



## **RNAI TECHNOLOGY- A BOON FOR CROP IMPROVEMENT**

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### **ABSTRACT**

RNA interference (RNAi) is a method of blocking gene function by inserting short sequences of ribonucleic acid (RNA) that match part of the target gene's sequence, thus no proteins are produced. Since Science named it as "Breakthrough of the Year" and Fortune magazine hailed it as "Biotech's Billion Dollar Breakthrough" in 2003, RNAi has significantly gained prominence as the method of choice for researchers sleuthing the structure and function of important genes. RNAi has provided a way to control pests and diseases, introduce novel plant traits and increase crop yield. Using RNAi, scientists have developed novel crops such as nicotine-free tobacco, non-allergenic peanuts, decaffeinated coffee, and nutrient fortified maize among many others. A major challenge in the post-genomic era of plant biology is to determine the functions of all genes in the plant genome. Compared to other techniques, RNAi offers specificity and efficacy in silencing members of a gene or multiple gene family. In addition, the expression of dsRNAs with inducible promoters can control the extent and timing of gene silencing, such that essential genes are only silenced at chosen growth stages or plant organs.

**Keywords:** RNA, RNAi, gene silencing, dsRNA

## CYTOGENETIC EFFECTS OF PESTICIDES IN ONION (*ALLIUM CEPA* L.) ROOT TIP CELLS

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### ABSTRACT

Extensive use of chemical pesticides in agriculture becomes hazardous to the environment as well as living beings. Nowadays, biopesticides have been used as a safer alternative. Cytogenetic analysis is needed to determine the genetic effects of chemical and biopesticide in plants if these are used frequently in an improper concentration. In this investigation the effects of a chemical systemic insecticide 'Actara 25WG' and a bioinsecticide 'Bio Sona' were assessed for seed germination and on root mitosis of five onion varieties. Three concentrations of Actara 25WG were used as seed treatment *viz.*, 25 g, 50g (recommended) and 75 g kg<sup>-1</sup> seed. Similarly, Bio Sona was applied @ 2%, 5% (recommended) and 8% concentrations. Depressing effects of the two pesticides were recorded in seed germination percentage except Bio Sona 2% in variety Bhima Shakti. Actara 25WG and Bio Sona showed either mitoenhancing or cytotoxic effect depending on dose and variety. These pesticides induced genotoxicity at recommended and higher doses on root tip cells (binucleate cells, clumps, stickiness, disturbed stage, laggards, bridges and fragments). There was differential response of the varieties to the pesticide treatment. More research is needed to study the genetic effects of chemical as well as biopesticide in plants.

**Keywords:** cytotoxicity, genotoxicity, total abnormal percentage, mitotic index, biopesticide

**EFFECT OF ETHYLENE ADSORBENTS IN THE QUALITY IMPROVEMENT OF MICRO-SHOOT FROM NODAL SEGMENTS IN SWEET ORANGE (*C. SINENSIS* L.) CV. MOSAMBI**

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**ABSTRACT**

The present investigation was carried out in ICAR-National Institute of Plant Biotechnology, ICAR-Indian Agricultural Research Institute, New Delhi during 2020 to 2022. The investigation was based on the development of an improved reliable protocol for multiplication of plantlets from nodal segments of sweet orange cv. Mosambi by the use of different growth regulators and ethylene absorbents. MS medium was supplemented with different cytokinins (BAP and Kinetin) at different concentrations (1, 1.5, 2 and 2.5 mg L<sup>-1</sup>) individually and in combinations to study the shoot organogenesis from nodal segments. Among the tested PGRs, BAP 2 mg L<sup>-1</sup> and kinetin 1.5 mg L<sup>-1</sup> resulted in best shoot organogenesis with the highest response (81.40%), No. of micro-shoots/explant (2.06), mean micro-shoot length (1.30 cm) and No. of leaves/micro-shoot (3.55) owing to synergistic effect of these factors. However, the regenerated micro-shoots failed to establish due to 100% leaf abscission and mortality of micro-shoot. To retard the effect of ethylene accumulation on the regenerated micro-shoots, two types of ethylene adsorbents namely, AgNO<sub>3</sub> (1, 3 and 5 mg L<sup>-1</sup>) and Ag<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (20, 40 and 60 μM) were tested at different concentrations along with cytokinin (BAP 2 mg L<sup>-1</sup> and kinetin 1.5 mg L<sup>-1</sup>). Addition of AgNO<sub>3</sub> 3 mg L<sup>-1</sup> to the medium improved No. of micro-shoots/explants (2.14) and micro-shoot length (3.20 cm) whereas Ag<sub>2</sub>S<sub>2</sub>O<sub>3</sub> at 20μM led to significant reduction in shoot abscission rate (3.96) and enhanced the total chlorophyll content (3.40 mg g<sup>-1</sup> FW) three times as compared to control. Rooting of micro-shoots was recorded highest (81.12%) with the supplementation of NAA (1 mg L<sup>-1</sup>), which also resulted in promoting the number of roots/explant (4.52) and mean root length (5.26 cm). The supplementation of ethylene adsorbents during in vitro micro-shoot multiplication significantly improved their quality and establishment of protocol which can be used for different citrus genotypes.



## INFLUENCE OF INDOLE-3-BUTYRIC ACID (IBA) ON ROOTING ABILITY OF *BOUGAINVILLEA SPP.*

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### ABSTRACT

The Nyctaginaceae (Four o'clock) family of plants includes the evergreen attractive shrub genus *Bougainvillea*, which comprises 14 species, three of which are significant horticulturally. The *bougainvillea* plant thrives best in tropical climates without harsh frost. In the house corridor, office, and play areas, it is utilised to adorn fences and arbours with vivid colour displays. In order to look into how varying IBA (indole-3-butyric acid) concentrations affect the capacity of hardwood cuttings to take root. Treatments included 1750, 2000, and 2250 ppm IBA in addition to control (without IBA). After being treated with IBA solution for ten seconds, the cuttings were immediately placed in the rooting medium. Sand and cocopeat in the rooting media aid to hold water and provide humid conditions that make it simple for roots to form. A completely randomised design (CRD) with two replications was used to evaluate the treatment. The results showed a substantial difference in rooting % between the IBA treatment and the control. Cuttings were given IBA hormone treatments, and when compared to other treatments and the control treatment, the maximum rooting rate was 2250 ppm. And the treatment of 2000 ppm revealed the maximum root number, root length, and root fresh weight. Due to food that is kept in cuttings, this study demonstrated that the hard wood section of plants aids in the early induction of roots. It is one of the suitable method for propagation of *bougainvillea* plants.

**Key words:** *Bougainvillea* hardwood cuttings, Indole-3-butyric acid (IBA), Root dip method

## STUDIES ON POLYMER SEED COATING WITH NUTRIENTS AND PESTICIDES ON GROWTH AND YIELD OF RADISH (*RAPHANUS SATIVUS* L.)

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### ABSTRACT

The present investigation entitled “Studies on Polymer Seed Coating with Nutrients and Pesticides on Growth and Yield of Radish (*Raphanus sativus* L.)” was carried out using cv. Pusa Himani. The experiment was laid out in Randomized Complete Block Design (RCBD) with 15 treatments comprising of different combinations of polymer with nutrients and pesticides, in the Research Farm of Department of Vegetable Science for two years (2016 and 2017). The observations in field were recorded on field emergence (%), days to marketable maturity, number of leaves per plant, top length (cm), leaf length (cm), leaf width (cm), root length (cm), root diameter (mm), gross root weight (g), net root weight (g), root/top ratio: length basis & weight basis and root yield per plot (kg) and per hectare (q). Analysis of variance showed significant differences among the treatment combinations for all the characters studied. Experimental results revealed that polymer seed coating @10 ml+ NPK (19:19:19) @ 5g+ carbendazim @ 2g+ imidacloprid @ 3ml/kg seed was found superior over all treatments in terms of most of the growth and yield characteristics in both years i.e. 2016 and 2017. Therefore, coating the seeds of radish with polymer @10 ml+ NPK (19:19:19) @ 5g+ carbendazim @ 2g+ imidacloprid @ 3ml/kg seed can be recommended for getting higher yield of radish in Himachal Pradesh after multilocational testing.

**Keywords:** Polymer seed coating, nutrients, insecticides, growth and yield, radish

## INFLUENCE OF FISH AMINO ACID ON THE GROWTH, YIELD AND QUALITY OF AMARANTHUS

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### ABSTRACT

Vegetables form an indispensable part of the daily diet, Amaranthus is the most popular vegetable consumed by people. In the present situation, organically grown vegetables are gaining importance due to increased health consciousness and free of pesticide residue. Use of foliar formulations is gaining importance in crop production owing to its quick response in plant growth. An experiment was undertaken to assess the influence of foliar application of organic liquid manures on the growth, yield and quality of *Amaranthus dubius* var. Co-1 at Horticultural College and Research Institute for Women, Tiruchirappalli. In this study, eight treatments viz., foliar spray of vermiwash (5%), composite manure of groundnut cake + neem cake + poultry manure (1:0.5:0.5), egg amino acid (EAA 0.2%), fish amino acid (FAA 0.1%), cowpea sprouted extract (2%), PPFM (2%), urea (2%) and control were compared. All the bio inputs recorded higher yield than urea and control. The highest shoot length (24.50 cm), number of leaves (20.41), leaf area (150.35 cm<sup>2</sup>), Magnesium (126.22 mg/100g) and calcium content (390.00 mg/100g) was observed in the plants treated with FAA (0.2%). Organic sprays viz., FAA, EAA and vermiwash could be used as a valuable organic liquid fertilizer for better yield without the harmful effects of chemical fertilizers.

**Keywords:** Amaranthus, Organic spray, FAA, PPFM, EAA, Sprouted extracts





## EFFECT OF INM ON VIABILITY AND VIGOUR OF CORIANDER SEED AFTER ARTIFICIAL AGEING

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### ABSTRACT

Artificial ageing is one of the most useful and quick test used for the estimation of viability and vigour. The goal of this study was to determine how different phases of accelerated ageing, such as 24, 48, 72, 96, and 120 hours at  $40\pm 1^\circ$  C and 100% relative humidity, influenced seed viability and vigour. The study was conducted in a completely randomised design in the Department of Seed Science and Technology, CCS Haryana Agricultural University, Hisar, for two consecutive years, 2017 and 2018 with eighteen treatment combinations of organic manures (*viz.*, Farm yard manure and vermicompost), bio-fertilizers (*viz.*, *Azotobacter* and phosphate solubilizing bacteria) and inorganic fertilizers on the viability and vigour of coriander seed. Experimental results revealed that the co-inoculation of *Azotobacter* and PSB alongwith 100% recommended dose of nitrogen through vermicompost (VC) of recommended dose recorded significantly higher standard germination (%), seedling length (cm), seedling dry weight (mg), vigour index-I and vigour index-II at every stage of accelerated ageing of seed. The electrical conductivity was also recorded less in the same treatment which was due to cell membrane stability and decreased leakage of solutes from the seeds.

**Key words:** Accelerated ageing, relative storability, seed quality, vermicompost

## ESTIMATION OF YIELD LOSS IN ASHWAGANDHA DUE TO *OROBANCHE* INFESTATION

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### ABSTRACT

Indian ginseng called the ashwagandha (*Withania somnifera* Dunal. Linn.) is one of the most widely used herb in ayurvedic formulations prepared to boost up immune system. The main economic part of this plants is roots and the principal active ingredients in roots are a group of steroidal lactones; collectively known as withanolides. Achlorophyllous holoparasitic angiosperm nodding broomrape (*Orobanche cernua*) is a root parasite living on range of host plant species. In a field experiment, physiological and biochemical parameters of broomrape infected plants were studied and compared with uninfected plants. At 120 days after sowing (DAS) the net photosynthetic rate ( $P_N$ ) and stomatal conductance ( $g_s$ ) in infected plants was 68% and 69%, respectively that of the uninfected plants. The leaf nitrate reductase activity in infected plants was 88% and 48% of uninfected plants at 100 and 120 DAS, respectively. Broomrape infestation had resulted in overall stunted growth causing as high as 83% decline in leaf area and loss of total biomass up to the extent of 82% at 145 DAS. Chemo-profiles showing absence of withanolide in broomrape stems demonstrated that this parasite does not mine withanolide from the host plant. At the same time, it is important to note that the broomrape infestation caused nearly two-fold increase in total withanolide concentration in dry roots however, at the cost of as high as 68% loss in root yield leading to 38% decline in major withanolide yield at 145 DAS. This was the first systematic study reporting yield loss estimation due to broomrape infestation in *W. somnifera*. Future research on management of broomrape in *W. somnifera* is suggested to prevent a huge yield loss in this important medicinal root crop.

**Keywords:** Broomrape, *O. cernua*, *W. somnifera*, withanolide, yield loss assessment

**PHYTOCHEMICAL SCREENING OF PLANT EXTRACT OF BHRINGARAJ  
(*ECLIPTA ALBAL.*) MORPHOTYPES**

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**ABSTRACT**

Bhringaraj (*Eclipta alba* L.), is one of the important traditional medicinal plants traded in India. It is an annual herb commonly known as false daisy belonging to the family asteraceae widely distributed in tropical and sub-tropical region of Asia. It is a hepatoprotective medicinal herb reported for its various pharmacological activities like hair growth promotion, antidiabetic, antimicrobial property and anticancerous activity. The estimated annual trade in India is 200 5000 MT. In the present study 30 morphotypes of Bhringaraj were screened for phytochemical constituents such as wedelolactone, total phenolic (Singleton and Rossi, 1965) and total flavanoid content (Chun *et al.*, 2003) analysed from methanolic extract of herb. Wedelolactone is the principle compound present in bhringaraj having hepatoprotective property and is estimated by HPLC protocol. Among 30 morphotypes accession IIHR 3 recorded the highest wedelolactone content (0.6% w/w) whereas, accession IIHR 36 recorded the lowest content (0.0006% w/w). Among the morphotypes, the highest phenolic content was recorded in accession IIHR 3 (39.0 mg/g) while the lowest phenol content was recorded in the accession IIHR 37 (8.13 mg/g). The highest flavanoid content was recorded in accession IIHR 46 (16.79 mg/g) while the lowest content was recorded in accession IIHR 37 (5.86 mg/g).

**Keywords:** Bhringaraj, morphotypes, accession, wedelolactone

## EXOGENOUS PLANT GROWTH CHEMICALS ENHANCE PRODUCTIVITY AND POSTHARVEST QUALITY OF FRUITING VEGETABLES IN WATER SCARCE REGIONS

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### ABSTRACT

Plant growth chemicals play strategic role for sustaining crop productivity and alleviating water stress in drought prone regions. However, their impact are yet to be quantified on yields formation while maintaining post-harvest quality of major fruiting vegetables such as eggplant (*Solanum melongena* L.) and okra (*Abelmoschus esculentus* L.) cultivated in water scarce regions of Deccan Plateau, India. Therefore, a series of field experiments were conducted during 2016-2018 (eggplant) and 2019-2021 (okra) for evaluating the interactive effects of plant growth chemicals viz., salicylic acid (SA; 20 $\mu$ M), 1.5% potassium nitrate, thiourea (TU; 500 ppm) and biopolymer solutions (BP; 100 ml L<sup>-1</sup>) and varied levels of soil moisture deficit generated using line source sprinkler (LSS) system. The marketable yield reduced by 8-86% in eggplant and 12-83% in okra with increased moisture deficit when compared with those with optimum soil moisture. Further, exogenous plant growth chemicals improved yields of eggplant fruits and okra pods by 7-23% and 7-18%, respectively. The maximum water productivity (WP) varied between 5.5-6.8 kg m<sup>-3</sup> for eggplant and 3.4-3.8 kg m<sup>-3</sup> for okra with different growth chemicals and it was 5.16 and 3.32 kg m<sup>-3</sup> in controls of both crops indicating water savings up to 24-60 per cent. Among formulations used in this experiment, PN and TU were superior in alleviating negative impacts under severe water stress conditions. The fruit quality attributes such as mean diameter, sphericity, fruits weight and firmness traits declined with water stress while these were considerably rectified with plant growth chemicals. Similar observations were reported in pod quality attributes of okra including pod lengths. Higher accumulation of dry matter, sugar, protein, total phenolics, flavonoids and improved rehydration quality as well as activity of key enzymes associated with stress tolerance were monitored in both crops. It is concluded that exogenous application of PN and TU under moderate water stress can help in rational utilization of water resources and could effectively improve yield and post-harvest quality of eggplant fruits and okra pods especially under water stress environment of Deccan Plateau.

**Keyword:** Plant growth chemicals, eggplant, okra, postharvest quality, water stress



## **DOUBLING FARMERS INCOME THROUGH INTEGRATED FARMING SYSTEM APPROACHES**

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### **ABSTRACT**

Agriculture is considered as the backbone of Indian economy with majority of its population directly or indirectly depending on this sector. In a country like India, where most of the farmers come under the category of marginal farmers, the practice of integrated farming system has emerged as one of the viable options for doubling the income of the farming society. Presently, farmers follow conventional methods of farming and they opt to grow only one crop at a time, but in an integrated farming system, farmers can choose multiple crops or enterprises at the same period of time. Farmers can follow various farming approaches like fruit production, olericulture, floriculture, forestry, mushroom production, dairy, poultry and pisciculture along with the conventional practices of growing agronomic crops. These Enterprises not only provide extra income to the farmers, but also allow them to use the residues or by-products of one enterprise into another, ultimately reducing the input cost. This practice also aids to lower down the risks of crop failure. Integrated farming system approaches help in generating higher income and provide better opportunities to the farmers.

**Keywords:** Marginal farmers, Integrated farming system, Pisciculture, Olericulture



## EVALUATION OF GENETIC DIVERSITY OF MANDARINS USING MORPHOLOGICAL MARKERS AND SSR MARKERS

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### ABSTRACT

Mandarins are highly preferred fruit crop in India where maximum genetic diversity is seen in Northeast part of the country. The present investigation was conducted during the year 2018-21 by collecting mandarin genotypes from different parts of Northeast India (Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim) along with three wild species to evaluate the genetic diversity using morphological markers. On the basis of mean performance genotypes showed better results in the desirable traits chosen such as maximum fruit weight in G31, G6, G34, G23, G4, G40, G9 while minimum seeds per fruit in G16, G38, G1, G29, G38. Maximum number of genotypes were found in cluster 2 and least number of genotypes are found in cluster 5, cluster 9 and cluster 10 by cluster analysis. From the cluster mean analysis of different parameters of genotypes cluster 4 was found to be promising with maximum number of seeds, titratable acidity, shelf life but minimum of yield, number of fruits, pH, vitamin C, total sugar, fruit length and fruit weight while cluster 10 provides maximum yield number of fruits, vitamin C, total sugar, TSS and minimum seed weight and titratable acidity. The highest (2766.74) inter-cluster distance was recorded between cluster 4 and cluster 10 and least (24.48) inter-cluster distance was recorded between cluster 8 and cluster 5. Genetic diversity revealed that characters like number of fruits and vitamin C (mg/100g) imparted maximum percent with respect to genetic divergence (11%). In SSR marker analysis 23 primers showed polymorphism and SSR primer CCSM18, CAT01, AG14 and CiBE5866 showed maximum PIC value with polymorphic bands indicating their usefulness in discriminating genotypes. From these results obtained it can be concluded that mandarin found in North East India are morphologically diverse but molecular diversity was comparatively less except few genotypes. It could be utilized for future crop improvement of mandarin.

**Key words:** Diversity, genotypes, mandarin, morphological and SSR.

## BIOCHEMICAL CHANGES IN FLOWERING EXPRESSION OF *CITRUS* SPECIES

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### ABSTRACT

An experiment was conducted on trees of acid limes (Pusa Udit, Pusa Abhinav and ALC-29), lemons (Konkan Seedless, Kagzi Kalan and Hill lemon) and sweet oranges (Pusa Sharad, Pusa Round and. Mosambi) during 2017-18 with aim to understand the relationship of seasonal changes in biochemical traits with the flowering behaviour of citrus species. Sweet oranges and Hill lemon expressed flowering once (February to March), and lemons and Acid limes bloomed almost round the year. In all lemons (except Hill lemon) and limes, protein level =  $9.30 \text{ mg g}^{-1} \text{ FW}$  promoted the flowering, however, it was =  $19.3 \text{ mg g}^{-1} \text{ FW}$  in Hill lemon and sweet oranges. In lemons and limes, superoxide dismutase (SOD) activity =  $9.88 \text{ Unit mg}^{-1} \text{ min}^{-1} \text{ TSP}$  expressed the association with flowering except Pusa Abhinav lime. Hill lemon and sweet oranges bloomed at the activity of SOD =  $13.77 \text{ Unit mg}^{-1} \text{ min}^{-1} \text{ TSP}$ . The catalase (CAT) activity was non-significant in most of the cultivars. The level of POX activity =  $17.77 \text{ } \mu\text{mol min}^{-1} \text{ mg}^{-1} \text{ total soluble proteins (TSP)}$  showed flowering in limes and lemons (except Hill lemon), the plant), while in rest of the genotypes, its level was =  $52.45 \text{ } \mu\text{mol min}^{-1} \text{ mg}^{-1} \text{ TSP}$  to initiate flowering. In most of the limes and lemons during August to February, ascorbate peroxidase (APOX) activity =  $0.20 \text{ } \mu\text{mol min}^{-1} \text{ mg}^{-1} \text{ TSP}$  favoured the flowering. The lower activity of  $\text{O}_2^-$  ( $0.91\text{--}1.76 \text{ } \mu\text{mol g}^{-1} \text{ FW}$ ) between August to January in limes and lemons promoted the flowering.

**Key words:** Flowering, SOD, CAT, TSP, APOX,  $\text{O}_2^-$



**EFFICIENCY AND EFFECTIVENESS OF MUTAGENIC AGENTS (GAMMA RAYS AND ETHYL METHANE SULPHONATE) ON *BOUGAINVILLEA* SPP.**

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**ABSTRACT**

Mutation breeding is a well-known crop improvement technique that has resulted in the development of many new decorative flower shape and color mutant types. In order to develop originality between 2020 and 2021, researchers at the College of Horticulture in Bengaluru, Karnataka, India, employed a physical mutagen like gamma rays and a chemical mutagen, Ethyl Methane Sulphonate to induce mutations in *Bougainvillea* spp. Hardwood cuttings were treated to three different concentrations of Ethyl Methane Sulphonate as well as four different gamma-ray dosages (5, 10, 15, and 20 Gy) (0.6, 0.8 and 1.0 percent). Several morphological features were assessed in the first mutant-vegetative (M1V1) generation. As the mutagen dose concentration increased, so did the percentage of sprouting seedlings and the survival rate. All morphological attributes have been recorded a declining trend with increasing mutagenic treatments. Albina, albina green, xantha, chlorina, viridis, yellow viridis, striata, maculata, and variegated chlorophyll mutations were discovered. Chlorina was the most common chlorophyll mutant identified, followed by maculata and viridis. When it came to mutagenic treatments, EMS 1.0 percent had a higher number of morphological mutants (3) as well as chlorophyll mutants (6 Nos.). Gamma-radiation at 5.0 Gy had a higher mutagenic effectiveness (212.43) and efficiency (112.69) than the other treatments. In terms of efficacy (112.23) and efficiency, EMS produced the highest mutation rates in *Bougainvillea* (87.65).

**Keywords:** Mutagenicity, mutation, mutant-vegetative generation, *Bougainvillea*, mutagens



## EVALUATION OF BLACK PEPPER CULTIVARS OF KERALA FOR YIELD AND QUALITY TRAITS

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### ABSTRACT

Black pepper (*Piper nigrum* L.), believed to be originated in Western Ghats of India, is undoubtedly a hot spice from the spicy olfactory family *Piperaceae*. A survey of the major black pepper growing tracts in Kerala was conducted during 2019-20 and from there twenty one local cultivars of farmer's preference were selected for yield and quality evaluation. Analysis of Variance corresponds to yield characters of the cultivars showed no significant difference among them and for quality attributes there existed a considerable variation. Biochemical analysis for piperine, essential oil, oleoresin, starch, crude fibre and total ash content of the selected cultivars revealed G<sub>16</sub> was superior in terms of piperine, oleoresin and essential oil content. Sensory evaluation of the selected cultivars for organoleptic qualities such as colour, odour, taste and flavour revealed a significant variation among them. G<sub>16</sub> was significantly superior in taste while G<sub>15</sub> was superior in odour and flavour. Proximity matrix corresponds to the biochemical characters indicated a divergent nature of G<sub>16</sub> over the remaining cultivars except G<sub>15</sub> and G<sub>21</sub>. In the present study, the high-quality cultivars were evaluated *insitu*, and a detailed assessment of the cultivars can be done so that they can be utilized for breeding for quality improvement in black pepper.

**Keywords:** Black pepper, Quality, Cultivars, Piperine, Evaluation, Variability

## STUDIES ON NUTRIENT AND NUTRACEUTICAL ASPECTS OF SNAP MELON (*CUCUMIS MELO. VAR. MOMORDICA*) FOR NUTRITIONAL SECURITY

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### ABSTRACT

Snapmelons are one of the important groups of Cucurbitaceous crop worldwide and play major role in international trade. However this potent crop is still remains as an under exploited one. Snap melon (*Cucumis melo var. momordica*) fruits are rich in many nutrients and possess numerous nutraceutical and pharmaceutical properties. In North India snap melon is commonly called as 'Phoot' which means "To split". The large-scale cultivation of 'phoot' is confined to the states of UP, Rajasthan, Haryana, Punjab and Bihar and to certain extent cultivated in Kerala and Tamil Nadu in India. A total number of 23 snap melon genotypes were assessed for their field performance on growth, yield, quality, nutrient and nutraceutical parameters. Among them the maximum total soluble solids of 7.82° Brix and the highest carbohydrate content (21.23g 100g<sup>-1</sup>), alkaloid content of 8.21 per cent, flavanoid content of 92.31 (mg 100g<sup>-1</sup>) were recorded in G<sub>3</sub> (Amaravathi). It also recorded maximum TSS/Acid ratio of 10.25 per cent. The maximum ascorbic acid content of 11.25 per cent and fibre content of 0.87 (g 100g<sup>-1</sup>) were recorded in G<sub>12</sub> (Rannebannur). The genotype G<sub>9</sub> (Kalacherry) recorded maximum reducing sugar content of 3.36 per cent and the highest non reducing sugar content of 2.78 per cent was recorded in Thirumangalam long (G<sub>16</sub>). The maximum calcium content of 0.76 mg 100g<sup>-1</sup> and highest iron content of 0.84 (mg 100g<sup>-1</sup>) were recorded in the genotype G<sub>3</sub> (Amaravathi). Among the genotypes evaluated the genotype G<sub>3</sub> (Amaravathi) recorded the highest yield of 13.80 kg. Hence the same genotype has been adjudged as best one based on yield, nutrient and nutraceutical parameters.

**Key words:** Snap melon, Genotypes, Assessment for yield, nutrient, nutraceutical characters

## NANOTECHNOLOGY FOR FOOD SAFETY AND SECURITY

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### ABSTRACT

Food safety is one of the most concerned problems of consumers, from land to table. Food ingredients need to be regulated and preserved. Ensuring a sustainable supply of nutrient rich and safe food is a big challenge. Nanotechnology will bring great opportunities to improve food safety and enhance agricultural productivity in a sustainable way. At present, most of food packaging materials are polymer which have lower strength, poor permeability and thermal stability. Nanoparticles improve barrier properties of packages by adding nanoparticles to the matrix. Nanoclay is the most claimed barrier material additive. Nanocellulose and Chitosan improve packaging performance. Incorporating nano size oxygen scavengers into polymer material (TiO<sub>2</sub> nanotube) helps to reduce oxygen content in packaging. Combining polymers and nanodevices such as nanosensor is future trend of smart packaging, which are developed to monitor quality status of food. Active intelligent packaging materials improve the stability of food quality and food safety. Silver nanoparticles and chitosan nanoparticles are promising options for eliminating pathogenic microorganisms. TiO<sub>2</sub> nanoparticles have bactericidal functions which can be used as coating for packaging. Sensors based nanotechnology have been developed for rapid and accurate detection of microorganisms. Microfluidic based nanobiosensor technology detects *Salmonella*.

**Keywords:** Nanoparticle, oxygen scavenger, nanosensor, Active intelligent packaging, nanobiosensor



## **INFLUENCE OF INDOLE-3-BUTYRIC ACID (IBA) ON ROOTING ABILITY OF *BOUGAINVILLEA SPP.***

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### **ABSTRACT**

The purpose of this study was to see how different concentrations of Indole-3-butyric acid (IBA) affected the rooting ability of hardwood cuttings. The treatments included a control (no IBA), 1750, 2000, and 2250 ppm IBA. The cuttings were treated with IBA solution for 10 seconds before being placed in rooting medium. Sand and cocopeat in the rooting media help to hold water and create humid conditions for easy root induction. A completely randomised design (CRD) with two replications was used to evaluate the treatment. According to the results, there was a significant difference in rooting percentage between the IBA treatment and the control. When IBA hormone concentrations of 2250ppm were applied to cuttings, maximum rooting was observed when compared to other treatments and the control treatment. The treatment 2000ppm produced the highest root number, root length, and root fresh weight. This study found that the hard wood portion of plants aids in the early induction of roots due to food stored in cuttings. It is one of the most effective methods for propagating bougainvillea plants.

**Key words:** Bougainvillea hardwood cuttings, Indole-3-butyric acid (IBA), Root dip method



## INTEGRATED NUTRIENT MANAGEMENT IN VEGETABLE CROPS

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### ABSTRACT

The agriculture era has been changed from resource degrading to resource conserving technologies and practices which will enable help for increasing crop productivity besides maintaining soil health for future generations. Green revolution besides achieving food security, imposes several threats like deterioration of the soil organic carbon stock, decreasing factor productivity, imbalances in NPK and micronutrient use and disparity in fertilizer consumptions etc. The Integrated Nutrient Management (INM) is a practice where all sources of nutrients namely organic, inorganic (chemical fertilizer) and biofertilizer can be combined for improving soil health, get good quality yield and maintain ecology and environment. It provides an excellent opportunity not only for sustainable soil but enhancing crop productivity also. The INM is the maintenance or adjustment of soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop production through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. The continuous and imbalance use of fertilizers is adversely affecting the sustainability of agricultural production besides causing environmental pollution. The major issue for the sustainable agricultural production will be management of soil organic carbon and rational use of organic inputs such as animal manure, crop residues, green manure, sewage sludge and wastes known as integrated plant resource management. However, since organic manure cannot meet the total nutrient needs of modern agriculture, hence integrated use of nutrients from fertilizers and organic sources will be the need of the time.

**Keywords:** Soil, NPK, INM, Nutrients, fertilizers, organic, production

## RESPONSE OF MICROBIAL CONSORTIA AT GRADED LEVELS OF N P K ON GROWTH AND FLOWERING PARAMETERS OF ASIATIC LILY UNDER PROTECTED CULTIVATION

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### ABSTRACT

Lilium is one of the most important ornamental bulbous plants. It comprises one of the distinctive flowers in form, appearance and colour. The flower stems of lily are long and sturdy with luxuriant foliage and it has longer vase life. They look charming in large clusters for mass effect (Singh *et al.*, 2006). It is a species of great economic importance in production and commercialization of cut flower in the international market (Jimenez *et al.*, 2012). Due to its size, beauty and longevity lilium is one of the ten most superior cut flowers in the world (Thakur *et al.*, 2005). The study was conducted to find out the suitable combination of graded levels of N P K and biofertilizers on growth and flowering of Asiatic lily Cv. Indian Summerset under protected cultivation during 2018-19 in the Department of Horticulture, College of Agriculture, Shivamogga. The experiment consists of seventeen treatments with three replications laid at Complete Randomized Design (CRD). The significant differences were observed for growth and flowering parameters. Among the treatments studied, the treatment at 75 % RDF + *Azotobacter croococcum* + *Aspergillus awamori* + *Bacillus musilogensis* (T<sub>14</sub>) recorded significantly higher values with respect to plant height (55.09 cm), number of leaves (54.21), leaf length (6.07 cm), leaf breadth (2.04 cm), leaf area per plant (496.31 cm<sup>2</sup>) leaf area index (0.83) and the flowering parameters like least number of days to first flower bud emergence (23.08 days), minimum number of days to 50 per cent flowering (47.05 days) and significantly maximum duration of flowering (14.88 days).



## WEALTH GENERATION THROUGH MANAGEMENT OF TRICKY WATER

### HYACINTH

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### ABSTRACT

Water hyacinth can completely cover lakes and wetlands, outcompeting native aquatic species. Large infestations of water hyacinth can prevent river transport, fishing, damage bridges, and clog dams and imbalance micro ecosystem. Ooty spent millions to clean the lakes in the tourist town. Calcium, magnesium, and manganese were detected in the highest amounts in water hyacinth among all macro and micro nutrients. Increasing awareness on degradation of soil fertility due to imprudent fertilizer uses, organic fertilizer gaining popularity, with use of liquid organic fertilizer the nutrient are better absorbed by plant and beneficial in saline soil condition. absorbed by the plant and hence more beneficial to plant growth even in saline soil. Post extraction residue that could be enriched with micronutrients ions, to produce bio-based micronutrient fertilizer. Large scale production with Low cost & low energy production setup. Waste management enables the generation of economically sustainable goods while also tackling climate change, public health, human communities, and animal welfare.

**Keywords:** Micro ecosystem, nutrients, organic fertilizer, saline soil, waste management, sustainable.



## **BIOFORTIFICATION OF VEGETABLES FOR FOOD SAFETY AND NUTRITIONAL SECURITY**

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### **ABSTRACT**

Global hunger is on the rise in 2020, with 821 million people undernourished at the beginning of 2019. This means that roughly 10.5% of the world's population is currently living with hunger. Humans require a well-balanced diet for optimum growth and development. It aids in the prevention of illnesses as well as the maintenance of body metabolism for physical and emotional well-being. In the absence of a balanced diet, a person does not get enough nutrients or the right balance of nutrients for optimal health and it causes malnutrition. Currently, one in eight people are undernourished, monotonous diet consisting milled cereals with few micronutrients leads to micronutrient deficiencies. Biofortification provides a feasible means of reaching malnourished populations in relatively remote rural areas, delivering naturally fortified foods to people with limited access to commercially-marketed fortified foods. Good nutrition depends on adequate intakes of a range of nutrients and other compounds, in combinations and levels that are not yet completely understood. Thus, the best and final solution to eliminating under nutrition as a public health problem in developing countries is to increase consumption of a range of non-staple foods. Biofortification is a promising agriculturally based strategy for improving the nutritional status of malnourished populations throughout the world.

**Keywords:** Biofortification, malnutrition, nutrition, balanced-diet.





## **AGRITOURISM TO ENHANCE INTEGRATED FARMING MODEL: A CASE OF GAURIKOT AGRITOURISM CENTRE**

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### **ABSTRACT**

Uttarakhand is an Indian state which is located in the northern region of the country. As 86 per cent of the state consists of hills, the yield per hectare is low. Less than 20 per cent of all croplands are in the hills while major portion of it is in the plains (Uttarakhand: the state profile,2011) and so people are moving towards the plains so as to ensure a sustainable livelihood. To bridge this gap Gauri Self-Help Group with two more SHGs started practicing integrated farming model which undoubtedly improved their income, but up to a certain extent. To add more income without additional inputs, agritourism was introduced to their farms and they opened their farms for tourists, visits and trainings. This research paper is putting forward the successful case of Gaurikot Agritourism Centre that is jointly run by 20 female members of 3 SHGs and one male supervisor and helping 18 families to sustain in hilly areas of Uttarakhand that are managing the issue of migration with innovative approaches.

**Keywords:** Agritourism, Self-help Group, Integrated farming, sustainable livelihood



**EFFECT OF PRE SOWING SEED TREATMENT ON SEED QUALITY OF PADDY  
HYBRID KRH-4 UNDER DSR METHOD**

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**ABSTRACT**

The present investigation was conducted during Kharif 2019 at I-Block, ZARS, V C Farm, Mandya, UAS, GKVK, Bengaluru to investigate the effect of different pre-sowing treatments on crop growth and yield of paddy hybrid KRH-4 under direct seeded rice method. The experiment comprised of nine treatments with three replications in randomized complete block design. The results revealed that quality parameters includes higher seed germination, root length, shoot length, mean seedling length, amylase activity, TDH, seedling vigour index I and II and the lowest EC of seed leachates was observed in seed priming with ZnSO<sub>4</sub> @ 3 % (97.33 %, 23.84 cm, 23.88 cm, 47.00 cm, 1.35, 1.58, 4576, 10348, 109.09  $\mu$ Scm<sup>-1</sup> respectively) followed by seed priming with CaCl<sub>2</sub> @ 2 % (96.33 %, 23.00 cm, 22.16 cm, 44.66 cm, 1.33, 1.51, 4306, 10297, 113.18  $\mu$ Scm<sup>-1</sup>) and untreated control expressed (89.66 %, 16.33 cm, 16.33 cm, 31.66 cm, 0.74, 0.83, 2839, 8458, 188.44  $\mu$ Scm<sup>-1</sup> respectively).

Keywords: Seed priming, Seed quality, Hybrid rice, Seed germination



**INFLUENCE OF ORGANICS ON SEED YIELD AND OIL CONTENT (%) IN  
SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)”**

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**ABSTRACT**

A field experiment was conducted at Agriculture Research Station, Hagari during *Rabi* 2019-20 to know the influence of organics on seed yield and quality in safflower. The experiment constituted of ten treatments and laid out in randomized block design with three replications. Among the treatments, T<sub>5</sub> (T<sub>2</sub>- Seed soaked in beejamrutha for 12 h + Foliar spray with panchagavya @ 3%) at 50, 70 and 90 DAS recorded significantly highest plant height (67.56, 92.05 and 95.33 cm), more number of primary and secondary branches (6.83, 10.78, 12.13 and 8.46, 10.69, 15.25) at 60 DAS, 90 DAS and at harvest, more number of capitulum per plant (21.62), number of seeds per capitulum (23.18), seed yield per plant (22.35 g), seed yield (1529 kg / ha), stalk yield (2441 kg / ha) and Oil yield (459 kg / ha)

**Keywords:** Organic foliar spray, seed yield, stalk yield

**PERFORMANCE OF KHASI MANDARIN (*CITRUS RETICULATA* BLANCO.) AS INFLUENCED BY FOLIAR APPLICATION OF MICRONUTRIENTS IN RI BHOI DISTRICT, MEGHALAYA**

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**ABSTRACT**

Khasi Mandarin (*Citrus reticulata* Blanco.) of family Rutaceae commonly known for its thin and loose peel is one of the most financially important and worldwide accepted fruit that is mainly found in the North Eastern region of India. Being a nutrient loving and responsive plant, it requires adequate nutrition for proper growth and development. To ensure its high economic productivity and sustaining the nutrition of the plant, the present investigation was conducted to find out the effect of micronutrient applications on the growth and quality of Khasi mandarin. The experiment was conducted in Umling, Ri Bhoi District of Meghalaya during 2018-2019. The treatment applied were Zinc Sulphate, Micronutrient mix and Sulphate of potash in different proportions and combinations. It was laid out in randomized block design with 11 treatments. Results of two years data revealed that foliar application of SOP 1.0% along with Micronutrient mix 0.1% showed higher fruit set (24.81 %), fruit yield (37.65 kg/tree), fruit weight (160.46 g), TSS (10.87 °Brix), total sugar (7.20 %), reducing sugar (3.58 %), protein (3.44 %) with lower acidity (0.65%).

**Keywords:** Khasi Mandarin, micronutrients mix, sulphate of potash, yield, quality

**IMPROVING WATER AND NUTRIENT USE EFFICIENCY OF WHEAT UNDER LIMITED IRRIGATION WITH DIFFERENT FERTILIZER DOSES**

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**ABSTRACT**

In recent years, yield stagnation in wheat has been observed due to soil degradation, inadequate application of fertilizer and irrigation, which poses a serious threat to the sustainability of India's food security. A field experiment entitled "Effect of fertilizer application on productivity and quality of wheat under limited irrigation" was conducted during *Rabi* 2019-20 at Soil Research Farm, CCS Haryana Agricultural University, Hisar. The study includes three irrigation levels in the main plot *viz.*, one (CRI), two (CRI and flowering stage) and three irrigations (CRI, late jointing and dough stage) and four fertilizer levels in the subplots (control, 75, 100, 125 per cent RDF). The results indicate that the three irrigations and 125 per cent RDF under fertilizer treatment resulted in higher N, P and K content and uptake both in grain and straw, agronomic efficiency and apparent recovery. The water use efficiency was numerically highest under two irrigations followed by three and one irrigation. Therefore, three irrigations with fertilizer dose at 125 per cent RDF can serve as best option for achieving higher water and nutrient use efficiency under limited irrigation.

**Key words:** wheat, limited irrigation, fertilizer, apparent recovery, water use efficiency.



## **UREA AMMONIUM NITRATE (UAN) APPLICATION SYSTEM FOR CROP PRODUCTION ON INDIAN FARM**

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### **ABSTRACT**

Urea Ammonium Nitrate (UAN) which is an aqueous solution of urea [ $\text{CO}(\text{NH}_2)_2$ ] and ammonium nitrate [ $\text{NH}_4\text{NO}_3$ ], containing 28-32% N and its aqueous solutions is useful for both basal and foliar applications. Aqueous UAN is safe to handle, convenient to mix with other nutrients and chemicals, and can be easily applied. The use of aqueous UAN can reduce the possibility of volatilization and de-nitrification when applied in the sub surface of soil as compared to prilled urea. The liquid fertilizer applicator available in foreign countries are large in size and requires high capital and higher horse power tractors; cannot be used in Indian conditions of fragmented land holdings and also farmers cannot afford it. The prototype UAN applicator was designed and developed for basal application and test evaluated on IARI farm. The major components of the UAN applicator were shovel type furrow opener, precision seed metering mechanism, common rail UAN metering mechanism operated by diaphragm type pump (18.9 LPM capacity at 3.1 bar and 12V battery operated), fertilizer delivery tubes. A plain orifice nozzles were used for uniform application of UAN diluted with water (1:30). There are nine furrow openers for seeds and separate nine furrow openers for fertilizer fitted on the frame in such a way there is no direct contact between seed and fertilizer after delivery. The UAN applicator was designed to place the fertilizer 2.5 cm beside the seed at a depth of 5 and 10 cm. The UAN placement depth of 5 cm was better than 10 cm, especially with respect to various crop parameters in case of direct seeded rice and wheat crops as it reduces the proximity of seed and fertilizer.

**Key words:** UAN applicator, common rail UAN metering mechanism

## EFFECT OF SLOW-RELEASE UREA AND NITRIFICATION INHIBITOR ON N-DYNAMICS IN WHEAT

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### ABSTRACT

Urea is the most important Nitrogen (N) source for crop production. Urea–N use efficiency less because of leaching, volatilization and denitrification losses. Reducing the urea solubility and inhibition of nitrification have the potential to minimize these losses. This current study evaluates the effect of urea coating (Control, Sulphur, 3% and 4% Palmolein vegetable oil coating respectively) and DCD on the release of N at different growth stages of wheat. Results show 3% vegetable oil coating was more consistent at releasing N over the crop duration as indicated by minor peaks of ammonia. Peak release of N from sulphur coat and control was at 5 DAS. 4% oil coating peaked after 12 DAS. Nitrate concentration in soil was high for all three coating over control at 20 DAS with maximum being for 3% vegetable coating. Effect of DCD was more significant as the concentration of ammonia was higher than nitrate as compared to treatment without DCD. First order kinetics show greater half-life of ammonia with DCD treatment from 0 to 30 DAS. This is supported by low concentration of nitrate in the same period. Results show 3% coating best delayed N release from urea and subsequent delay in nitrification due to DCD, which would achieve higher Urea–N use efficiency.

**Keywords:** Oil coat, slow–release urea, DCD, nitrification inhibitor, ammonia, nitrate

## **EFFECT OF COCONUT SHELL BIOCHAR ON PHYSICAL, CHEMICAL PROPERTIES AND AVAILABLE MAJOR NUTRIENT STATUS OF ACIDIC SOIL**

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### **ABSTRACT**

The effect of coconut shell biochar addition on the physical and chemical properties of acidic soil such as soil bulk density, maximum water holding capacity, pH, electrical conductivity (EC), available major nutrients were investigated in a field experiment with soybean. This study was conducted by application of coconut shell biochar in combination with recommended Lime. The coconut shell biochar was applied at three rates (5, 7.5 and 10 t ha<sup>-1</sup>) and lime (calcium carbonate) was applied at two rates (100% and 50% recommendation) to acidic soil. Amendment type, application rate, and their interaction had significant effects ( $p < 0.05$ ) on soil bulk density, maximum water holding capacity, pH, EC, and available major nutrients after the harvest of soybean. Application of coconut shell biochar at 10 t ha<sup>-1</sup> in combination with 50% recommended lime had shown a relatively higher improvement in soil physical and chemical properties after the harvest of soybean.

**Keywords:** Coconut shell biochar, soybean, soil physical, chemical properties, acidic soils

## EFFECT OF FOLIAR NUTRITION ON GROWTH AND YIELD OF *KHARIF* COWPEA

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### ABSTRACT

A field experiment was conducted at Agronomy Instructional Farm, C P College of Agriculture, S D Agricultural University, Sardarkrushinagar to study the “Effect of foliar nutrition on growth and yield of *kharif* cowpea” during *kharif* season of 2020. Total eight treatment combinations were laid out in RBD with four replications. Cowpea variety Gujarat cowpea 5 was sown at a distance of 45 cm × 10 cm. Plant population was uniform during the course of investigation. Various growth parameters of cowpea like plant height, number of branches/plant, dry matter accumulation and yield attributing characters *viz.*, number of pods/plant, number of seeds/pod, pod length and seed yield/plant were recorded significantly maximum with the application of 75% of RDF + 2% spray of each urea and urea phosphate at 15 and 30 DAS over the all other treatments except application of 75% of RDF + 2% spray of NPK 19:19:19 at 15 and 30 DAS. Significantly lower value of said growth and yield attributes are recorded with control. Seed index and harvest index remained unchanged due to different treatments. Seed and stover yields were also significantly affected by various treatments of inorganic fertilizer with foliar nutrition. Crop fertilized with 75% of RDF + 2% spray of each urea and urea phosphate at 15 and 30 DAS recorded significantly higher seed yield (1422 kg/ha) and stover yield (2553 kg/ha) of cowpea which is statistically at par with application of 75% of RDF + 2% spray of NPK 19:19:19 at 15 and 30 DAS.



## EFFECT OF APPLICATION OF FOLIAR NITROGEN AND POTASSIUM APPLICATION ON LEAF NUTRIENT CONTENTS OF FIG (*FICUS CARICA* L.)

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### ABSTRACT

A field experiment was carried out in the model farm of Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, during the years 2016-17 and 2017-18 to see the effect of foliar nitrogen and potassium applications on leaf nutrient contents of fig. Thirteen treatment combinations were arranged in a randomized block design comprising two levels of nitrogen viz.  $N_{0.5}$  (0.5 per cent urea) and  $N_{1.0}$  (1.0 per cent urea); two levels of K i.e.  $K_1$  (1.0 per cent  $KNO_3$ ) and  $K_2$  (2.0 per cent  $KNO_3$ ) and two application times i.e. September and January, and were replicated thrice. The maximum leaf N was recorded under treatment  $T_9$  (2.71%), whereas, the highest leaf P (0.38%), leaf K (1.22%) and leaf Ca (4.64%) were recorded under treatment  $T_{13}$ , comprising nitrogen application through urea spray @ 1.0 per cent and potassium through  $KNO_3$  @ 2.0 per cent twice during September and January. The maximum leaf micronutrient contents were also observed in the same treatment.

**Keywords:** Fig, urea, potassium nitrate, foliar spray, leaf nutrient contents

## COCONUT BASED INTEGRATED FARMING SYSTEM: TOWARDS SUSTAINABILITY OF SOIL HEALTH AND ALLEVIATION OF RURAL POVERTY

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### ABSTRACT

Coconut is an important horticultural crop which has a significant bearing on the livelihood security of small and marginal farmers across the globe. In the recent past, coconut turned out to be a sensitive victim to the catastrophes of drought events, price fluctuations, debilitating pests and dreadful diseases affecting the livelihood security of small and marginal farmers. An attempt was made at Coconut Research Station, Aliyarnagar during 2015 to integrate Telicherry breed of goats (6+1) across coconut area of one ha to augment system productivity. IFS with coconut + Telicherry Breed of Goats + Fodder Trees + Pasture Crops ( $T_1$ ) was compared with monocrop of coconut ( $T_2$ ). Average nut yield realized from IFS during 2016-2021 was 19780 nos. per ha as against 18820 nos. in monocropping. Gross returns accrued through lamb production, pasture production and goat manure was Rs. 3.58 lakhs per ha as against Rs.2.25 lakhs in monocropping. Incremental income realized from coconut based IFS was Rs. 1.12 lakh per ha per year. Fertilizer replacement value is 412 kgs of urea, 281 kgs of SSP and 138 kgs of MOP. Green House Gas emission -17875.3 units and thus is ecologically safe.

**Keywords :** Coconut, monocrop, net returns, fertilizer replacement, telicherry breed.



## EFFICACY OF NANO-FERTILIZERS IN QUALITY FRUIT PRODUCTION

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### ABSTRACT

Nanofertilizers are the important assets of nanotechnology that can be instrumental in horticultural sector for increasing the productivity. They have the potential to improve nutrient use efficiency and in reducing unfavourable environmental effects through slow release mechanism in organic matter rich soil and could improve nutrient uptake for balanced nutrient fertilization. Fruit crops are heavy feeders of nutrients and therefore optimum nutrient management strategy is required for proper growth and quality production. Nanoparticles serves this purpose as they are the nutrient carriers of nano dimensions ( $10^{-9}$ m) at 1-100 nm that are capable of holding large quantity of nutrient ions due to high surface area, reduced size, high reactivity, high dispersibility and better catalytic activity that helps in terms of ultra high absorption to improve crop performance. Nano-fertilizers application through foliar sprays avoid toxicity symptoms and minimize fertilizer related pollution especially micronutrient cations. They are therefore preferred over traditional fertilizers due to their gradual and controlled release and potential of absorption both by plants, roots and leaves. They can be a promising tool as an alternative source of nutrients for enhancing growth, production, quality and shelf life of fruits.

**Keywords:** Nanofertilizers, nutrient use efficiency, nutrient uptake, dispersibility and absorption

## FODDER YIELD, QUALITY AND ECONOMICS OF PEARL MILLET INFLUENCED BY VARIOUS NUTRIENT MANAGEMENT PRACTICES

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### ABSTRACT

Agriculture is known as backbone of Indian economy that having two most important pillars viz., crop production and livestock sector. According to 20<sup>th</sup> livestock census 2019, India having the highest number of livestock in the world that is 536.76 million. livestock population increase 4.6% compared to previous livestock census (2012). Fodder demand increase for ever increasing population of livestock. Consequently, we need to increase productivity and quality of green fodder through proper nutrient management to ensure better health and productivity of the livestock. Keeping these facts in mind an experiment was conducted during *kharif* season, 2019-20 at Agronomy research farm, ICAR-NDRI, Karnal (Haryana). The experiment was laid out in Randomized Block Design (RBD) with eight treatments viz., T<sub>1</sub> (Absolute control); T<sub>2</sub> (100% RDF); T<sub>3</sub> (100% RDF + Cow urine foliar spray); T<sub>4</sub> (100% RDF + PGPR); T<sub>5</sub> (100% RDF + PGPR + Cow urine foliar spray); T<sub>6</sub> (75% RDF + Cow urine foliar spray); T<sub>7</sub> (75% RDF + PGPR); T<sub>8</sub> (75% RDF + PGPR + Cow urine foliar spray) with three replications. The soil of the experimental field was clay loam in texture; low in available nitrogen (215 kg/ha) and organic carbon (0.49%); medium in available phosphorus (24.70 kg/ha) and potassium (285 kg/ha), and neutral in reaction (7.35). The results revealed that the growth, yield and quality parameters of fodder pearl millet significantly influenced with varying nutrient management practices. Plant height (178.30 and 307.50cm), leaf length (86.50 and 110.40cm), leaf width (4.36 and 5.10cm), number of leaves (11.43 and 15.33 plant<sup>-1</sup>) and number of tillers (11.30 and 13.17 plant<sup>-1</sup>) at 40 DAS and harvest; Leaf to stem ratio (0.44), green fodder yield (545.83 q/ha) and dry fodder yield (111.75 q/ha) at harvest; dry matter (20.48%), crude protein (9.47%) and ether extract (2.42%) significantly increase up to application of 100% RDF+PGPR. However, it was remains at par with the treatment that received 100% RDF+PGPR+ Cow urine foliar spray and both were found significantly higher over rest of the treatments. The highest net returns (57124 Rs/ha) and B:C ratio (2.31) found with application of 100% RDF+PGPR.

**Key words:** Pearl millet, fodder, cow urine, PGPR, quality

## NUTRIENT UPTAKE BY DIRECT SEEDED RICE UNDER DIFFERENT WEED MANAGEMENT PRACTICES

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### ABSTRACT

A field experiment was conducted during 2017 at N.E. Borlaug Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, to evaluate "A comparative analysis of nutrient uptake by weed and rice under different weed management practices". The experiment was laid out in randomized block design with three replication and twelve treatments i.e. stale seed bed with shallow tillage *fb* post emergence application of penoxsulam (PoE) at 22.5g/ha, stale seed bed with shallow tillage *fb* pre emergence application of pendimethalin (PE) at 1000 g/ha along with 1 hand weeding (HW) 30DAS, stale seed bed with shallow tillage *fb* application of pre-emergence application of pendimethalin *fb* 1 mechanical weeding (MW) with conoweeder at 25 DAS along with 1HW at 45 DAS, mulch (wheat straw of 4t/ha) *fb* post emergence application of penoxsulam at 22.5g/ha *fb* 1HW at 45 DAS, post emergence application of penoxsulam at 22.5g/ha *fb* 1HW at 45 DAS, *Sesbania* line sowing with pre-emergence application of Pendimethalin *fb* 1 mechanical weeding *fb* 1HW at 45 DAS, *Sesbania* broadcasting *fb* brown manuring with 2,4-d at 500 g/ha (brown manuring with) along with 1 HW at 45 DAS, stale seed bed with shallow tillage *fb* *Sesbania* line sowing *fb* pre-emergence pendimethalin *fb* brown manuring with 2,4-D at 500 g/ha *fb* 1 HW at 45 DAS, pre emergence application of pendimethalin *fb* penoxsulam (PoE) *fb* 1HW 45 DAS, pre-emergence application of pendimethalin *fb* penoxsulam (PoE) *fb* 1HW 45 DAS (20cm), weedy check and weedy free. All the treatments were in 25 cm except one. The nitrogen, phosphorous and pottasium uptake by grain, straw and total uptake at harvest of the crop was significantly due to various weed management practices. Among the weed management practice highest nitrogen uptake by grain and straw was under stale seed bed *fb* shallow tillage *fb* PE application of pendimethalin @1kg a.i./ha *fb* 1 mechanical weeding at 25DAS with conoweeder *fb* 1 hand weeding at 45 DAS (T<sub>3</sub>) followed by PE application of pendimethalin @1kg a.i./ha *fb* PoE application of penoxsulam @ 22.5g a.i./ha at 25cm spacing (T<sub>9</sub>) *Sesbania* line sowing+ PE application of pendimethalin @1kg a.i./ha *fb* 1 MW *fb* 1 hand weeding at 45 DAS (T<sub>6</sub>), mulch *fb* PoE application of penoxsulam @ 22.5g a.i./ha (T<sub>4</sub>) and stale seed bed *fb* shallow tillage *fb* *Sesbania* line sowing *fb* PE application of pendimethalin @1kg a.i./ha *fb* BM *fb* 1 HW (T<sub>8</sub>) which were also statistically at par. The lowest nitrogen, phosphorous and pottasium uptake by grain and straw was under weedy check plots. All the weed control treatments had higher total nitrogen, phosphorous and pottasium by crop over weedy check.

**Key word:** Direct seeded rice, weed management, nutrient uptake

## EVALUATION AND STANDARDIZATION OF GREEN SYNTHESIZED IRON OXIDE NANOPARTICLES FOR SEED PRIMING IN GROUNDNUT

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### ABSTRACT

Ferric oxide nanoparticle (Np) was synthesized using Hibiscus leaf extract and *Aspergillus niger* and characterized by Particle size analyzer and Dynamic Light scattering method. The average particle size obtained was approximately <100 nm. Further different concentrations of FeO nanoparticles were prepared to standardize for seed priming in groundnut. The seeds were soaked for 10 hours in different concentrations of FeO nanoparticle synthesized both from hibiscus leaf extract and *Aspergillus niger* (@ 50 ppm, 100 ppm, 200 ppm), FeSO<sub>4</sub> (0.5%), CaCl<sub>2</sub> (0.5%) and control (water soaking). Later it was shade dried and kept for germination in the germination paper for a period of 10 days. The observations were recorded such as germination rate, shoot length, root length, Root: shoot and seedling vigour index. It was observed that among all the treatments, the FeO nanoparticle synthesized from *Aspergillus niger* @ 100ppm showed significantly highest germination rate (95%), root length (13.5 cm), shoot length (13.9 cm), and seedling vigour index (2603) as compared to control [germination rate (85%), root length (9.3cm) and shoot length (11.4cm) and seedling vigour index (1759)] and other treatments. This study concludes that the FeO nanoparticle synthesized from *Aspergillus niger* @ 100 ppm is optimum for seed priming in groundnut seeds.

**Key words:** Green synthesis, FeO nanoparticles, *Aspergillus niger*, seed priming,

## NITROGEN MINERALIZATION RATE OF DIFFERENT ORGANIC SOURCES IN *INCEPTISOL* OF UMIAM, MEGHALAYA

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### ABSTRACT

Study of the release pattern of nitrogen from locally available organic sources helps to reduce the chance of occurrence of nitrogen pollution of soil and water and determine the period of peak nitrogen release from organic amendments. These considerations are more relevant in the case of farming in the state of Meghalaya where the farming by default is organic in nature. An incubation study was carried out for a period of 100 days with four organic amendments namely farm yard manure, Poultry manure, Pig manure and Vermicompost and a control (at a rate of 120kg/ hectare) which were evaluated at every 10 Days interval with the aim to quantify the amount of Nitrogen mineralised and the rate of Nitrogen mineralisation at different time intervals. Initially, soil nitrate and ammonium contents were 17.5ppm and 28.0ppm respectively but with advancement in the incubation period, nitrate and ammonium in soil were found to increase. Amendment with pig manure resulted in highest nitrate and ammonium content in soil (39.6ppm and 72.3ppm respectively corresponding to 126.2% and 158.2 % over the initial soil nitrate and ammonium content). Unamended soil recorded the lowest amount of mineralised nitrogen in soil which were only 13.14% and 20.71 % higher over the initial soil nitrate and ammonium content. Change in rate of mineralizable nitrogen (dN/dt) with respect to incubation periods was found to be highest i.e 0.39mg/kg ammonium nitrogen at 60 Days after Incubation and 3.13mg/kg nitrate nitrogen at 10 Days after Incubation. Nitrogen release kinetics were worked out using two models, namely, first order and second order. The first order kinetics model was found to provide best fit equation for predicting nitrogen mineralization rate at any point of time.

**Keywords:** Nitrogen mineralisation rate, organic inputs, nitrogen mineralisation kinetics.



## NUTRITIONAL MANAGEMENT OF BUTTON SHEDDING IN COCONUT (*COCOS NUCIFERA* L.)

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### ABSTRACT

Abscission of flowers and immature nuts are the important factors which influence the coconut yield. An experiment was conducted to determine the physiological management of flower abscission in coconut by using nutrients and growth regulators through root feeding. At first, a survey was conducted at Coconut Research Station, Balaramapuram to select the west coast tall palms with uniform age having significant flower abscission. The respective solutions as per different treatments fixed for the study were prepared and administered to the palms through root feeding. After the root feeding, the number of flowers retained in the newly opened inflorescence were observed and recorded for a period of first six months. Various biochemical, physiological and yield parameters were also estimated. Among the seven treatments given, T2 (Hoagland solution -2X) showed the lowest percentage of flower abscission which was followed by T6 (Salicylic acid-200 ppm) and T5 [Borax (0.5 g palm<sup>-1</sup>) + 2, 4- D (50 ppm)] treatments respectively for the first four months after the root feeding.

**Key words:** flower abscission, root feeding, Hoagland solution, nutrients, growth regulators.

## CLUSTERING APPROACH TO CLASSIFY SOIL SAMPLES OF KARNATAKA

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### ABSTRACT

The soil behavior highly depends on soil characteristics which are most variable in nature. Soil behaviour helps in measuring soil performance for growing crops, which in turn will help the farmers to make decisions about the crops to be grown. In order to predict soil behaviour and to know the appropriate clustering technique to classify soil samples of varied kind, the knowledge of soil grouping based on similar characteristics is necessary. To this end, the data on soil samples was collected from ICAR-NBSS & LUP Regional Center, Bengaluru, Karnataka. Gower's distance metric was employed in the present study to get distance matrix of the data which are both quantitative and qualitative in nature. By Elbow method, the ideal number of clusters was found to be three. Clustering of soil samples was done by employing three techniques namely Single linkage, Complete linkage, and K-Medoid methods. The classified soil samples were validated using Dunn, and Silhouette Index. Among clustering techniques, K-Medoid method had the highest value for Dunn Index (1.29), and Silhouette Index (0.13). Similarly, soil classification based on K-Medoid method has been found to be realistic in making crop selection decisions.

**Keywords:** Single linkage, Complete linkage, K-Medoid method, clustering indexes.



## EFFECT OF GREEN SYNTHESIZED CU NANOPARTICLES PRIMING ON SEED QUALITY IN GREENGRAM

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### ABSTRACT

The research work deals with investigating the effect of seed priming with green synthesized CuNPs with Tulasi leaves on seed quality attributes of greengram seeds variety DGGV 2. The greengram seeds were primed with different concentrations of green synthesized CuNPs in the ratio of 1:2 for 1 and 3 hrs soaking duration to find best concentration and soaking duration. The experiment consists of nine different treatments which includes T<sub>1</sub>: 50 ppm CuNPs for 1 hr, T<sub>2</sub>: 50 ppm CuNPs for 3 hr, T<sub>3</sub>: 75 ppm CuNPs for 1 hr, T<sub>4</sub>: 75 ppm CuNPs for 3 hr, T<sub>5</sub>: 100 ppm CuNPs for 1 hr, T<sub>6</sub>: 100 ppm CuNPs for 3 hr, T<sub>7</sub>: Tulasi leaf extract for 1 hr, T<sub>8</sub>: Tulasi leaf extract for 3 hr and T<sub>9</sub>: Control. After drying back to 10 per cent moisture content, standard seed germination test was conducted through between paper method. The final count was taken on 7<sup>th</sup> day and various seed quality parameters were determined. Increasing CuNPs concentration showed reduced effect on seed germination and seedling vigour. Whereas, the soaking duration for 1 hr had shown high germination per cent for all the treatments when compared to soaking duration for 3 hrs. The lowest concentration of 50 ppm CuNPs soaked for 1 hr exhibited the highest seed germination of 93 per cent accounting for 10 per cent increase in germination over control. The same treatment showed higher shoot length (14.66 cm), root length (16.5 cm), highest seedling vigour index I (2897) and seedling vigour index II (23,34.3) and seedling dry weight (25.1 mg).

**Key words:** CuNPs (Copper nanoparticles), germination per cent, tulasi leaf extract, green synthesis, seedling vigour.

## FODDER QUALITY OF BERSEEM AS INFLUENCED BY ZINC AND IRON FERTI-FORTIFICATION

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### ABSTRACT

An experiment was carried out during *Rabi* season, 2020 to analyze the quality of berseem fodder as influenced by zinc (Zn) and iron (Fe) fortification. The experiment was laid out in Randomized Block Design with seven treatments of nutrient management with three replications. The treatment supplied with 100% RDF + Zn (basal) recorded significantly higher green fodder (69.82 t/ha) and dry matter yield (9.59 t/ha) over control. Results revealed that percentage dry matter, organic matter, crude protein and ether extract were significantly higher in treatment supplied with 100% RDF + Zn (basal) which were statistically at par with 100% RDF + Fe (basal). While significantly lower fractions of NDF, ADF, ADL and hemicellulose found with treatment imposed 100% RDF + Zn (basal). Total N and K content was significantly higher in 100% RDF + Zn (basal) treatment while P content was significantly higher in 100% RDF treatment as compared to control. Zn and Fe content was significantly higher in 100% RDF + 0.5% foliar spray of Zn and 100% RDF + 0.5% foliar spray of Fe, respectively.

**Key words:** Ferti-fortification, zinc, iron, quality, crude protein, ether extract

## INFLUENCE OF INTEGRATED FOLIAR NUTRITION TO COWPEA (*VIGNA UNGUICULATA* (WALP))

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### ABSTRACT

A field experiment was conducted to study the influence of integrated foliar nutrition to cowpea (*Vigna unguiculata* (L.) Walp) in medium black soils at ICAR - Krishi Vigyan Kendra (KVK) Farm, Vijayapur during summer 2021. The experiment was laid out in Randomized Complete Block Design with nine treatments replicated thrice. The results revealed that, integrated foliar nutrition through different nutrients exerted significant influence on the growth and development parameters, yield attributes, yield, nutrient uptake and economic returns of cowpea. Among them, the treatment RPP + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% at flower initiation stage and peak flowering stage recorded significantly higher seed yield (1692 kg ha<sup>-1</sup>), haulm yield (3466 kg ha<sup>-1</sup>), net returns (₹ 59,398 ha<sup>-1</sup>) and BC ratio (3.36) compared to all other treatments. Recommended Package of Practices recorded lower seed yield (1197 kg ha<sup>-1</sup>), haulm yield (2208 kg ha<sup>-1</sup>), net returns (₹ 36,648 ha<sup>-1</sup>) and BC ratio (2.58) at flower initiation stage and peak flowering stage over rest of the treatments and lowest was recorded with Recommended Package of Practices.

**Key words:** Cowpea, foliar nutrition, yield

**SOIL FERTILITY, GROWTH, YIELD AND ROOT QUALITY OF RADISH  
(*RAPHANUS SATIVUS* L.) AS INFLUENCED BY INTEGRATED NUTRIENT  
MANAGEMENT PRACTICES**

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**ABSTRACT**

Radish is a popular root vegetable grown worldwide and its young fresh tender tuberous roots which can be cooked or eaten raw in salads. The haphazard use of inorganic fertilizers for long period deteriorates fertility and productivity of soil. Therefore, this study was proposed for an extensive evaluation of different combinations of organic manure, bio fertilizer with inorganic fertilizers and their influence on growth, yield, quality, economics and soil health in radish. This study was carried out on radish cv. Japanese white with 13 treatment combinations in randomized block design with three replications. Soil quality was increased in terms of availability of N, P and K to the tune of 15.17, 18.66 and 13.01 per cent, respectively by integrated module (90% RDF + 10% SMC + FYM + AZB+ PSB) i.e. T<sub>6</sub>, over the recommended practice. Application of 90% RDF (Recommended Dose of Fertilizers) + 10% SMC (Spent Mushroom Compost) + FYM (Farm Yard Manure) + AZB (*Azotobacter*) + PSB (Phosphate Solubilising Bacteria) (T<sub>6</sub>) recorded maximum number of leaves (15.68), leaf size ((21.01 x 9.88 cm), root size (18.80 x 2.86 cm), root weight (130.42 g) and root yield (341.68 q/ha) while, 60 % RDF + 40% SMC + FYM + AZB + PSB (T<sub>9</sub>) proved best combination for quality attributes. Increase in yield under T<sub>6</sub> was to the tune 11.44% over standard practice (control). Our findings of integrated nutrient management approaches may effectively address the present notion of "farming for health" to maintain soil health for sustainable crop production.

**Key words:** Radish, organic manure, bio fertilizer, spent mushroom compost, inorganic fertilizers, soil quality



**INTERACTIVE EFFECT OF RESIDUE AND NITROGEN MANAGEMENT PRACTICES ON SOIL ORGANIC CARBON STATUS UNDER RICE-WHEAT CROPPING SYSTEM**

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**ABSTRACT**

The continuous practice of rice-wheat rotation in Indo-Gangetic plains of India results in nutrient imbalance, soil degradation and environmental deterioration. Soil carbon sequestration is conducive to mitigating climate change and improving soil quality. Recycling crop residue is considered a potential strategy for improving soil carbon sequestration in cropland. Various residue management practices, such as residue incorporation, mulching, enriching residues with microbial inoculants have been widely used in crop production. Efficient use of biomass by converting into biochar is a novel approach to counter the climate change and improve soil health. Applying biochar derived from crop residue effectively enhance soil organic carbon and soil quality. Incorporating crop residues and biochar has received increasing attention as tools to mitigate atmospheric carbon dioxide (CO<sub>2</sub>) emissions and promote soil carbon (C) sequestration. Nitrogen application along with biochar promotes microbial community shift towards increasing microbial carbon use efficiency in soil and reduce the population of recalcitrant carbon decomposing microbes. Increase in availability of nutrients under biochar and residue incorporation promotes growth of root biomass, triggers soil enzymatic activity which in turn increases soil carbon mineralization and soil organic carbon content.

**Keywords:** Carbon sequestration, climate change, residue recycling, biochar



## PROCESS ANALYSIS OF PRODUCTION OF FERTILIZER AND DETERMINING LOSS DUE TO FAILURE TO MEET THE SPECIFICATION

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### ABSTRACT

The sustainable development is responsible production and efficient use of resources available to human. The present paper refers to the best practices in fertilizer production in improving crop yield, farm profitability and resource efficiency while at the same time reducing adverse environmental impacts. So, the study is based on analysis of performance of four different train in a plant for production of three products namely DAP, N20 and N10 fertilizers by using Exponentially Weighted Moving Average (EWMA) and Moving Average (MA) control charts and Process Capability Indices. Further, the loss to producer due to not meeting the specification limits was determined. The result indicated that most of the time production process is out of control. Due to product failure the organization suffer production loss, time loss as well as money loss. Hence, the producer suffers loss of nutrients and its associated cost and consequently market prices of fertilizers increases which directly affect farmers' pocket. This paper, also, recommended use of Laser Induced Breakdown Spectroscopy (LIBS) technology to give instantaneous quality result for the outgoing product and in turn reducing losses of nutrients, resources, energy and capital.

**Keywords:** EWMA and MA control charts, Process capability indices, Loss to producer, Specification limits, LIBS.



## ORGANIC MANURE AND FERTILITY LEVEL AFFECTS THE FLOWERING, YIELD AND QUALITY ATTRIBUTES OF OKRA UNDER HEAVY CLAY SOIL OF SOUTHERN RAJASTHAN

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### ABSTRACT

The present experiment was conducted to find out the effects of organic manures and different dose of inorganic fertilizers on yield and quality of okra cv. Varsha Upkar. The experiment consisted of 21 treatment combinations with four organic manures (control, 15 t FYM. ha<sup>-1</sup>, 5 t vermicompost. ha<sup>-1</sup>, 5 t poultry manure. ha<sup>-1</sup>) and three fertility levels (control, 75% RDF and 100% RDF) in Factorial Randomized Block Design (FRBD) with three replications. The results showed that the application of poultry manure 5t/ha significantly found superior which took minimum days to first flower appearance (38.90), days to 50 percent flowering (44.70), maximum number of fruits per plant, fruit weight (18.28g), yield parameters (385.99g/plant), chlorophyll content and crude protein. Further, 100% RDF and combined application (100% RDF + poultry manure 5t/ha) were also exhibited better results of flowering, yield and biochemical parameters.

**Keywords:** Okra, poultry manure, inorganic, chlorophyll, crude protei

**YIELD AND ECONOMICS OF FOXTAIL MILLET (*SETARIA ITALICA*) AS  
AFFECTED BY APPLICATION OF ZINC AND IRON IN NORTHERN  
TRANSITIONAL ZONE OF KARNATAKA UNDER RAINFED CONDITION**

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**ABSTRACT**

The study of field performance of Foxtail millet (*Setaria italica*) as affected by application of Zinc and Iron in Northern Transitional Zone of Karnataka under rainfed condition was conducted at College Farm, College of Agriculture, Hanumanamatti, Ranebennur taluk, Haveri district (UAS, Dharwad) Karnataka state during *kharif* 2019 and 2020. The experiment was laid in RCBD with eight treatments each replicated thrice. RPP was common to all treatments (30:15:15 kg NPK ha<sup>-1</sup> + 6 t FYM ha<sup>-1</sup> + 500 g of *Azospirillum* ha<sup>-1</sup>) except control. The treatments comprised of T<sub>1</sub> : Farmers' practice (30 kg DAP ha<sup>-1</sup> & No FYM), T<sub>2</sub> : RPP (30:15:15 kg NPK ha<sup>-1</sup> + 6 t FYM ha<sup>-1</sup> + 500 g of *Azospirillum* ha<sup>-1</sup>), T<sub>3</sub>: T<sub>2</sub>+ ZnSO<sub>4</sub> @ 10 kg ha<sup>-1</sup>, T<sub>4</sub>: T<sub>2</sub>+ ZnSO<sub>4</sub> @ 15 kg ha<sup>-1</sup>, T<sub>5</sub>: T<sub>2</sub>+ FeSO<sub>4</sub> @ 10 kg ha<sup>-1</sup>, T<sub>6</sub>: T<sub>2</sub>+ FeSO<sub>4</sub> @ 15 kg ha<sup>-1</sup>, T<sub>7</sub>: T<sub>2</sub>+ ZnSO<sub>4</sub> @ 10 kg ha<sup>-1</sup>+ FeSO<sub>4</sub> @ 10 kg ha<sup>-1</sup> and T<sub>8</sub>: T<sub>2</sub>+ ZnSO<sub>4</sub> @ 15 kg ha<sup>-1</sup>+ FeSO<sub>4</sub> @ 15 kg ha<sup>-1</sup>. In the present investigation, significantly higher grain yield was recorded in T<sub>8</sub> during both the years (17.73 & 19.17 q ha<sup>-1</sup> during 2019 & 2020, respectively) as well as in pooled data (18.45 q ha<sup>-1</sup>) as compared to rest of the treatments under study. However, it was on par with T<sub>7</sub>. Almost similar trend was noticed in stover yield also. In the present study cost of cultivation of different treatments ranged from ₹ 19081 ha<sup>-1</sup> to ₹ 26907 ha<sup>-1</sup>. Among different treatments, T<sub>8</sub> has recorded higher gross return (₹ 44629 ha<sup>-1</sup> & ₹ 62419 ha<sup>-1</sup> during 2019 & 2020, respectively and ₹ 53524 ha<sup>-1</sup> pooled years) and was closely followed by T<sub>7</sub> (₹ 40920 ha<sup>-1</sup> & ₹ 58626 ha<sup>-1</sup> during 2019 & 2020, respectively and ₹ 49773 ha<sup>-1</sup> pooled years) during both the years of study as well as in pooled data. Similarly, T<sub>8</sub> (₹ 17744 ha<sup>-1</sup> & ₹ 35491 ha<sup>-1</sup> during 2019 & 2020, respectively and ₹ 266184 ha<sup>-1</sup> pooled years) has recorded higher net return and was closely followed by T<sub>7</sub> (₹ 14960 ha<sup>-1</sup> & ₹ 32623 ha<sup>-1</sup> during 2019 & 2020, respectively and ₹ 23792 ha<sup>-1</sup> pooled years) during both the years of study as well as in pooled data. Almost same trend was noticed with respect to benefit cost ratio.

**Keywords:** Foxtail millet, micronutrients, yield, net return, benefit cost ratio

**INFLUENCE OF MICROBIAL CONSORTIA AND WATER SOLUBLE  
FERTILIZERS ON PHYSIOLOGICAL AND LEAF YIELD PARAMETERS IN  
ANNUAL MORINGA VAR. PKM – 1**

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**ABSTRACT**

Research on influence of liquid bio fertilizers and water soluble inorganic nutrients on leaf yield of annual moringa Var. PKM-1 was conducted at Horticultural College and Research Institute, Periyakulam. The seeds were sown in raised bed with spacing of 40 cm × 20 cm and the beds were irrigated with drip fertigation method. The water soluble inorganic fertilizers *viz.*, urea (46% N), mono ammonium phosphate (12:61% of N and P<sub>2</sub>O<sub>5</sub>), potassium nitrate (13: 45% of N and K<sub>2</sub>O) and All 19 (19: 19: 19 % of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O). Liquid form of *Azospirillum* (10<sup>9</sup>cells/ml) and Phosphate Solubilizing Bacteria (10<sup>9</sup>cells/ml) Potassium Solubilizing Bacteria (10<sup>9</sup>cells/ ml) and Pink Pigmented Facultative Methylotrophs (PPFM) (10<sup>9</sup>cells/ml) were used for the trial. A dosage of 27.0:4.5:9.0 g of NPK / m<sup>2</sup> was taken as 100% dose (270: 45: 90 NPK kgha<sup>-1</sup>). Inorganic fertilizers were applied in four stages in all the treatments on 20 DAS, 50 DAS, 80 DAS and 110 DAS. Liquid bioinoculants were applied through the fertigation @ 125 ml each in four stages *viz.*, 35, 65, 95 and 125 DAS. The physiological and yield data were recorded during three harvests and statistically analysed. Plants received 125% of RDF along with biofertilizers resulted in increased physiological parameters *viz.*, chlorophyll 'a'(1.72, 2.01 and 2.07 mg g<sup>-1</sup>), chlorophyll 'b' (1.46, 1.52 and 1.54 mg g<sup>-1</sup>), total chlorophyll (3.18, 3.53 and 3.61 mg g<sup>-1</sup>), Chlorophyll stability index (85.38, 85.60 and 91.42 %), leaf area (710.12, 746.93 and 769.89 cm<sup>2</sup> plant<sup>-1</sup>), leaf area index (0.88, 0.93 and 0.96). The same treatment also recoded highest leaf fresh weight per plant (67.31, 70.08 and 72.34 g), leaf dry weight per plant (13.20, 13.22 and 13.90 g).

**Key Words:** Moringa, biofertilizers, Leaf yield



## STANDARDIZATION OF HPLC-PDA METHOD FOR DETERMINATION OF IMAZETHAPYR RESIDUES IN SOIL AND ITS APPLICATION IN REAL SOIL SAMPLES COLLECTED FROM TREATED URDBEAN POTS

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### ABSTRACT

Imazethapyr, an imidazolinone group of selective herbicide, widely used to control grasses and broad leaf weeds in different legumes. To determine imazethapyr from soil matrix, a HPLC-PDA method was standardized which involves acetonitrile-0.1% ortho phosphoric acid (70:30, v/v), as mobile phase with flow rate of 1 mL min<sup>-1</sup>. Acetate buffered quick, easy, cheap, effective, rugged and safe (QuEChERS) technique was utilized for sample preparation. Solvent-matched and matrix-matched calibration curves confirm matrix effect in analysis of imazethapyr. To nullify this effect, matrix-matched standards were used for residue quantification in soil samples. Recovery studies revealed 83.22-92.59% recoveries of imazethapyr from spiked soil samples (0.005 to 10 µg g<sup>-1</sup>). LOD and LOQ were found to be 0.005 and 0.01 µg g<sup>-1</sup>, respectively. Residue quantification was done in real soil samples collected from urdbean pots treated with imazethapyr at the rate of 100 and 150 g a.i./ha, as pre and post emergence application. Soil samples collected at periodic interval were analyzed, which confirms presence of imazethapyr residues in soil even after 75 days of application, with half-lives of 53.75 to 59.02 days. This HPLC-PDA method can be utilized to study imazethapyr residue status in field soil and harvested urdbean pods for quality evaluation.

**Keywords:** Imazethapyr, HPLC-PDA, acetate buffered QuEChERS, urdbean

## EFFECT OF ORGANIC MANURES ON GERMINATION AND GROWTH OF SNAKE GOURD

(*TRICHOSANTHES CUCUMERINA* L.)

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### ABSTRACT

The study on “Effect of organic manures on germination and growth of snake gourd (*Trichosanthes cucumerina* L.)” was conducted in Sithalavai village, Karur District, Tamil Nadu during August - November 2021. A field experiment was conducted to study the effect of organic manures on germination and growth of Snake gourd. The organic manures like farm yard manure, vermicompost, phosphobacteria were applied as basal form. The experiment was laid out in randomized block design (RBD) with six treatments, replicated thrice. The results of the investigation revealed that the growth parameters like number of days taken for germination, vine length (cm) and leaf area (cm<sup>2</sup>) were recorded to be highest in the treatment T<sub>4</sub> receiving vermicompost @5t ha<sup>-1</sup> along with RDF, followed by T<sub>6</sub> (RDF + phosphobacteria (2kg ha<sup>-1</sup>)). The minimum values of all these characters were recorded under control.

**Keywords:** Snake gourd, vermicompost, farmyard manure, phosphobacteria, growth.

## **ROLE OF AGROCHEMICALS, BIOLOGICAL AND TECHNOLOGICAL INTERVENTIONS TOWARDS SAFE FOOD AND NUTRITIONAL SECURITY**

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### **ABSTRACT**

This study examined the role of agrochemicals, biologicals and technological interventions towards safe food and nutritional security. Food crops are threatened by 30,000 species of weeds, 3,000 species of worms and 10,000 species of plant eating insects. This makes the role of judicious use of agrochemicals, biological, Technological Intervention in order to keep food safe and support nutritional security. The locust attack last year, the worst in past three decades, has reportedly destroyed nearly 1.7 hectare of farmland in Rajasthan and Gujarat. Agrochemicals are important for sustaining growth of plants and regaining the fertility of soil without affecting the environment until uses in excessive amount. Eventually new technique including biological (GMO) and technological methods came in practice which cause huge impact on food safety and nutritional security by improving the trait, higher crop production, decreases the uses of fertilizers and pesticides which reduces the impact on natural ecosystem. Interestingly the per hectare consumption in India the top exporters of agrochemicals products are only 0.29 kg/ha as compare to 13.06 kg/ha in China, 11.85 kg/ha in Japan. Agrochemical are not the reason for declining soil fertility and cancer etc. lack of knowledge among farmers on the type and amount of product needed for that crop and soil causes imbalance. Realising the importance of such knowledge regular farmer education camps by government and private bodies should held.

**Key words:** Role of agrochemicals, biological (GMO), food safe and nutritional security, agrochemical's consumption



## SURVIVAL OF MICROBIAL INOCULANTS IN CAPSULE BASED FORMULATION

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### ABSTRACT

Survival of *Azotobacter chroococcum* and *Bacillus megaterium* was observed up to 180 days of storage in both single and dual inoculant combination. The population of *Azotobacter chroococcum* in capsule based formulation maintained at its maximum  $\log_{10}8.21$  cells/g in first 30 days the population declined from  $\log_{10}8.21$  cell/g to  $\log_{10}6.33$  cells/g at the end of 180 days of storage. Percent survival of 77.57 was recorded at the end of 180 days of storage. *Bacillus megaterium* in capsule based formulation recorded  $\log_{10}7.92$  cells/g at the beginning of storage. Later, gradually declined with an intermittent increase in the population. At the end of 180 days of storage *Bacillus megaterium* population declined from  $\log_{10}7.92$  cells/g to  $\log_{10}6.21$  cells/g. percent reduction of *Bacillus megaterium* at the end of 180 days of storage found to be 78.40. survival of dual inoculants *Azotobacter chroococcum* + *Bacillus megaterium* in capsule based formulation showed  $\log_{10}7.90$ ,  $\log_{10}7.76$  cells/g at beginning, reduced to  $\log_{10}5.90$ ,  $\log_{10}6.46$  cells/g at the end of 180 days of storage.

**Keywords:** Microbial inoculants, *Azotobacter chroococcum*, capsule based formulation

**TO ANALYSE THE EFFECT OF VARIOUS BIOFERTILIZERS AND CHEMICALS ON ELECTRICAL CONDUCTIVITY AND FIELD PARAMETERS IN WHEAT [*TRITICUM AESTIVUM* (L.) EM. THELL] SEED**

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**ABSTRACT**

The viable and vigorous seed availability during the time of planting is important to achieve the maximum agricultural production. Keeping in view the present study was conducted during 2018-2020 in the laboratories of the Department of Seed Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Hisar. To study the effect on field emergence index, electrical conductivity of seed leachates and seedling establishment of wheat [*Triticum aestivum* (L.) em. Thell]. During the conductance of this study, the seed were treated with *Azotobacter*+Phosphate solubilizing bacteria enhanced the quality of seed in terms of all parameters such as field emergence index, electrical conductivity of seed leachates and seedling establishment of fresh and old seed lots of wheat, and Chlorpyrifos and its combinations showed negative effect on seed quality. Through this study, it was concluded that to maintain the better plant stand in the field use biofertilizers which enhances the quality of seed whereas the insecticides and fungicides treatments may reduce the pests and disease incidence but have slightly negative impact on the seedling growth.

**Key Words:** Seed, seed treatment, biofertilizer, seed quality parameters, seed vigour

**ASSESSMENT OF SEDIMENT QUALITY OF KOLAR RIVER OF MADHYA PRADESH**

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**ABSTRACT**

The sediments of Kolar River at Bhopal region of Madhya Pradesh have been studied. The sediment samples were collected from different stations of the River during summer, winter, monsoon and post monsoon seasons. The physico chemical parameters like pH electrical conductivity, TDS, alkalinity, chloride, bulk density, moisture content, organic matter, organic carbon, nitrate, phosphate, particle size distribution were analyzed. although sediment parameters were in the suitable range, the overall results suggested that better management of techniques should be practices in order to overcome impact on Kolar River.

**Key words:** Sediment quality, kolar river, physicochemical parameters, particle size distribution, Bhopal region.

## FORMULATION OF *PACHYRHIZUS EROSUS* SEED OIL CONTAINING ROTENONE AS POSSIBLE BIOPESTICIDE

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### ABSTRACT

Botanicals are considered as eco-friendly alternative to synthetic pesticides for crop protection. The seeds of *Pachyrhizus erosus* is reported to contain rotenone as its active principle for pesticidal property. An attempt was made to standardize oil extraction method from *Pachyrhizus* seed powder using different solvent systems. Among the solvents, dichloromethane produced highest oil yield (41%) followed by chloroform (35%), 50% chloroform in hexane (31%) and acetone (28%). Rotenone in dichloromethane extract was estimated using High Performance Liquid Chromatography (HPLC) coupled with UV-Vis Spectrophotometer. Among the six methods followed for clean-up based on QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe: M1-M5) and SPE (Solid-Phase-Extraction: M6) techniques, M5 appeared to be the best. The highest concentration of rotenone (3.94  $\mu\text{g/g}$ ) was obtained in oil extract cleaned up by M5 followed by M6 (2.97  $\mu\text{g/g}$ ). Emulsifiable Concentrate (EC) formulations (F1-F6) were prepared from *Pachyrhizus* seed oil (30%) using three different solvents (60%), viz., liquid solvent naphtha, soybean and mustard oil and combinations of two surfactants (10%) among CAS, CABS, NP-13, Triton X-100, Tween-20 and Tween-80 in 1:1 ratio. Three EC formulations (F1, F2 and F6) with satisfactory pH, storage and emulsion stability values are recommended for further exploration as botanical pesticide.

**Keywords:** Botanical pesticide; Emulsifiable Concentrate; HPLC; *Pachyrhizus erosus*; Rotenone.



**VARIETAL RESPONSE OF BARNYARD MILLET GENOTYPES AGAINST SHOOT FLY, *ATHERIGONA FALCATA* (MUSCIDAE: DIPTERA)**

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**ABSTRACT**

This field experiment was carried out during *Kharif* 2019 at Agricultural Research Station, V. C. Farm, Mandya. Results revealed that among 18 evaluated genotypes, IIMR BM-2-17 and DHBM 93-3 genotypes expressed high tolerance (HT) with mean dead heart in the range of 1.00 to 5.00 per cent. Further, BMV 583 and VL 270 genotypes were as tolerant (T) with mean per cent of head heart (5.00 to 25.00). Eight genotypes (IIMR BM-29-17, VMBC 333, VL 207, LDR 1, BMV 591, TNEF 317, BMNDL-2 and BMNDL-3) were grouped under moderately tolerant (MT) with mean per cent dead hearts (25.00 to 50.00). Similarly, DHBM 19-7, BMNDL-1, VMBC 332 and TNEF 318 genotypes were grouped under susceptible (S) with mean of dead hearts (50.00 to 85.00 per cent). VL 254 and PRD 903 genotypes were highly susceptible (HS) with more than 85.00 per cent of dead hearts. Similarly, lowest number of eggs were noticed in IIMR BM-29-17 followed by BMV 591 BMV 583 (0.11), IIMR BM-2-17, VL 270 and highest number of eggs<sup>-1</sup> 10 plants was recorded in LDR 1 genotype. PRD 903, IIMR BM-29-17 and DHBM 93-3 genotypes at 14, 21, 28 and 35 days after sowing expressed resistance against shoot fly.

**Keywords:** Genotypes, Barnyard millet, Shoot fly.



**DEVELOPMENT AND EVALUATION OF *CELOSTERNA SCABRATOR*  
MANAGEMENT STRATEGY AND IT'S ECONOMIC ANALYSIS UNDER  
FARMER VINEYARD CONDITIONS**

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**ABSTRACT**

Management practice involving mechanical removal of *C. scabrator* grubs was developed and validated at farmers' vineyards in Nashik between February 2020 and February 2022. It was found that regular monitoring at 10 days interval during December to April and mechanical removal of *C. scabrator* grubs at the initiation of appearance of frass near the plant was highly effective. The experiment was conducted in seven *C. scabrator* infested vineyards at Sarole Khurd, Nashik and the level of infestation ranged from 6.15 to 20.35% before imposing the management. After following this practice for two fruiting seasons 2020 and 2021, the infestation level ranged from 0.17 to 0.55 per cent during 2022 resulting in total 96.84 per cent reduction in the infestation and total savings of Rs. 1.88 lakh per year in these seven vineyards. This was also evaluated at Nashik and Solapur during October-April 2022 in two other farmers' vineyards and the level of infestation was 12.25 & 22 per cent, respectively. The observations were taken on yield per vine on healthy, treated and untreated vines at the time of harvest and the yield in healthy and treated vines were statistically similar and was significantly superior over infested untreated vines.

**Keywords:** grape, stem borer, mechanical, management



**CONTROL OF BIOFILM IN FOOD PROCESSING ENVIRONMENT WITH METHANOLIC EXTRACTS OF *CITRUS LIMON*, *AVERRHOA CARAMBOLA* AND *BRASSICA JUNCEA***

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**ABSTRACT**

*Yersinia enterocolitica* is the third commonly reported enteropathogen that mostly infects humans from contaminated processed meat and other food products. Its biofilm forming ability allows the organism to thrive after regular cleaning and disinfection, which in turn can create problems for its control in food processing environments. Extensive research has been carried out for phytochemicals serving as antimicrobial agents over the past few decades. Moreover, their potential as a control measure for biofilms in food industry has also been studied upon, with a large number of phytochemicals reported to exhibit antibiofilm activities. Plant derived methanol extracts of *Citrus limon*, *Averrhoa carambola* and *Brassica juncea* were subjected to preformed biofilms of *Y. enterocolitica* in microtitre plates with different concentrations and then were stained with crystal violet for measuring their biofilm activity by spectrophotometry. Extract of *Citrus limon* was able to inhibit biofilm better than *Averrhoa carambola* and *Brassica juncea*. The results were also confirmed by microscopy where visualisation of depletion of biofilm was observed. The resulting inhibition could be attributed to the presence of bioactive phenolic compounds in the extracts which was further confirmed through phytochemical and GC-MS/MS analysis of the extracts.

**Keywords:** *Yersinia enterocolitica*, biofilm, *Citrus limon*, *Averrhoa carambola*, *Brassica juncea*, microtitre plate assay



## ADVANCEMENT OF FOOD AND NUTRITIONAL SECURITY THROUGH HOME GARDENING AND URBAN AGRICULTURE IN RESPECT TO COVID-19 PANDEMIC

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### ABSTRACT

Despite a 2.3 percent rise in global grain output in 2019, the number of people experiencing extreme food insecurity is expected to double from 135 million in January 2020 to 265 million by the end of 2020. Food and nutritional insecurity is a major issue in metropolitan cities, where the world population is expected to grow by 1.84, 1.63, and 1.44 percent per year from 2015 to 2020, 2020 to 2025, and 2025 to 2030, respectively, rising from 54 percent in 2016 to 60 percent by 2030. The number of metropolitan cities (cities with more than 10 million inhabitants) would rise from 34 in 2015 to 41 by 2030. The COVID-19 pandemic has exacerbated food insecurity in urban areas due to disruptions in the food supply chain, aggravation of physical and economic obstacles to food availability, and a catastrophic rise in food waste due to labour shortages. As a result, more resilient food systems, reduced food waste, and strengthened local food production are required. Home gardening and urban agriculture are essential strategies for increasing availability at the household and community levels. Food production in cities includes small-scale agriculture in families, communal gardens, indoor and rooftop gardens, vertical farming, and so on. Home gardening can help advance food and nutritional security during and after the COVID-19 pandemic, while also improving the supply of a variety of ecosystem services (for example, plant biodiversity, microclimate, water runoff, water quality, and human health). However, the concerns of heavy metal pollution of soil must be addressed.

**Keywords:** Food and nutritional security, Home gardening, Urban agriculture, COVID-19 pandemic, Food production.



## FOOD AND NUTRITIONAL SECURITY

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### ABSTRACT

Food and nutritional security is when “All the people at times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. Food security and food insecurity are dynamic reciprocal and time dependent and the resultant status depends upon the interaction between the stresses of food security and the coping strategies to deal with them. Four dimensions of food securities have been identified in line with different levels. Availability, Accessibility, Utilization, Stability. These may be considered as time dimensions that affects the levels. Most recent developments emphasize the importance of sustainability, which may consider as long term time. dimension to food security . the world food summit in 1996 provided a comprehensive definition for food security which brings into focus the linkage between food, nutrition and health. India has been Self-sufficient for food production. Over the decade, there has been the increasing recognition that though has been reduction in severe acute food security, dietary intake in large segments of population does not meet energy (hunger) and micronutrients (hidden hunger) requirements and consequently under nutrition and micronutrients deficiencies.

**Keywords:** food security, nutritional security, food insecurity, food production, sustainability



## **INTEGRATED FARMING SYSTEM APPROACH: A WAY FORWARD TO ALLEVIATE POVERTY**

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### **ABSTRACT**

The agricultural system and the farmers in our country are currently facing tremendous pressure, in terms of new agrarian structure, land reforms and increasing impacts of climate change. This has adversely affected the food and livelihood security of the people. This scenario points towards an urgent need for a planned policy framework and development in the agriculture sector to meet the nutritional requirements of the country. Attaining self-sufficiency in food production in this peculiar condition is indeed a challenge and it can be achieved only through a noble sustainable approach and Integrated Farming Systems (IFS) shows a way forward. IFS is broadly defined as a system comprising of several mutually cohesive and complementary agro based enterprises. Along with the benefits of sustainability and livelihood security, IFS also helps to mitigate the risks associated with mono cropping system by integrating livestock rearing and other enterprises which have a stable market. Attaining minimum dependence on external resources and efficient recycling of farm waste are the major objectives of IFS. Therefore, Integrated Farming System is a strong bet which could help the farmer to improve the overall productivity and thereby maximizing the profitability from a unit area.

**Key words:** Integrated Farming System- Enterprises – Linkage

## PREPARATION OF MORINGA POD PULP POWDER AND EVALUATION OF PHYSICOCHEMICAL AND BIO-FUNCTIONAL PROPERTIES

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### ABSTRACT

*Moringa oleifera* is popularly used as medicinal plant, since each and every part of the plant like leaves, fruits/pods, flowers, seeds, stem, and root are having significant importance towards human health and nutrition. Hence, an attempt was made to prepare the moringa pod pulp powder using tray drying method and the powder was analysed for both physicochemical and bio-functional attributes. The moisture, protein, fat, total carbohydrates, crude fiber, ash, and acid insoluble ash content of product was  $5.55 \pm 0.02$ ,  $9.52 \pm 0.08$ ,  $0.62 \pm 0.01$ ,  $69.03 \pm 0.12$ ,  $9.05 \pm 0.09$ ,  $6.23 \pm 0.04$ , and  $0.13 \pm 0.01$  respectively. The powder has got water solubility index of  $69.17 \pm 0.81\%$ , water absorption index of  $7.67 \pm 0.22$  g/g dry weight, and browning index of  $10.99 \pm 0.11$ . The total phenolic content was found to be  $70.63 \pm 0.1761$  mg GAE/g powder. The powder exhibits concentration gradient antioxidant, antidiabetic, ACE inhibitory, and antimicrobial activities. The powder has shown the  $IC_{50}$  value of 4.19, 3.68, and 4.47 mg/mL respectively for DPPH assay,  $\alpha$ -amylase inhibition, and ACE inhibition assay. Since, the moringa pod pulp powder has got better nutritional profile and functional attributes, one can exploit the powder to utilize as an ingredient in the formulation of functional dairy and other food products for value addition.

**Keywords:** Moringa, Tray drying, Nutrition, Functional attributes,



**TRANSFORMING AGRICULTURE IN INDIA THROUGH THE ‘TRIPLE-HIGH’ SYSTEM: A CASE STUDY ON NATURAL RICE FARMS OF NORTH-COASTAL ZONE IN ANDHRA PRADESH, INDIA**

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**ABSTRACT**

The Indian agriculture sector needs an integrated technology system that focuses on increasing crop productivity, farmers’ income and resource-use efficiency simultaneously (a triple-high system) to assure food security and environmental sustainability. The ‘triple-high’ system through Natural Farming (NF) focuses on increasing grain yield, boosting nutrient supply in the root zone, and increasing resource use efficiency, thereby increasing farmers’ income and environmental quality. In the North Coastal zone of Andhra Pradesh (AP), this system has been successfully tested and demonstrated in about 100 ecologically sustainable rice farms by working with well-organized farming associations, government extension networks and non-government organisations. To realise the reality of ‘triple-high’ system the approach included agricultural technology transfer and extension for high-yield and high-efficiency crop production, which focuses on (1) farm-based approaches for promoting knowledge transfer to farmers; (2) enterprise-based approaches of incorporating knowledge into commercial bio-products through collaborating with bio-fertilizer companies, start-ups and other enterprises; and (3) government-based approaches for improving the national extension network of agricultural technology. Innovative trajectories of ‘triple-high’ agriculture promote soil quality, resource-use efficiency, increased crop productivity, and farmers’ income while providing a promising option for resource use inefficiency, environmental concerns, food security and sustainable farmers’ income.

**Keywords:** Triple-high; Natural farming; Yield; Resource-use efficiency; Farmers’ income



## THE STATUS OF GROUNDWATER POLLUTION AND AGRICULTURE IN TIRUPPUR DISTRICT OF TAMIL NADU

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### ABSTRACT

A river is a natural flowing watercourse. One such is the Noyyal river, non-perennial, draining water in the western part of Tamil Nadu, predominantly in Tiruppur district. Its river basin including Groundwater, gradually became deteriorated due to industrial effluents (pollution). These industries polluted the river till 2011, after which Zero Liquid Discharge principle is under practice in complete stoppage of pollution. But the effect of pollution caused prior to the year 2011 still continues even now particularly in groundwater which affects production of groundwater irrigated crops as for agriculture is concerned. Considering the serious constraint of revamping of better groundwater condition, this research study is taken up which aims to find the impact of polluted groundwater use on agriculture in Avinashi block of Tiruppur district. The block is divided into three regions based upon the distance from the Noyyal river viz., Closer region, middle region and distant region and the study was carried out with a sample size of 120 farms covering 40 farm samples in each region. The findings of the study are i) the quality of the groundwater was comparatively good in the middle region and better in the distant region, ii) the predominant irrigated crop in the study area was found to be coconut and the net income was almost two times greater than the closer region in middle region and it was two and half times in case of distant region. The suggested policy implications include construction of farm pond (percolation) in the regions surrounding the Noyyal river in order to reduce the groundwater pollution level. All the ponds, tanks and lakes surrounding the Noyyal river are to be desalinated and allowing those structures only for recharge for next few years to improve groundwater quality.

**Keywords:** Groundwater, pollution, agriculture, water quality

**CHARACTERIZATION OF PHYTOCHEMICALS AND PIGMENTS IN  
DIFFERENT EXTRACTS OF RED SEAWEED, *GRACILARIA CORTICATA*, AND  
THEIR ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES**

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**ABSTRACT**

Marine algae have attracted considerable attention as a sustainable source for bioactives. The study investigates the phytochemical and pigment profiles of different extracts of *Gracilaria Corticata*. The study also evaluates the antioxidant and antimicrobial properties of these extracts. The samples were collected from the SE coast of India. These were cleaned, dried and powdered, for extraction using different solvents. The phenolic content ( $2.1 \pm 0.2$  mgGAE/g) was observed to be high in chloroform extract while dichloromethane extract showed high flavonoid content ( $7.3 \pm 0.02$  mgRE/g) and ethanol extract showed high tannin content ( $5.24 \pm 0.01$  mgTAE/g). The chloroform and acetone extracts showed similar FRAP ( $5.0$  mgAAE/g) values that could be attributed to the high polyphenols. This also possibly indicates its effectiveness in preventing the risk of cardiovascular diseases. The Spectrophotometrical analysis showed high amounts of chlorophyll a in ethanol extract ( $266 \mu\text{g/g}$ ), chlorophyll b in ethyl acetate ( $193 \mu\text{g/g}$ ) and chlorophyll c in methanol ( $29 \mu\text{g/g}$ ). The ethyl acetate ( $27.8$  mg/g) showed higher values for carotenoids. The chloroform and DMSO extracts showed similar values for fucoxanthin ( $27 \mu\text{g/g}$ ). The chloroform extract showed antimicrobial activity against E.coli. Therefore, the chloroform extract with its potent bioactive components could be used for various food and pharmaceutical applications.

**Keywords:** Marine algae, antioxidants, phytocomponents, antimicrobials



## **KNOWLEDGE, HYGIENE PRACTICES AND AWARENESS ON ANTIMICROBIAL RESISTANCE (AMR) AMONG MEAT HANDLERS IN ASSAM, INDIA**

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### **ABSTRACT**

Poor handling of raw meat results in cross contamination of microbes, mainly driven by poor knowledge on hygiene and non-adoption of good meat handling practices by meat handlers. It is a major contributing factor for meat-borne diseases in developing countries. Further, lack of knowledge on antibiotics use and AMR by the meat handlers might accentuate the resistance problem in humans. This study assessed the Knowledge, Hygiene Practices and Awareness on Antimicrobial Resistance (AMR) Use of Meat Handlers in Guwahati, Assam. A cross-sectional survey using a multistage sampling technique was carried out among 120 meat handlers in Guwahati. A structured questionnaire was used to collect the data concerning knowledge, hygienic practices and AMR. Further, observation data on hygienic practices by the meat handlers were also collected. The results revealed that all the sample meat handlers (100%) were aware on the negative health effects of improper handling of meat and they are also aware about regular washing of hands before and during meat processing will reduce the risk of contamination. However, 99% of the meat handlers were unaware about AMR. Regarding their practices, 70% of meat handlers wash their hands before and after handling meat and 80% of them eat or drink at the workplace. In conclusion, the meat handlers had fair knowledge on negative health effects on unhygienic meat handling but with a low level of meat hygiene practices. Hence, to increase the adoption of hygienic practices by the meat handlers, public health education and training on safe handling practices backed by policy support that modernises the meat handling is strongly recommended.

Keywords: Knowledge, Practices, Meat handlers, Meat hygiene, Anti-Microbial Resistance (AMR)



## STUDIES ON EFFECT OF COLD PLASMA TREATMENT IN COMBINATION OF ENZYME ON CELLULOSE

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### ABSTRACT

Atmospheric Cold Plasma (ACP) is a novel non-thermal processing technology used to alter the physical and chemical properties of starch without affecting its bulk properties. The present study deals with changes in physico-chemical properties of untreated and plasma treated cellulose. Cellulose was exposed to dielectric barrier discharge (DBD) plasma at 170 V, 200 V and 220 V for 5, 10 and 15 minutes. The action of cellulase on plasma-treated cellulose was also studied. Some of the physico-chemical properties of cellulose such as reducing sugars, water binding, water holding, oil holding, oil absorption capacity and color values were being observed. Water holding and water binding capacities were found to be increasing with increase in the plasma voltage and time which may be due to the breakage of  $\beta$  (1, 4) linkages present in cellulose and air plasma is also known to make the surface more hydrophilic. Similarly oil holding and oil absorption capacity revealed higher values with an increasing voltage of plasma and time of treatments. FTIR, XRD and SEM images gave glimpse idea about the changes in the surface morphology of the untreated, plasma-treated cellulose and plasma-treated cellulose being acted upon by the enzyme.

**Keywords:** Atmospheric Cold Plasma, cellulose, cellulase, physico-chemical, reducing sugars

## EVALUATION OF TRADITIONAL NOURISHMENT PROPENSITIES OVER MODERN DIETARY PATTERN OF LACTATING MOTHERS OF BIJNOR DISTRICT

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### ABSTRACT

The lactation period is a major source of concern specially in developing countries as it posses' positive impact on infant health and nutrition. The study was conducted on fifty-five nursing women from the contiguous areas of Kalakheri and Bhurapur of Nagina tehsil, block Kotwali dehat, district Bijnor (U.P.) in 2022. The primary study tool was a predesigned and pretested Performa socioeconomics and general characteristics of these women were chosen by interviewing them via survey interview method. According to the current study, lactating mothers consume 285 g/day of cereals instead of the recommended balanced diet, which is 98.33 percent of the average; similarly, pulse consumption is only 32.90 g/day, which is 68.33 percent of the recommended quality; and consumption of milk and milk products is only 102.80 g/day, which is less than the recommended dietary allowance. The average daily intake of calories, protein, calcium, iron,  $\beta$ -carotene, thiamine, riboflavin, niacin, and vitamin C were  $1624 \pm 145$  Kcal,  $45 \pm 06.32$  gm,  $484 \pm 111$  mg,  $35.00 \pm 08.3$  mg,  $1846 \pm 537$   $\mu$ g,  $1.00 \pm 0.49$  mg,  $1.04 \pm 52.00$  mg,  $13 \pm 1.00$  mg, and  $31.30 \pm 7.8$  mg, per day respectively. Despite the fact that the majority (80%) of lactating mothers increased their dietary intake during lactation, their consumption of cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, milk and milk products, fat and oil, sugar and jiggery, and non-vegetarian foods was inadequate. A significant proportion of lactating mothers consumed garlic ki sabji, pat/harira, shandra, hot water, munga dal, roti and ghee, deashamularisht, and other foods during the initial phase of lactation. After delivery, mothers are given special foods such as lahasun, pyaj ki sabji, pat, harira, nishastat /chhoka, dasmularista, dry fruits, fish,egg, loki, moong dal, and papeta ki sabji. According to 90% of respondents, it increases strength, relieves pain, and improves milk secretion. According to one study, more than 90% of lactating women avoided sour foods such as urd dal, rajma, arbi, kathal, kela, brinjal, chana sabut, guava, and poi saga because they are heavy in nature, difficult to digest, and cause acidic/gas problems.

**Keywords:** lactation period, RDA, infant health, Traditional Foods, Women health



## COMBATING HIDDEN HUNGER THROUGH BIOFORTIFICATION

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### ABSTRACT

More than 60% of the world population suffers from iron deficiency, and over 30% of the global population has zinc deficiency. Micronutrient deficiency leads to compromised health and economic losses and is prevalent in populations depending on non-diversified plant-based diets. Increasing mineral content of staple food crops through biofortification is the most feasible strategy of combating micronutrient malnutrition. Additionally, it will also enhance the agronomic efficiency of crops on mineral poor soils. A multipronged strategy towards enhancing mineral content of cereal grains should involve increased uptake of minerals from soil, enhanced partitioning towards grain and improved sequestration in the edible tissues of grains. At the same time, it is essential to improve mineral absorption in vivo from cereal-based diets. Both conventional and modern breeding approaches and genetic engineering are being employed for biofortification of crop plants. With increased understanding of mineral uptake and transport mechanisms in plants, it is becoming ever more possible to engineer biofortified crop plants with the ultimate goal of overcoming hidden hunger.

**Key words:** Nutritional security -hidden hunger-biofortification

## REPELLENT EFFECT OF BOTANICALS EXTRACTS AGAINST LARVAE OF CORCYRA CEPHALONICA (STANTON)

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### Abstract

The *Corcyra cephalonica* is a widely distributed serious pest of stored grains and processed food products. Its infestation begins with minor contamination and continues until entire damage under various environmental circumstances. Controlling of this pest is major concern; use of chemical causes negative effect on human life as compared with botanicals which are safer and eco-friendly. Present study planned to know the repellent effect of extracts of black pepper (*Piper nigrum*) and clove (*Syzygium aromaticum*) against *Corcyra cephalonica* larvae by filter paper test in Completely Randomized Design (CRD) with three replications. The result revealed that maximum repellency was observed in black pepper extract (75.98%) followed by clove (71.88%) after 48 hours of exposure. Study suggests that botanicals extracts contains active ingredients which can be used as desirable tool to keep pest away from food products.

Keywords: Repellency, *Piper nigrum*, *Syzygium aromaticum*, botanicals, *Corcyra cephalonica*

## STUDIES ON FOLIAR APPLICATION OF BORON, MAGNESIUM AND IRON ON VEGETATIVE GROWTH PARAMETERS OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. HISAR SURKHA

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### Abstract

A field experiment was conducted at the experimental orchard of CCS Haryana Agricultural University, Hisar, Haryana during year 2020-21 and 2021-2022. In this study 63 guava cv. Hisar surkha trees planted at a spacing of 6×6 m were subjected to foliar sprays of boron, magnesium and iron at the time of fruit set and again after one month to study the effect of foliar sprays of boron, magnesium and iron on yield and quality of guava. The experiment was carried out in Randomized Block Design with 21 treatments and 3 replications. The foliar sprays of boron, magnesium and iron significantly influenced vegetative growth of guava tree. Plant height, plant spread, canopy volume, leaf area, leaf area index, length of laterals shoots and length of terminal shoots were found to be maximum under the treatment T<sub>21</sub> [FeSO<sub>4</sub> (0.5%) + H<sub>3</sub>BO<sub>3</sub> (0.5%) + MgSO<sub>4</sub> (0.5%)] whereas minimum in case of treatment T<sub>1</sub> (control). However, stem girth was non-significantly influenced by the nutrient sprays.

**Key words:** Guava, growth, height, spread and Hisar Surkha

## **COST-EFFECTIVE CLARIFIED MOLASSES MEDIUM FOR THE BIOSURFACTANT PRODUCTION USING *BACILLUS TEQUILENSIS* RP01 AND ITS ANTIFUNGAL ACTIVITY AGAINST *FUSARIUM***

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### **ABSTRACT**

Biosurfactant are the microbial surfactants has the tendency to reduce surface tension and interfacial tension and they are produced from microbe such as bacteria, fungi, yeast. *Bacillus tequilensis* RP01 was isolated from the gut of an Indian mealworm and found to produce biosurfactant and have antifungal activity. The biosurfactants were identified as a combination of lipopeptides, which are potent biosurfactants typically produced by *Bacillus* sp., using FTIR. The effect of biosurfactant production in molasses medium was high in the treatment containing Molasses with 2% TS than other treatments and low in clarified molasses as such. In soybean oil, the emulsifying activity of biosurfactant from molasses medium was strong at a concentration of molasses of 2% TS. The antifungal efficacy of *Bacillus tequilensis* RP01 against *Fusarium oxysporum* seemed promising. The highest inhibition was reported after 7 to 10 days of incubation at 25+2? when cultured in PDA adjusted with bacterial cell free supernatant. The study highlights the usefulness of optimization of carbon and nitrogen sources and their effects on biosurfactant production and further emphasizes on the potential of lipopeptide biosurfactant produced by *Bacillus tequilensis* RP01.

**Keywords:** Biosurfactant, *Bacillus tequilensis* RP01, lipopeptides, Antifungal activity, *Fusarium oxysporum*.

## POST HARVEST LOSSES CAUSED BY STORED GRAIN INSECT-PESTS WITH SPECIAL REFERENCE TO WHEAT

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Post-harvest losses at the storage stage, particularly the loss resulting due to the attack of various pests, are considered most critical in developing countries. The average food grain loss in storage condition due to biotic and abiotic factors accounts for nearly 10 per cent per annum. Stored product insects can cause post-harvest losses, estimated up to 9 per cent in developed countries to 20 per cent or more in developing countries. The postharvest losses in India amount to 12-16 million metric tons of food grain each year. Wheat, *Triticum aestivum* L. is one of the most important food grain crop which is cultivated annually in an area of 220 million hectares across the world and provides 21 per cent of the food calories and 20 per cent of the protein for more than 4.5 billion people in 94 countries. The target of wheat production in India is projected around 140 million tons by 2050 considering its growing demand for consumption and trade. This is a big challenge keeping in view the present production of 98.61 million tons in an area of 29.72 million hectares under cultivation with a productivity of 33.18 q/ha. Wheat is heavily infested by a number of insect-pests during storage viz. rice weevil, *Sitophilus oryzae* L.; granary weevil, *S. granarius* L.; lesser grain borer, *Rhyzopertha dominica* L.; khapra beetle, *Trogoderma granarium* Everts; Angoumois grain moth, *Sitotroga cerealella* (Oliver) and red rust flour beetle, *Tribolium castenium* Herbst. In order to achieve the target of our production, it is important to increase our efforts not only for enhancing productivity of wheat, but also for minimizing huge post-harvest losses across the food supply chain from harvesting of crop until its consumption. In Himachal Pradesh, wheat is very important cereal crop which is cultivated in an area of 0.35 million hectares with an overall production of 0.68 million tons and productivity of 1968 kg/ha. Farmers of the state usually store wheat in modern bins as well as in traditional storage structures for their own consumption and for seed purpose. Several insect-pests have been reported to damage stored food grains in the state, however, very scanty information is available regarding management of these pests.

**Theme - 8**  
**Global and Regional Policy Transformation**

**Determinants of Institutional Agricultural Credit: Region-wise Analysis**

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**ABSTRACT**

Institutional credit is playing a significant role in Indian agriculture. Determination of factors' influencing its supply helps in framing policies to minimize regional imbalance and achieve the goal of sufficient credit thereby agrarian distress and farmer suicides can be curtailed by reducing their dependence on non-institutional credit. This study estimates the impact of important drivers on institutional credit to agriculture at various levels using district level data. Factors like district wise number of scheduled commercial bank (SCB) branches, share of gross irrigated area (GIA) in gross sown area (GSA), share of area under commercial crops (AUC) in GSA and annual rainfall were regressed on outstanding agricultural advances by SCBs through employing panel data regression technique using "plm" package in R software. At all levels, fixed effect model is consistent and suitable than random effect model as per Hausman test. Institutional credit to agriculture found to be more responsive to branch expansion since at national level for every increase in one operating branch in a district the outstanding agricultural advances by Scheduled Commercial Banks will increase by 12.86 crore rupees. Share of Gross Irrigated Area in Gross Sown Area in southern and central regions and share of AUC in GSA in central and northern regions are important drivers for agriculture development.

**Keywords:** *Agricultural credit, Scheduled commercial banks, Panel data regression, Gross irrigated area, Gross sown area.*

**Knowledge and Attitude of Respondents on Adoption and Acculturation of Digital Technologies**

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**ABSTRACT**

The present study was conducted in Karnal, Rohtak and Jhajjar districts of Haryana state using data from 360 respondents. Results showed that more than two-fifths of the respondents (42.78%) had above average knowledge regarding the usage of digital technologies at preparation stage followed by nearly half of the respondents (48.33%) had high knowledge regarding the usage of digital technologies at production stage and 37.22 per cent of the respondents had average knowledge regarding the usage of digital technologies at processing stage. Nearly half of the respondents (47.50%) agreed to the usage of digital technologies followed by strongly agreed (19.45%) and strongly disagreed (14.45%). A significant and positive relationship was found between independent variables and knowledge and of digital technologies at five per cent level of significance. ~~Therefore, null hypothesis cannot be rejected.~~ All the dependent variables including knowledge and attitude had significant and positive relationship with z value at five per cent level of significance which showed that it is between -1.96 to +1.96, therefore, the data falls between the acceptance region, ~~that's why null hypothesis is accepted.~~

**KEYWORDS:** *Knowledge, attitude, Association, digital technologies, significant, positive relationship*



## Generative Adversarial Networks (GANs) for Agricultural Stock Market Prediction

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### ABSTRACT

Edible oil prices are likely to witness a rise in the next few months due to Indonesia's decision to ban crude palm oil exports followed by geopolitical tensions. Due to these situations, there is an impact on price volatility in several edible stocks. To combat this variation prediction of edible stock returns is one of the most important and challenging issue. Nowadays, by utilising the deep learning GAN model was used by employing generator built by Gated Recurrent Unit (GRU) and Convolutional Neural Network (CNN) combinations in generator to mine the data distributions of stocks from given data in stock market and generate data in the same distributions, whereas the discriminator designed aims to discriminate the real stock data and generated data. An attempt was done for the first time in agriculture by an empirical study using daily data on Ruchi Soya Industries Ltd. stock has been done and the daily closing prices have been predicted. Experimental results revealed that the novel GAN seem to have promising performance in the closing price prediction on the real data compared with other models in deep learning like Time Delay Neural Network (TDNN), GRU, Long Short-Term Memory (LSTM) and Bidirectional LSTM (Bi-LSTM).

**Keywords:** *Bidirectional LSTM (Bi-LSTM), Convolutional Neural Network (CNN), Discriminator, Gated Recurrent Unit (GRU), Generator, Long Short-Term Memory (LSTM), Time Delay Neural Network (TDNN)*

## Women Empowerment in Agriculture for Livelihood Security

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### ABSTRACT

Women empowerment is a key feature for sustainable development along with improved rural livelihoods and enables groups or individuals to make purposive choices and attaining desired livelihood outcomes. This study was conducted to examine the role of women empowerment in agriculture for livelihood security in mid-hills zone of Himachal Pradesh. The Abbreviated Women Empowerment in Agriculture Index was modified to collect data for empowerment and livelihood index was constructed on the basis of economic status, resource endowment, social support, political participation and psychological capital. In the present study, the overall average farmers' livelihood index was recorded 0.478, which was more for the empowered women in agriculture as compared to disempowered women, implying that the livelihood index is positively associated with women empowerment. Further, family size, employment status, occupation, educational level, women's decision-making power, women's decision toward credit and women's group-membership reflected a significant positive effect on livelihood security. The study also reflects that the age of the respondents was negatively associated with the livelihood index, implying that livelihood security shows a downward trend with increasing age. It was also suggested that policy of equal rights for both genders should be implemented to increase livelihood security.

**Keywords:** *decision-making, empowerment, gender equality, livelihood security, sustainable development*



## Policy Options Promoting Market Access to of Vegetable Producers and their Impact on Farmers Livelihood: Empirical Evidence from High Hills Region of Himachal Pradesh, India

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### ABSTRACT

The vegetable crops such as pea and cauliflower produced for markets are considered as increasing source of income for the farmers of high hill regions. To reach markets and actively engage in the markets is a key challenge influencing vegetable production and marketing options in Himachal Pradesh. The determinants of market options are the contributing issues, which may have impact on production and marketing of vegetable crops and also on farmers' livelihood. Despite their significance, yet adequate research has not been carried out on it, particularly in high hill regions of India. Therefore, considering the significance of this, the present study was conducted to characterize vegetable market in high hills region of Himachal Pradesh, India. The present study focuses on the factors affecting vegetable farmers' choice of marketing and how their options impact on livelihood. The data were collected from 200 farm households who were selected using multistage random sampling. Furthermore, the information gathered through field interviews using structured schedule. The multinomial logistic regression model was employed to determine the factors influencing farmers' options for marketing channels. Whereas, to study the impact of market on farmers livelihood, the tobit regression model was used. The empirical results of this study revealed that household factors like education, farm income followed by vegetable production influencing factors such as farming experience, storage facilities, distance to market, vegetable sales factor like payment at the time of sale, slow sale and source of market information through word of mouth/relatives, friends, government department, TV and radio significantly influenced farmers participation in output marketing channels viz., producer-commission agents-retailer-consumer and producer-wholesaler-retailer-consumer. Furthermore, the market channel options found to be significant at 1% significant level followed by index of market access (5%) and farm landholding (1%) were significantly affecting farmers' livelihood. Relying on the survey results and observations, study indicated that vegetable marketing options is significantly improving the farmers' livelihood. Therefore, the research study concluded with policy implications for marketing of vegetable produce and improving farmers' livelihood in high hill regions of India.

**Keywords:** choice, determinants, marketing channels, multinomial logistic regression, tobit regression model.



## A Study on Food Habits among the Adolescent Girls of Vijayapura District of Karnataka

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### ABSTRACT

The present study was conducted to understand the food habits among urban and rural adolescent girls of Vijayapura district of Karnataka. Samples of 100 adolescent girls between the age group of 14-17 years were selected for the study. The self-structured questionnaire was used for collection of data regarding food habits among adolescent girls. The results revealed that, majority of the girls were ova-vegetarian (49%), majority of the girls skip the meals everyday (69%) because of lack of time and majority of the adolescent girls consume bakery products (72%) once in a week. It was also found that, less number of respondents take nutritional supplements (27%) once in a week. As adolescence is the growing age and the body need more nourishment. Skipping of meals every day may hamper their growth and development as the body is at the peak of growth and development. Adolescence is the age of puberty in which, individual can grow to maximum. So adolescents can be given awareness regarding the importance of food in growth and development and complications of skipping of meals or lower intake of food.

*Keywords: Food habits, adolescent girls, nutritional supplements, puberty*

### Achieving Food Security: Role of Community Grain Banks

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### ABSTRACT

The United Nations Sustainable Development Goal (SDG) 2 aims to achieve zero hunger, improved nutrition, and food security for all by 2030. However, recurring catastrophic events like COVID 19 and war conflicts have pushed this goal off track. According to the *State of Food Insecurity in the World report 2022*, the number of people affected by hunger crises increased by 46 million after COVID 19 pandemic and rose to 828 million in 2021. As per the *World Hunger Index, 2021*, South Asian and South African regions have the highest hunger levels in the world. These findings exhibit a demand for sustainable policies and institutions at the local, national, and global levels to get the zero-hunger goal back on track. Contextualising these demands, this review paper aims to identify the role of Community Grain Banks in achieving food and nutrition security in Asia and Africa. Based on the research gaps found, this paper gives policy recommendations for national and regional stakeholders to enhance the decentralised Institutions like Grain Banks to achieve local food sustainability and thereby, regional, and global food and nutrition security. NO MENTION ABOUT THE FINDINGS?

*Keywords: Community Grain Banks, Local food Security, SDG-2, Hunger*

## EMPOWERING FARM WOMEN THROUGH VALUE ADDITION AND PRODUCT DIVERSIFICATION

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### Abstract

Women are predominant at all levels of production like pre-harvest, post-harvest processing, packaging, marketing of the agricultural value chain, to increase productivity in agriculture but under shadows of our food systems. According to NSSO data, out of 405.9 million rural female, 12.2 per cent are regular waged/salaried and casual labourers besides 42.2 per cent attends domestic duties. The unemployment Rate (UR) for rural female is 29 per cent. Rural women those engaged in agriculture, only three per cent of women devoted about 118 min/day in marketing, processing of food products. The economic devastation caused by Covid -19 hit women workers hardest. Wide gender disparity in India's workforce likely to push female workers further into poverty. By 2030, upto 400 million women's economic potential may be left unaddressed. So, economic-empowerment remains critical to harness their economic potential contributions of women and thus, to achieve the *Sustainable Development Goals (SDGs)* by 2030. Agro-industry and high value-added agricultural sectors are the key sectors to improve gender inequality issues, smoother employment transformation, generate high production growth and production. Women need to be trained about the new technologies and policies in the post harvest handling of crops to fulfill the needs as well as bridging the gender gap enabling *Atma Nibhar Bharat*.

**Key words:** Unemployment, SDG, gender disparity, ~~Gender sensitization~~, Value addition

### Assessing Socio-Economic Vulnerability for Development: A Bottom-Up Approach

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### ABSTRACT

Vulnerability assessment is vital for developing appropriate adaptation measures to improve community resilience. This research aims to assess the socio-economic vulnerability of the Ahmednagar district in Maharashtra state using a novel Socio-Economic Vulnerability Index (SEVI). Ahmednagar is one of the most populous and progressive districts with a high Human Development Index (HDI) value (0.72). This study covered 14 tehsils of the Ahmednagar district and used secondary data sources for assessing sensitivity and adaptive capacity. It was found that, Ahmednagar district had low social sensitivity (0.28) with moderate social adaptive capacity (0.48) and high economic sensitivity (0.63) with low economic adaptive capacity (0.38). Overall, the Socio-economic Vulnerability Index of Ahmednagar district was low (0.30). Though of Ahmednagar was socio-economically low vulnerable, out of 14 tehsils, 5 tehsils (Nevaa, Shrirampur, Shevgaon, Rahuri, and Jamkhed) of the district were highly vulnerable, which needs immediate attention on social sensitivity aspects. The one-way ANOVA test also revealed that statistically significant differences in indicators of SEVI framework among all the tehsils of Ahmednagar district. This calls for concerted efforts in developing location-specific intervention/policy measures to reduce sensitivity and increase adaptive capacity, by considering the key drivers of sensitivity and adaptive capacity in identified highly vulnerable tehsils.

**Keywords:** Socio-economic Vulnerability, Adaptive Capacity, Sensitivity, SEVI, Bottom-up approach

**Theme-9**  
**New Education Policy on**  
**International Perspectives**



## **Farm scientists' health: an essential element of research productivity**

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### **ABSTRACT**

The Farm Scientists' health is affected by different ways. The reasons that affect the scientists' health in general and farm scientists in particular were listed from the available literature. The purposively selected sample of 199 from SAUs of Karnataka were respondents of the present study. Further, the degree to which farm scientists' research productivity was affected with the changes in their health status was analysed by using the ordinal logistic regression. The aim is to increase the contribution of farm scientists to solve the field problems for which he/she had to spend lot of time in field, lab, analysis and digital devices. Therefore, health is directly related to the quality time spent by the farm scientists on research. A set of initiatives that thrives to maintain the scientists good health is need of the day. The Scientists' require work environment that supports them to be healthy which should be included in faculty development plans. Thus, necessary measures to make scientists not to feel isolated or ignored in their work environment should be taken up.

**Keywords:** Research management, work-life balance, state Agricultural Universities (SAU), agricultural research environment

## Attitude of students towards online learning: a study in the University of Agricultural Sciences, Bangalore

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### ABSTRACT

A study was conducted at the University of Agricultural Sciences, Bangalore, Karnataka by personally interviewing post graduate students (60 boys and 60 girls) of agriculture. *Ex-post-facto* research design was used. As high as 56.67 per cent of the boys and 48.33 per cent of post graduate girls students had less favorable attitude towards online-learning. The statement 'on-learning acts as the best way to continue education in pandemic situation' was assigned first rank and the statement 'e-learning helps to spend time with family along with learning' was ranked second. On the contrary the statement 'I prefer online learning rather than conventional learning' and the statement 'online classes are superior than conventional classes' were assigned least rank by the post graduate students. Innovativeness and e-access had positive and highly significant relationship with the attitude of post graduate students towards online-learning and devices used, computer / mobile skills, mass media usage and the education of the post graduate students had a positive and significant relationship with their attitude towards online learning. The major problem perceived by the post graduate students in online-learning were poor internet connectivity / network issues, difficulty to understand practical components, lack of in person interaction and lack of motivation.

**Key words:** Post graduate students, online learning, attitude.

### Transformations in Education and Research: Towards Inclusion and Excellence

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### ABSTRACT

Innovative transformations are brought in the field of education and research in recent years. Education system marks the onset of a new era that contributes to an equitable and vibrant knowledge society by providing education to all. The National Education Policy (NEP) 2020 has regarded the universal high quality education as the best way forward for developing and maximizing our country's rich talents and resources for the good of the individual, the society, the country, and the world. The policy is aimed at reorientation of the education system towards meeting the needs of 21<sup>st</sup> century by achieving the twin objectives of inclusion and excellence.

It emphasizes the due importance of multidisciplinary education and research for the holistic development of the individual as well as our nation. Witnessing the dynamics in the international perspective, our nation with a pool of younger minds is moving towards inclusion and excellence through the transformations in education and research.

## Portal for ICAR accreditation of higher agricultural educational institutions

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### ABSTRACT

Portal for ICAR accreditation of Higher Agricultural Educational Institutions (HAEIs) has been developed for HAEIs in India to apply online for ICAR accreditation. Both Government and Private Agricultural Universities/Colleges can apply for online accreditation by submitting Letter of Intent (LoI) along with Institutional Eligibility for Accreditation (IEA) and Statement of Compliance (SoC) to the National Agricultural Education Accreditation Board (NAEAB) Secretariat. After acceptance of LoI, IEA and SoC, HAEI can submit a Self Study Report (SSR) to the respective Regional Centre of the NAEAB through this portal. Regional Centre of the NAEAB examines the SSR submitted in the portal online and ensures that SSR meets the requirements of the NAEAB guidelines. All the stakeholders in the accreditation system use this portal in a workflow manner. This online system has made the ICAR accreditation process more transparent, accountable and reduces time and requirements for physical file movements. Since inception, more than 300 applications for accreditation have been processed through this portal. Universities find it very convenient to apply, track and respond back accordingly through this online system for accreditation. NAEAB can easily manage to handle and process the applications through this portal. For policy makers, this online system can provide critical information required for decision making. The portal is hosted (<https://accreditation.icar.gov.in>) in ICAR Data Centre (ICAR-DC) which is situated at ICAR-IASRI, New Delhi.

**Keywords:** HAEI, IEA, LoI, NAEAB, portal, SSR.



ONLINE MODE OF EDUCATION AND CONSTRAINTS IN DIPLOMA AGRICULTURE  
COLLEGE, ICAR - KRISHI VIGYAN KENDRA BIDAR, KARNATAKA.

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**ABSTRACT**

The present study was conducted at Diploma Agricultural college, ICAR - Krishi Vigyan Kendra, Bidar district, Karnataka during 2022 to analyze the online mode of education for diploma I<sup>st</sup> year and II<sup>nd</sup> year students (2021 batch) of this college. During Covid-19 pandemic lockdown situation, in order to continue the process of teaching and learning, the students and teachers got connected through online platforms, virtual mode of education itself being a new concept to learn within a short period of time virtual mode has proven promising as an alternate way of teaching, although there are many drawbacks as compared to physical mode of education. In this study, it was found that most of the teachers conducted online class through Google meet platform. Nearly half (48.57 %) of the students felt that availability of internet connection was a major constraint and more than half (54.50 %) of the expressed responded that the virtual mode of education was good, whereas 38.00 per cent found that it was moderately good and 7.50 per cent of the students found virtual mode to be poor.

**KEYWORDS:** Google meet, online mode, pandemic, internet, virtual mode, smart gadgets



## Personality assessment among post graduate students of Tamil Nadu Agricultural University

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### ABSTRACT

Personality refers to individual differences in characteristic patterns of thinking, feeling and behaving. It is important to assess students' personality in order to improve their academic achievements. Hence, the personality assessment has been conducted among 60 post graduate students of Tamil Nadu Agricultural University. Here, both projective (Expressive techniques) and non - projective techniques (self-report questionnaires) are used to assess students' personality and intelligence. From various tests of personality, three tests namely bell adjustment inventory, IQ test and House-Tree-Person (HTP) test had been selected to measure intelligence and behaviour among post graduate students. Based on bell adjustment inventory, it has been concluded that majority of the students were having less adjustment problems related to home (70.00 %), whereas, more than half of the post graduate students belong to less adjustment problems category of health (56.66 %) and aggressiveness in the society (53.33%). From the IQ test, most of the students belong to average category (66.66 %) of Stanford–Binet Intelligence Scale. From House-Tree-Person (HTP) test, vast majority of the students belonged to the category of openness, with more ego strength, aggressiveness, were successful and willing to engage with others.

**Key words:** Personality, bell adjustment inventory, IQ level, HTP test, higher education.



## Higher education in India: problems and prospects

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### ABSTRACT

The world has realized that the economic success of the states is directly determined by their education systems. The higher education system in India has grown in a remarkable manner to become one of the largest systems of its kind in the world. To cope up with the changing priorities the New Education Policy-2020 has been formulated with the main thrust to end the fragmentation of higher education by transforming it into large multidisciplinary universities, colleges, and Higher Education Institution (HEI) clusters. At present there are 1043 Universities, 42343 Colleges and 11779 Stand Alone Institutions where 38.5 million students are enrolled in these institutions. The aim of the policy is to increase the Gross Enrolment Ratio in higher education from 27.1 per cent in 2019-20 to 50 per cent by 2035 whereas in USA and China it has been observed as 85.50 and 43.39 per cent respectively. Expenditure on education as percentage of Gross Domestic Product in India is less than 4 per cent which is around 6-8 per cent in most of the developed nations in the world. Pupil Teacher Ratio at all India level was 26 whereas at international level it was 3:1, 6:1, 7:1, 9:1 in MIT University, Yale University, Harvard University, and Oxford Universities respectively. Gender Parity Index (GPI) in higher education for all categories is 1.01 and has improved in the recent decades. In world's university rankings 2022, only five Universities of India are among the top 500 universities in the world. Therefore, there is a need to implement innovative and transformational approach in Indian educational system to make it globally more relevant and competitive. Government must promote collaboration between Indian higher education institutes and top international institutes for better quality education and collaborative research.

**Keywords:** Higher Education, GER, GPI, PTR



## **An analytical study on the relationship between academic self concept and academic achievement**

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### **ABSTRACT**

Carl Rogers was the first who introduced the term self-concept in the late 1950's and divided the self into two broad categories *i.e.* real self and the ideal self. The real self (who am I) is the awareness of the person's own ability to grow and it can be referred to as the actual nature of the individual. Ideal self is what the person wants to become or what one desires to be. The term self-concept is broader in its meaning and usually referred to as perception about one's own self. The term self-concept is generally defined as the knowledge and view about oneself. It is built on self-awareness and assessment of qualities and characteristics made through involvements in one's situation. Academic self-concept is the students self-assessment regarding their educational abilities and potentials they possess. Its level can determine the degree of performance in educational field. Academic self-concept usually varies from grade to grade. A slight rise in academic self-concept is observed with the increase in academic achievements. The aim of the present study is to investigate the relationship between academic self-concept and academic achievement among agricultural graduates.

**Keywords:** Self Concept, academic self concept, ideal self, real self, academic achievement, agricultural graduates

**NATIONAL EDUCATION POLICY 2020 - an international perspective**  
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**ABSTRACT**

The New Education Policy 2020 was formulated based on the recommendation of the Dr K. Kasturirangan committee. This policy aimed to achieve national integration and greater economic and cultural growth by 'revolutionary reforming' of India's educational system and equalizing educational chances for all. NEP has had a significant role in reorganizing agricultural education in India, including the introduction of academic credit banks and degree programs with various entry and exit points to the country's 74 agricultural universities. Academic Credit Banks will make it easier to integrate campuses and remote learning systems by allowing students to move between and within universities. Offering a credit recognition mechanism may aid in the seamless integration of talents and experiences into a credit-based formal system. It will digitally store academic credits earned from accredited Higher Education Institutions (HEIs) and allow credit redemption for the award of a certificate, diploma, or degree. The NEP mentions experiential education, which has advocated for a shift to four-year undergraduate degrees. Agricultural degrees are already four-year programs, and the contents of several courses are designed in such a way that practical classes can be held concurrently with theory classes covering the same topics. If the multiple entry-exit systems are implemented, one major challenge will be to ensure that all students have access to experiential learning. Students with multiple entry and exit options can earn a diploma or an advanced diploma while also having the option to re-enter as and when they can resume their studies and earn a full college degree. Some issues that require policy attention include the challenge of multidisciplinary approach. Agricultural universities have been modelled after the land grant model, with a focus on research and extension and strong community ties, driven by the belief that farmers require holistic solutions to their problems. However, several domain-specific universities in horticulture, veterinary science, and fisheries sciences have emerged in recent years. Incorporating humanities and social sciences into these settings may prove difficult. NEP anticipates that ICAR will continue to play a standards-setting role under the new higher education regulatory system. However, it is unclear whether it will continue to perform accreditation and grant-making functions under the new regime. The curriculum has been responsible for the development of much-needed agricultural skills as well as the promotion of an entrepreneurial mindset. They are encouraged to start their businesses, improve rural livelihood security, and accelerate agricultural transformation through science-based policy options and actions. Many new courses in emerging fields such as Precision Farming, Hi-tech Cultivation, Artificial Intelligence, Mechatronics, Nanotechnology, Food Storage Engineering, Emerging Food Processing Technologies, and so on have already been introduced by AUs, and they perfectly align with the NEP recommendations. The NEP's proposed National Scholarship Portal will provide students with more scholarship opportunities for stipends, boarding and lodging, and not just tuition waivers. Under the NEP, AUs must achieve the highest global standards in quality agriculture education through collaboration with global universities, as well as provide platforms for research and innovation in frontier areas of research, increased industry-academic collaboration, and interdisciplinary research, including humanities and social sciences. The existing AU system will benefit greatly from various provisions of NEP to promote HEIs as global study destination hubs and restore India's role as a *Viswa Guru*.

**Key Words:** National Education Policy, credit system, university, scholarship

## **National Education Policy: A meandering pathway for revolutionizing Indian Education**

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### **ABSTRACT**

Education is a dynamic environment that shapes a person's personality and development during their critical learning period. India has the second-largest education system in the world in terms of size. With more than 15 lakh schools in India, more than 25 crore students, and 89 lakh teachers. The system related to higher education in the country is also massive. According to the 2019, higher education report of All India Survey on Higher Education (AISHE) 3.74 crore students pursue higher education in India in thousands of universities, 39,931 colleges, and 10,725 independent institutions. The NEP 2020 replaced the 34 year old National Policy on Education (NPE)-1986. Principally, NEP 2020 aims to create an equitable, accessible education system that will transform India into a global knowledge superpower while staying rooted in Indian ethos. It is built on the foundation pillars of access, equity, quality, affordability and accountability of education. This policy is aligned to the 2030 Agenda for Sustainable Development that aims to transform India into a vibrant knowledge society and global knowledge superpower by making both school, college and university education more holistic, flexible, multidisciplinary, suited to 21st century needs and aimed at bringing out the unique capabilities of each student. National Education policy is flexible and open to minor modifications and corrections based on the views, satisfaction level of parents, adjusting capacity of the students and cooperation of educational institutions to adopt the revolutionized and inclusive NEP. Programs related to the NEP 2020 also include NIPUN, Bharat Mission, Vidya Pravesh, DIKSHA, NISHTHA etc. Diksha is a program related to providing online e-content through the portal, NISHTHA is a program associated with the training of School teachers. In India, the current education system has several lacunae related to employability, equal opportunity and flexibility in learning. This visionary NEP 2020 policy aims to revolutionize India's educational environment over the next 20 years, from 2020 to 2040. NEP has gained some momentum to some extent, but the path to its full implementation is full of obstacles. The sheer size of a country like India and the diversity of its education system, implementing a new initiative are like climbing a huge mountain.

**KEYWORDS:** New Education Policy 2020, holistic development, Indian ethos, life-long education, sustainable development goals

**Constraints faced by the academic staff of agricultural universities**Ekhande Y. S.<sup>1</sup>, Sawant P. A.<sup>2</sup>, Holkar S. C.<sup>3</sup> and Raykar S. S.<sup>4</sup>*1, 3 & 4. Ph. D. Scholar, Department of Extension Education, College of Agriculture, Dr. B.S.K.K.V., Dapoli**2. Head, Department of Extension Education, College of Agriculture, Dr. B.S.K.K.V., Dapoli***ABSTRACT**

The present study was undertaken with the main objective to study the constraints faced by the academic staff members of agricultural universities. The study was conducted in four Agricultural Universities of Maharashtra state. In all 240 respondents were selected by using proportionate random sampling method. The “ex-post-facto” research design was used for conducting the study. The data were collected through the personal interview. The data collected were processed and statistically analyzed by using statistical techniques like frequency and percentage. The major constraints were “institution has not sufficient staff and funds for conducting teaching, research, extension activity (71.66 per cent)”, “There is no required laboratory facilities for conducting the experiments (65.83 per cent)” and “The decision regarding programs are made at higher levels without consulting subordinates (50.83 per cent)” were the major constraints experienced by the academic staff. Most of the academic staff suggested that institution should be provided with sufficient staff and funds for teaching, research and extension education activity (74.58 per cent), more laboratory facilities should be created (68.33 per cent) and teachers/scientists should be given training annually (55.83 per cent).

**Key words:** - Constraint, academic staff and agricultural universities**Transformations in Education and Research: Towards Inclusion and Excellence**

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**ABSTRACT**

Innovative transformations are brought in the field of education and research in recent years. Education system marks the onset of a new era that contributes to an equitable and vibrant knowledge society by providing education to all. The National Education Policy (NEP) 2020 has regarded the universal high quality education as the best way forward for developing and maximizing our country's rich talents and resources for the good of the individual, the society, the country, and the world. The policy is aimed at reorientation of the education system towards meeting the needs of 21<sup>st</sup> century by achieving the twin objectives of inclusion and excellence.

It emphasizes the due importance of multidisciplinary education and research for the holistic development of the individual as well as our nation. Witnessing the dynamics in the international perspective, our nation with a pool of younger minds is moving towards inclusion and excellence through the transformations in education and research.

## NEP 2020 - Attempt to manufacture a whole child

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### ABSTRACT

New Education Policy 2020 announced by the Ministry of Human Resource Development to replace the NEP, 1986. It focuses on the school and higher education systems in the view to transform them to meet the needs of the 21st century. The world is undergoing a rapid phase change. To keep pace, with this the students are required to adopt to these changes. NEP 2020 puts forward those changes to be done for the betterment of the students by providing them with high-quality education. This paper outlines the multidisciplinary approach of NEP 2020 and analyses how it would be beneficial for the students.

The ancient system of education focused on the holistic development of an individual. The *shishyas*, i.e., the students lived with their *gurus* who educated them how to lead a disciplined life. The main motive of the *gurus* was to make their *shishyas* realise their inner potential while they were pursuing their education in different disciplines like history, medicine, law, architecture, as well as sports. Universities such as Takshashila and Nalanda followed this education system of multidisciplinary approach by combining subjects across the fields.

The New Education Policy 2020, aims at developing a whole child - an intellectual, aesthetic, social, physical, emotional, and ethical human being. The students of 21st century live in a complex and a competitive world where they are expected to run faster. Besides their academic accomplishments, the students are required to possess certain exemplary qualities to stand out from the crowd. A flexible curricula in their higher education might help them to develop professional, technical and also vocational skills. Hence it is indispensable to provide them with creative combinations of disciplines at their undergraduate, post graduate and doctoral levels. NEP 2020 emphasises on the credit- based system where the students are allowed to exit their degree programme whenever they want. It gives the privilege to the students to choose the subjects and allow them to carve their own path. An Academic Bank of Credit is also established to digitally store the academic scores of the students.

Although the idea of providing the students with flexible education is fine, the multidisciplinary approach of NEP 2020 is debatable. Providing the students with multiple subjects, it may allow them to learn everything. But they might not specialize any particular subject. There is a famous phrase, "*Master of all trades, Jack of none.*" Gaining knowledge in every domain might help the student but the HEIs should be careful to develop the students to mastery in one domain at-least. The curricula should be designed in such a way that it does not make the students feel exhausted. The NEP 2020 has given a bonanza to the students by providing them ways to actually gain knowledge rather than making them learn by rote.

**Keywords:** Multidisciplinary, flexibility, credit, knowledge





## **New Education Policy on International Perspectives**

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### **ABSTRACT**

National Education Policy 2020 is the first education policy of the 21<sup>st</sup> century and aims to address the many growing developmental imperatives of our country. This Policy proposes the revision and revamping of all aspects of the education structure, including its regulation and governance, to create a new system that is aligned with the aspirational goals of 21<sup>st</sup> century education, while building upon India's traditions and value systems. To remain relevant in the fast-changing field of educational technology and we need courses and programmes in subjects, such as Indology, Indian languages, AYUSH systems of medicine, yoga, arts, music, history, culture, and modern India, internationally relevant curricula in the sciences, social sciences and beyond, meaningful opportunities for social engagement, quality residential facilities and on-campus support, etc. to be fostered to attain this goal of global quality standards, attract greater numbers of international students, and achieve the goal of 'internationalization at home'. Besides, the National Skills Qualifications Framework will be detailed further for each discipline, vocation and profession. Further, Indian standards will be aligned with the International Standard Classification of Occupations maintained by the International Labour Organization. This Framework will provide the basis for Recognition of Prior Learning. It is recognized that there may be several pedagogical approaches internationally for teaching particular subjects. Acknowledging the criticality of faculty in achieving the goals of higher education, various initiatives have been introduced in the past several years to systematize recruitment and career progression, and to ensure equitable representation from various groups in the hiring of faculty. Compensation levels of permanent faculty in public institutions have also been increased substantially. Various initiatives have also been taken towards providing faculty with professional development opportunities. The factors that lie behind low faculty motivation levels must be addressed to ensure that each faculty member is happy, enthusiastic, engaged, and motivated towards advancing her/his students, institution, and profession of teaching will be required to be upscaled to be able to cope with changing world scenario.

Keywords: Education Policy, curricula, stakeholders, career progression, development



## **Perception and attitude of post-graduate students towards online education during Covid-19 pandemic**

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### **ABSTRACT**

Education is most important for human development. The process of education is changing from time to time and nowadays education methods have become very advanced and upgraded due to technological innovations. The sudden outbreak of the Covid-19 pandemic caused by the corona virus shook the entire world. It trapped people in houses and stopped outdoor physical activities. The situation made “work from home” as the only option. All educational institutions had started online education and it was new for students as well as for the teachers. Apart from school education, higher education also suffered a lot, especially post-graduate education where in research activities are very much essential. Considering this, post-graduate students’ perceptions and attitudes towards online education during covid times were analysed. The study was conducted in the southern Gujarat and a descriptive research design was used for the study. Totally 100 postgraduate students from various disciplines whose research work was going on were selected purposively for collecting their responses through a structured questionnaire. The result of the study indicated that post-graduate students have good perception and positive attitude towards online education in terms of theoretical part only, while in terms of research activity, they showed negative perception and negative attitude as they suffered many hurdles and lots of problems during the covid period.

**Keywords:** Education, post-graduation, research, covid-19, perception, attitude



## **A revamp in Agricultural Education system in India – A vital step for revolution in Education, Research and Extension**

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### **ABSTRACT**

Vital changes in agriculture education, research and extension are needed like establishment of Central Agricultural Research Institutes, at least one in each state (similar to central universities already established) or separate wing as PG / PhD / Post-doctoral research in already established Indian Research Institutes established by ICAR, New Delhi like IIHR, CRRI etc., and / or separate division in already established Central Universities in all the states. The Dr. R. S. Paroda committee (2019) report said highlights the recent establishment of private agricultural colleges and universities is a serious threat to the goals and objectives of present-day agricultural education. Establishment of new SAUs and new faculty / colleges without providing necessary financial and faculty support is another serious concern. Agricultural education system must evolve with the rapidly changing national and international needs. Instead of being the world's largest ICAR-AU system, the country needs to have the world's finest ICAR-AU system. Therefore, as the recommendation of the Dr. Paroda committee, Government of India should take vital steps for the establishment of an Agricultural Education Council of India (AECI), which will be a regulatory authority to maintain quality of agricultural education, research and extension on the lines of the Veterinary Council of India (VCI).

**Key words:** Agriculture, education, extension, research, vital

## **Virtual classroom and Agri-DIKSHA: embracing the future of digital learning in agriculture higher education**

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### **ABSTRACT**

The National Education Policy (NEP), 2020, has paved the path towards revolutionizing the outlook of the education landscape in the country in general. The NEP, 2020 pushes for acceleration in the development of smart classrooms for using digital pedagogy and thereby enriching the teaching-learning process with online resources and collaborations. Agricultural higher education is also undergoing a digital transformation across India. Both offline and online education modes have grown in leaps and bounds in the past few years. The COVID 19 pandemic has further accelerated the transition to a more fluid, student centric teaching learning methodology. The use of new technology platforms and technology-aided learning tools is transforming the traditional teacher-class based teaching to digital learning in agricultural universities. One such digital learning initiative aligned with ICAR's vision of "Strengthening and Development of Higher Agricultural Education in India and Improving Quality of Agricultural Education" under National Agricultural Higher Education Project's (NAHEP) Component II project 'Investment in ICAR Leadership in Agricultural Higher Education', is setting up of "Virtual Classrooms", to enhance the teaching-learning experience in agricultural universities. To improve the quality of education and widen the access of education for students as well as up-skilling of teachers across the country, this initiative come out as a boon. These virtual classrooms are equipped with sophisticated, state-of-the-art physical infrastructure with various hardware equipment. The virtual classroom facility is bundled with Agri - DIKSHA web channel (<https://agridiksha.krishimegh.in>) which is an interactive portal for facilitating teachers to develop and broadcast virtual learning modules. The virtual classrooms are part of the blended learning method that combines on-line and in-person teaching/learning wherein quizzes, video lectures and other learning materials can be embedded in virtual learning modules. It combines entrepreneurial training, collaborative teaching and the latest technological teaching tools to create modern and effective education service environment in education setting leading to a resilient and sustainable agricultural higher education system.

*Keywords:* Agri-DIKSHA, NAHEP, NEP, virtual classroom, resilient



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