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SOUVENIR

International Conference
on
Advances in Agriculture & Food System Towards Sustainable Development Goals

August 22 - 24th, 2022

University of Agricultural Sciences, Bangalore

Jointly organized by

University of Agricultural Sciences, Bangalore

All India Agricultural Students Association New Delhi

Indian Council of Agricultural Research New Delhi

Supported by

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SOUVENIR

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नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

कृषि एवं किसान कल्याण मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

MESSAGE

The world's population is projected to reach 9 billion by 2050 and the global food demand is expected to rise, agricultural and allied sectors have a crucial role to play in feeding the world's hungry population. The Sustainable Development Goals (SDGs) of the United Nations are a universal call to action for all nations to work together to achieve sustainable development by the year 2030.

It is of immense pleasure to learn that All India Agricultural Students Association (AIASA), New Delhi in coordination with Indian Council of Agricultural Research and University of Agricultural Sciences, Bangalore is organizing International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals" (AAFS-2022) during 22-24 August 2022. I find this conference as well-designed and gives special emphasis to sustainable development goals which is very important and need of the hour. This will provide a fantastic forum for interaction on accomplishing SDGs for all the young researchers, research scholars, policymakers, academicians, and youth farmers worldwide.

I'm hoping that the scholarly community will find this souvenir book to be really beneficial and useful as a reference. The souvenir includes all the relevant aspects of sustainable transformation in agriculture and food production system, recent advances in aquaculture for food and nutritional security, innovation in global & regional agricultural education towards youth empowerment, climate change resilient agriculture, post-harvest technology for responsible consumption, global and regional policy transformation.

I convey my complements to all who have contributed directly or indirectly in organizing this conference and bringing out this souvenir.

(Narendra Singh Tomar)

ಥಾವರ್‌ಚಂದ್ ಗೆಹ್ಲೋಟ್
थावरचंद गेहलोत
THAAWARCHAND GEHLOT
Governor of Karnataka

No. GS 273 MSG 2022

MESSAGE

*I am delighted to know that University of Agricultural Sciences, Bangalore in association with All India Agricultural Students Association and Indian Council of Agricultural Research, New Delhi is organizing an International Conference on "**Advances in Agriculture and Food System Towards Sustainable Development Goals (AAFS2022)**" from 22-24th August, 2022 at University of Agriculture Sciences, GKVK Campus, Bengaluru in hybrid mode and has proposed to bring out a souvenir to commemorate the said occasion.*

My appreciation and warm wishes to the organizers and participants and wish the event grand success.

16.8.22

(Thaawarchand Gehlot)

Raj Bhavan, Bengaluru - 560 001 (Karnataka) Ph. 080-22254102 - 108

BASAVARAJ BOMMAI
CHIEF MINISTER
No: CM/PS/258/2022

VIDHANA SOUDHA
BENGALURU - 560 001

Date : 17/08/2022

MESSAGE

I am happy to know that the **International Conference on "Advances in Agriculture and Food System towards Sustainable Developmental Goals"** is being organized at the **University of Agricultural Sciences, Bangalore during 22nd to 24th August, 2022,** in collaboration with All India Agricultural Students Association (AIASA) and Indian Council of Agricultural Research, New Delhi.

Agriculture being the backbone of rural livelihood is time and again undergoing changes fuelled by innovation and inventions, not only in the field of agriculture, but also in other facets of Science and Technology. Hence, the sustainable development in Agriculture sector can be designed based on the global requirements with regional resources.

I hope the ICAR, New Delhi and SAUs are addressing such needs of the agriculture sector in the country. Likewise, International agencies and institutions that will be a part of the on-going conference and will provide necessary platform to usher global coordination for sustainable agricultural development. Working on the strategies to feed the hungry mouths in several developing countries will serve dual objectives of fighting the hunger and encouraging global development. In this pretext, I hope the International Conference will be most meaningful and provides directions to attain human welfare throughout.

I wish the organisers of the conference good luck and a grand success.

(BASAVARAJ BOMMAI)

Shri. Rajendra Prasad
Vice-Chancellor & Chairman,
Organising Committee (AAFS-2022)
Bangalore.

शोभा करांदलाजे
SHOBHA KARANDLAJE

राज्य मंत्री
कृषि एवं किसान कल्याण
भारत सरकार
Minister of State For
Agriculture & Farmers Welfare
Government of India

D.O. No.824.....MOS(A&FW)/VIP/2021-22/

Dated: 27 July, 2022

MESSAGE

I am happy to know that All India Agricultural Students Association (AIASA), Indian Council of Agricultural Research (ICAR) and University of Agricultural Sciences, Bangalore is jointly organizing **International Conference on "Advances in Agriculture and Food System towards Sustainable Development Goals"** on 22nd -24th August, 2022 at University of Agricultural Sciences, Bangalore.

Agriculture, being the primary sector of Indian economy, is also the source of employment for more than 50% of the population. Agriculture must not be seen only as a profession, but it is more of personal commitment and dedication to serve the human community by eliminating hunger, malnutrition, and poverty. A sustainable food and agricultural system is a collaborative network that integrates several components in order to enhance a community's environmental, economic, and social well-being. It is built on principles of ecological, social, and economic values of a community and region. I am sure that this conference will be a strong platform for participants from various parts of the world and the souvenir brought out on this occasion will be useful and informative for all.

I endeavor for successful conduct of conference and publication of a Souvenir on the occasion. I wish organizers, editorial team and the participants a grand success.

Shobha Karandlaje

(Shobha Karandlaje)

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B.C. PATIL
Minister for Agriculture and
District Incharge Minister for
Gadag & Chitradurga.

No. AM/ GDK/ 676/2022.

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22377790
patoagrimin@gmail.com

Date: 12.08.2022.

MESSAGE

I am glad to know that **International Conference on Advances in Agriculture and Food System towards Sustainable Development Goals(AAFS2022)** at University of Agricultural Sciences, Bangalore in collaboration with All India Agricultural Students Association and Indian Council of Agricultural Research, New Delhi from 22-24th August, 2022.

Agriculture and allied sectors contribute to about 1/6th of GDP and nearly 50 per cent of work force in the country. Though India ranks first in the world with highest net cropped area, the GDP is declining due to country's broad based economic growth in several other production sectors. Karnataka is one among states with more area under arid agriculture. However, Karnataka has achieved higher yields in several of the rainfed crops. This is made possible by robust extension machinery, research and technical advancements made by State Agricultural Universities and Research Institutes and innovations and risk bearing farming community.

The conference is aimed at arriving decisions on climate resilient agriculture; hi-tech and precision farming; nutritional security through aqua culture, dairy and animal husbandry; environmental and food safety concerns of using agro chemicals; new education policy and evolving global and regional policy issues, which is highly pertinent globally in general and for the state in particular.

Therefore, I am happy to note that an International Conference addressing modern challenges and oppurtunities is being organized in the state of Karnataka and in reputed University of Agricultural Sciences, Bangalore.

I hope that the deliberation will be productive and fruitful and wish the conference a grand success.

(B.C. Patil)

डॉ. हिमांशु पाठक
सचिव, एवं महानिदेशक

Dr HIMANSHU PATHAK
SECRETARY (DARE) & DIRECTOR GENERAL (ICAR)

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद्
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली 110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION (DARE)
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH (ICAR)
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
KRISHI BHAWAN, NEW DELHI 110 001
Tel.: 23382629; 23386711 Fax: 91-11-23384773
E-mail: dg.icar@nic.in

MESSAGE

I am happy to know that All India Agricultural Students Association (AIASA), Indian Council of Agricultural Research (ICAR) and University of Agricultural Sciences, Bangalore are jointly organizing International Conference on "Advances in Agriculture and Food System towards Sustainable Development Goals" during August 22-24, 2022 at University of Agricultural Sciences, Bangalore.

Investing in the agricultural sector can address not only hunger and malnutrition but also other challenges including poverty; water and energy use; climate change; and unsustainable production and consumption. By adopting sustainable practices, farmers will reduce their reliance on non-renewable energy, reduce chemical use and save scarce resources. Keeping the land healthy and replenished can go a long way when considering the rising population and demand for food. I am sure that this conference will be useful for all the stakeholders.

I wish organizers and the participants a great success.

(Himanshu Pathak)

Dated the 11th August, 2022
New Delhi

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UNIVERSITY OF AGRICULTURAL SCIENCES, BANGALORE

Dr. S. RAJENDRA PRASAD
Vice-Chancellor

Gandhi Krishi Vignana Kendra
Bengaluru-560 065

Message

It is a pleasant experience for the University of Agricultural Sciences, Bangalore to jointly host the "***International Conference on Advances in Agriculture and Food System towards Sustainable Development Goals***" (**AAFS2022**) in collaboration with All India Agricultural Students Association and Indian Council of Agricultural Research, New Delhi, during 22-24 August 2022.

Presently, Agriculture is facing new challenges and also finding new opportunities to feed the world. Agricultural activities are inherently resilient. However, the ever growing demand for food and fiber has made it technologically and socio-economically vulnerable. Attaining steady and sustainable growth to meet both the basic needs and the comforts requires to revisit the agri-production scenario, globally in general and in India particular. New world-order is dictating not only the way agriculture needs to be taken forward, but also to accommodate the youth as the drivers of the required change. In this context an International Conference on Advances in Agriculture and Food System towards Sustainable Development Goals to arrive at new path for sustainable agricultural development and secure food to the growing human population, is most appropriate.

The Conference addresses transforming agriculture and food production system in alleviating poverty, making agriculture climate resilient, beat the post-harvest losses and encourage value-added food manufacturing, adopt precise and high-tech farming, prevent natural resources and food from contamination by agro-chemicals, promote aquaculture and livestock husbandry sectors, policies transformation to ensure food security and bring in international perspectives into agricultural education under NEP-2020. Identifying innovations and inventions in these sectors will definitely usher a path breaking solution for sustained agrarian growth.

UAS, Bangalore, as it is known to the world, is a premier Agriculture Institution which not only contributed to take agriculture forward in the state, but also added value to country's food production system and economic growth. The University pioneered in evolving new crop varieties and hybrids (hybrid cotton, sunflower, rice, etc.), crop production technologies, dry land farming and watershed development, extension and marketing system for effective farmers' out-reach which are all highly noteworthy. The dedicated faculty, enthusiastic students, institutional support both from the state and the central governments and the responsive farming community have made all these achievements possible. The University feels itself elevated to host the International Conference and contribute its might for next-gen farming plan. I therefore, personally and on behalf of the University of Agricultural Sciences, Bangalore thank All India Agricultural Students Association and Indian Council of Agricultural Research, New Delhi for the opportunity bestowed.

I wish the aspiration of the Agriculture sector and global population will be met out during the course of these three days through interaction among researchers, academician, students and farming community.

I wish the convention, a grand success

(S. Rajendra Prasad)

भारतीय कृषि अनुसंधान परिषद
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डा. अशोक कुमार सिंह
उप महानिदेशक (कृषि प्रसार)
Dr. A.K. Singh
Deputy Director General (Agricultural Extension)

MESSAGE

The agricultural and allied sectors are playing a crucial role in feeding the world. However, over the years, massive deforestation, water exploitation, soil depletion and high levels of greenhouse gas emissions have raised issues of sustainable food and agricultural production. Therefore, innovative systems have to be evolved to enhance the natural resource base while increasing productivity. The advancements in agricultural and food systems, such as circular economy, alternative technologies and sources of food production, digitalization, etc. may ensure food security for the world's growing population. The Sustainable Development Goals (SDGs) are intended to impact national development strategies in the next few years.

It gives me great pleasure to learn that the All India Agricultural Students Association (AIASA), New Delhi, in collaboration with the Indian Council of Agricultural Research and the University of Agricultural Sciences, Bangalore, is organising an International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals" (AAFS-2022) on August 22–24, 2022 at the University of Agricultural Sciences, Bangalore. I sincerely believe that this international conference will provide an appropriate platform for researchers, academicians, students, and others associated with the sectors to address relevant issues, and that the discussion will lead to the Sustainable Development Goals through the Agricultural Sector.

I place on record my sincere appreciation to the Convenor and Organizers for their efforts and I wish grand success of the conference.

(A.K. Singh)

Dated :02.08.2022.

भारतीय कृषि अनुसंधान परिषद
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उप महानिदेशक (कृषि शिक्षा) (अ.प्र.)
Dr. Rakesh Chandra Agrawal
Deputy Director General (Agril. Edn.) (Act.)

MESSAGE

I am glad to know that All India Agricultural Students Association (AIASA), Indian Council of Agricultural Research (ICAR) and University of Agricultural Sciences, Bangalore is jointly organizing International Conference on **"Advances in Agriculture and Food System towards Sustainable Development Goals"** on 22nd -24th August, 2022 at University of Agricultural Sciences, Bangalore.

Agriculture is not a profession in real sense; it is the personal commitments and dedication to serve the human community by eliminating hunger, malnutrition and poverty from this planet. It is an absolute form of service which touches the stomach and soul of every individual of the society. The overall development of a country is decided by their sustainable growth and how the resources are managed. I wish this conference will lead ways to innovations to flourish the Indian agriculture and food system towards sustainable development goals.

I wish that All India Agricultural Students Association (AIASA) will work for betterment of agriculture profession in great harmony within the framework of National Agriculture Research System (NARS) and with the cooperation and support of public and private organizations in the overall interest of agriculture fraternity.

I wish a great success to the conference and congratulate the organizers.

(R.C. Agrawal)

AllIndiaAgricultural Students Association (AIASA)
(RegisteredSocietyunderSocietiesRegistrationActXXI,1860)
RegdOffice:A/G-4,NationalSocietiesBlock,
NationalAgricultureScienceCentre(NASC)Complex,NewDelhi-12
Website: www.aiasa.org.in

PREFACE

The present souvenir is being brought on the occasion of International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals (AAFS2022)". AAFS2022 is being jointly organized by All India Agricultural Students Association (AIASA), Indian Council of Agricultural Research (ICAR) and University of Agricultural Sciences, Bangalore from 22-24th August, at University of Agricultural Sciences, GKVK Campus, Bangalore (Karnataka) in hybrid mode.

The souvenir contains articles, lead lectures and abstracts of national importance concerning agricultural innovations for sustainable livelihood and employment for present and future generations on theme areas of Sustainable Transformation of Agriculture & Food Production System in Alleviating Poverty; Technological Innovation in High-Tech Horticulture and Precision Farming; Advances in Aquaculture Research towards Food and Nutritional security; Climate Change Resilient Agriculture; Post-Harvest Technology: Agri-Value & Supply Chain for Sustainable Production; Advances in Dairy and Veterinary Sector Towards Sustainable Development Goals; Role of Agrochemicals, Biological and Technological Interventions Towards Safe Food and Nutritional Security; Global and Regional Policy Transformation; New Education Policy on International Perspectives. International Journal of Agriculture, Environment and Biotechnology; and Journal of Cereal Research are publishing their special issue on the occasion of the International Conference.

India is an agriculturally dominated country or it will not be wrong to say that India lives in villages. India as a country has great potential in the agriculture sector. We need to tap the available potential resources sustainably to make the best use of them. India with its young demographic dividend constitutes about 41% of the total population of our country. Youths are potential assets of our country and their involvement in agriculture is vital as they are more energetic, productive and receptive to new ideas and advanced technologies. Besides, they dare to take risks and go against the tide which is badly needed in the farm sector. Thus, it is the need of the hour to make agriculture occupation remunerative and attracting rural youths by providing them gainful employment in rural areas by engaging them in different enterprises which could provide regular income to them in a sustainable manner. Universities and colleges of agriculture have committed to provide education and various technological innovations in agriculture to attract and retain youths in this sector. Thus, involving the young generation in agriculture will give a much-needed push to this sector and will provide an opportunity to achieve "Sustainable Development Goals". On this motto, AIASA, a professional society of present and former students in the field of agriculture and allied sciences had

been established and registered under the Societies Registration Act, 1860 with a mission of "Empowering youth in agriculture for the development of agriculture and the nation".

AIASA fosters the bond between agricultural students & professionals to raise the voice for techno-administrative agriculture reforms including the creation of Indian Agricultural Services and advancement in agriculture by involving agriculturists in policy formulation and implementation. Over time, the drift between the technical workforce and bureaucracy has increased abysmally harming the farming sector and farmers at the state and national levels. Policymaking in agriculture has been largely limited to subsidies and loan disbursement, with a negligible component of science in it. AIASA envisions a common platform where Agriculturists and Bureaucrats will work together for Indian agriculture - with a "Right Person at Right Place" mode, to promote more application of science which is often left back.

AIASA organizes National Youth Convention every year to come out with solutions and fill the gaps in Indian agriculture. This time AIASA is organising International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals" in association with ICAR and UAS, Bangalore to encourage the participation of farmers, students, subject expertise, professionals and delegates for broader, deeper, detailed discussions and brainstorming sessions in national and international purview. I strongly believe that the outcome of this conference will be helpful in paving the path for a better status of agriculture in India and achieving the ambitious Sustainable Development Goals.

The present publication has been made possible by the cooperation, support and active participation of participants in the preparation of valuable articles and deliberations. We also take this opportunity to thank and extend our sincere and heartfelt gratitude to all the participants, organizers and sponsors namely ICAR, CIMMYT, YPARD India, NABARD, SERB, IFDC, APEDA, KSNDMC and Indus Seeds for their valuable suggestions, physical and financial support in organizing the convention for bringing a meaning on this grand event.

New Delhi-12

Date: August 12, 2022

Vivek Saurabh

(Vivek Saurabh)
National President, AIASA

International Conference on
ADVANCES IN AGRICULTURE AND FOOD SYSTEM TOWARDS SUSTAINABLE DEVELOPMENT GOALS (AAFS 2022)

University of Agricultural Sciences, Bangalore

All India Agricultural Students Association (AIASA), New Delhi

Indian Council of Agricultural Research, New Delhi

22-24th August, 2022

Venue : UAS, GKVK, Bangalore, India **Mode :** Hybrid

PROGRAMME

Day – 1: 22nd August 2022, Monday			
08:30-09:45	Breakfast with High Tea		
10:00-12:45	Inauguration, Felicitation and Awards Ceremony		
12:45-13:00	Photo Session		
13:00-14:00	Lunch Break		
14:00-15:45 (Main Hall)	**Technical Session I**	**:**	***Sustainable Transformation of Agriculture & Food Production System in Alleviating Poverty***
	Session link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. A. K. Singh, DDG Extension, ICAR, New Delhi
	Conveners	**:**	1. Dr. K.B. Umesh, Director of Research, UAS, Bangalore 2. Ms. Preeti Sagar Negi, Deputy Chairperson (Hq.) National Agri-Business Innovation and Incubation Cell, AIASA, New Delhi
	Rapporteurs	**:**	1. Dr. C.T. Subbarayappa, Prof. & Head, Dept. of Soil Science & Agril. Chemistry, UAS, Bangalore 2. Dr. B.S. Lalitha, Professor, Dept. of Agronomy, UAS, Bangalore
	Keynote Speaker	**:**	***APEDA's Role and Initiatives to promote exports*** Shri. R. Ravindra, Regional Head, APEDA, Bengaluru
	Panellists / Lead Speakers:		
	1. Dr. B.M. Prasanna, Director, CIMMYT Global Maize Program and CGIAR Research		
	2. Dr Manoj Rajan IFS, Commissioner and Director, Karnataka State Natural Disaster Management		
	3. Dr. C. Viswanathan, Joint Director Research (Acting), IARI, New Delhi		
	4. Dr. Raju Bheemanahalli Rangappa, Assistant Research Professor, Agronomy-Plant Stress Physiology, Dept. of Plant and Soil Science, Mississippi State University, USA (V)		

	General Discussion & Concluding Remarks by the Chairman		
15:45-16:00	**Tea break**		
16:00-18:00 (Main Hall)	**Technical Session II**	**:**	***Technological Innovations in High-Tech Horticulture, Precision Farming and Agri Start-up***
	Session Link:	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. Debi Sharma, Director, ICAR-IIHR, Bengaluru
	Conveners	**:**	1. Dr. N.B. Prakash, Dean (Agri), CoA, GKVK, UAS, Bangalore 2. Ms. Munmun Joshi, Senior Vice President, AIASA, New Delhi
	Rapporteurs	**:**	1. Dr. R. Vasantha Kumari, Professor, Dept. of Horticulture, UAS, Bangalore 2. Dr. K.N. Srinivasappa, Professor, Dept. of Horticulture, UAS, Bangalore
	Keynote Speaker	**:**	Dr. B.N.S. Murthy Former Horticulture Commissioner, Department of Agriculture & Farmers Welfare, GoI Former Director, ICAR- IIHR, Bengaluru,
	Panellists / Lead Speakers:		
	1. Dr. Santosh Pitla, Associate Professor, Biological Systems Engineering, University of Nebraska–Lincoln		
	2. Dr. Vinod Kumar Tripathi, Assistant Professor, Department of Agricultural Engineering, BHU, Varanasi		
	3. Ms. Sangeeta Bojappa Moorthy, Chief Farmress & Founder Farmington.in, Karnataka		
	General Discussion & Concluding Remarks by the Chairman		
16:00-18:00	***PARALLEL SESSION***		
	Technical Session III	**:**	***Advances in Aquaculture Research towards Food and Nutritional Security***
	Chairman	**:**	Dr. Joykrushna Jena**,** Deputy Director General (Fisheries Science), ICAR, New Delhi
	Session Link	**:**	https://us02web.zoom.us/j/5600655050?pwd=Y2FvWkx4ZnFIVWVPRDhESThkTmV4dz09 Meeting ID: 560 065 5050 Passcode: 22121
	Co-Chairman	**:**	Dr. Ravishankar C.N., Director and Vice Chancellor, ICAR-CIFE, Mumbai
	Conveners	**:**	1. Dr. O.R. Nataraju, Professor & Head, Inland Fisheries Unit, MRS, Hebbal. 2. Mr. D. R. K. Saikanth, Chairman, National Agro-Technocrat Cell, AIASA

	Rapporteurs	**:**	1. Dr. Rajanna, K.B., Associate Professor (Fisheries), Fisheries Research & Information Centre, KVAFSU, Hebbal. 2. Dr. Venkatappa, Asst. Professors (Fisheries), Inland Fisheries Unit, MRS, Hebbal.
	Keynote Speaker	**:**	*Food and Nutritional security: Sustainable Aquaculture and Fisheries management* Dr. Binay Kumar Chakraborty, Project Director at Department of Fisheries, Bangladesh Agricultural University, Bangladesh
	Panellists / Lead Speakers:		
	1. Dr. K. Riji John, Hon'ble Vice-Chancellor, Kerala University of Fisheries and Ocean Studies, Kochi		
	2. Dr. Ravishankar C.N., Director and Vice Chancellor, ICAR-CIFE, Mumbai		
	3. Dr. K.R. Salin, Associate Professor and Program Chair, Aquaculture and Aquatic Resources Management (AARM) School of Environment, Resources and Development (SERD), Asian Institute of Technology (AIT), Thailand		
	4. Dr. Ratan Saha, Dean, College of Fisheries, CAU, Imphal		
	5. Mr. Erick Nunda, Technical Advisor and Certified Knowledge Manager for Sustainable Development, YPARD DRC		
	General Discussion & Concluding Remarks by the Chairman		
20:00 – 21.30	**Dinner**		
Day – 2 : 23rd August 2022, Tuesday			
09:30-11:15	**Technical Session IV**	**:**	***Climate Change Resilient Agriculture***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. Y. S. Shivay, Principal Scientist, Division of Agronomy, ICAR-IARI, New Delhi
	Conveners	**:**	1. Dr. M. N. Thimme Gowda, Prof. & Head, Dept. of Agrometeorology, UAS, Bangalore 2. Dr. R Vinoth, National Spokesperson, AIASA
	Rapporteurs	**:**	1. Dr. Jayaramaiah, R., Professor & Controller of Examinations, University Examination Centre, UAS, Bangalore. 2. Dr. M. H. Manjunatha, Jr. Agronomist, Dept. of Agrometeorology, UAS, Bangalore
	Keynote Speaker	**:**	*Transforming Cropping Systems to Improve Ecosystem Services and Climate Resiliency* Dr. Sangu Angadi, Professor, Agricultural Science Centre, Clovis, New Mexico State University, USA
	Panellists / Lead Speakers:		
	1. Dr. Pradip Goel, Senior Scientist, Ontario Ministry of Environment, Mississauga, Ontario, Canada		

	2. Dr. Kulvinder Gill, Dept. of Crop and Soil Sciences, Washington State University		
	3. Dr. Amitava Rakshit, Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi		
	4. Dr. Ashish Shukla, Modeller - Domestic Building Energy System, Energy System Catapult, Birmingham, UK		
	General Discussion & Concluding Remarks by the Chairman		
11:15-11:30	**Tea break**		
11:30-13:00	**Technical Session V**	**:**	***Post-Harvest Technology: Agri-Value & Supply Chain for Sustainable Production***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. K.S. Mahesh, General Manager, Karnataka Regional Office, NABARD
	Conveners	**:**	1. Dr. C.T. Ramachandra, Prof. & Head, Dept. of Processing & Food Engineering, UAS, Bangalore 2. Mr. Vivek Saurabh, National President, AIASA, New Delhi
	Rapporteurs	**:**	1. Er. Manjunatha, M., Res. Engineer, PHET, UAS, Bangalore 2. Er. Babu R M Ray, Asst. Professor, CoAE, UAS, Bangalore
	Keynote Speaker	**:**	*Advances in Ethylene Management to Minimise Postharvest Losses in Horticultural Supply Chain to Ensure Food and Nutritional Security* Dr. Zora Singh, Foundation Professor Horticultural Science, School of Science, Edith Cowan University, Australia
	Panellists / Lead Speakers:		
	1. Dr. Lisa Kitinoja, Chairman, The Postharvest Education Foundation, USA		
	2. Dr. Ramesh Mittal, Director, NIAM, Jaipur		
	3. Dr. Soottawat Benjakul, Professor, Dept. of Food Technology, Faculty of Agro-Industry, Prince of Songkla University, Hat Yai, Songkhla, Thailand		
	4. Ms. Jyotsana, Founder, Lucknow Farmers Market		
	5. Dr Ram Asrey, Principal Scientist & Professor, Division of Food Science & Postharvest Technology, IARI, New Delhi		
	General Discussion & Concluding Remarks by the Chairman		
13:00-14:00	**Lunch break**		
14:00-15:45	**Technical Session VI**	**:**	***Advances in Dairy and Veterinary Sector Towards Sustainable Development Goals***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121

	Chairman	**:**	Dr. R. N. Srinivas Gowda, Former Hon'ble Vice-Chancellor, Karnataka Veterinary, Animal and Fisheries Sciences University (KVAFSU), Bidar
	Conveners	**:**	1. Dr. Vasundra Devi, Professor & Head, Dept. of Animal Science, UAS, Bangalore 2. Mr. Neeraj Dixit, Ph.D. Scholar (Dairy Science), SHUATS, Allahabad
	Rapporteurs	**:**	1. Dr. Anand Manegar, Asst. Professor, Dept. of Animal Science, UAS, Bangalore 2. Dr. Suresh, K.B., Asst. Professor of Dairy Technology, PHET, UAS, Bangalore
	Keynote Speaker	**:**	Dr. K. C. Veereanna, Hon'ble Vice-Chancellor, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar
	Panellists / Lead Speakers:		
	1. Dr. Rameshwar Singh, Hon'ble Vice-Chancellor, BASU, Patna, Bihar		
	2. Prof. A.K. Datta, Professor Emeritus, IIT Kharagpur		
	3. Shri. Sanjeev Kumar, Managing Trustee, The Goat Trust, Uttar Pradesh		
	General Discussion & Concluding Remarks by the Chairman		
15:45-16:00	**Tea break**		
16:00-17:45	**Technical Session VII**	**:**	***Role of Agrochemicals, Biological and Technological Interventions Towards Safe Food and Nutritional Security***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. P. K. Ghosh, Director, NIBSM, Raipur
	Co-Chairman	**:**	Dr. Hemalatha R., Director, NIN, Hyderabad
	Conveners	**:**	1. Dr. M. K. Prasanna Kumar, Professor, Dept. of Plant Pathology, UAS, Bangalore 2. Mr. Rakesh Kumar, Delhi President, AIASA
	Rapporteurs	**:**	1. Dr. A. Satish, Professor, Dept. of Soil Science & Agril. Chemistry, UAS, Bangalore 2. Dr. B. Shivanna, Professor, Dept. of Agril. Entomology, UAS, Bangalore
	Keynote Speaker	**:**	*Role of Biologicals in Food and Nutritional Security* Dr. H.B. Singh, Professor, Dept. of Plant Pathology, Institute of Agricultural Sciences, BHU
	Panellists / Lead Speakers:		
	1. Dr. Debi Sharma, Director, ICAR-IIHR, Bengaluru		
	2. Dr. Y. S. Shivay, Principal Scientist, Division of Agronomy, ICAR-IARI, New Delhi		
	3. Mr. Prabhakar Rao, Managing Director, Foragen Seeds Pvt. Ltd., Hyderabad		
	4. Dr. Kaushik Banerjee, Principal Scientist, ICAR-NRCG, Pune		

	5. Mr. Yogendra Kumar, Marketing Director, IFFCO, Bangalore		
	General Discussion & Concluding Remarks by the Chairman		
18:00-20:00	**Cultural Program**		
20:00-21:30	**Dinner**		
Day – 3 : 24th August 2022, Tuesday			
09:30-11:15	**Technical Session VIII**	**:**	***Global and Regional Policy Transformation***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. R. B. Singh, Padmabhushan Awardee, Former Chancellor, CAU, Imphal
	Conveners	**:**	1. Dr. M.R. Girish, Professor, Dept. of Agril. Marketing & Co-Op, UAS, Bangalore 2. Ms. Nidhi Chaturvedi, National Treasurer, AIASA, New Delhi
	Rapporteurs	**:**	1. Dr. G.M. Gaddi, Professor, Dept. of Agril. Economics, UAS, Bangalore 2. Dr. Mahin Sharif, Asst. Professor, Dept. of Agril. Economics, UAS, Bangalore
	Keynote Speaker	**:**	*Evolution of India's Food System Since Independence* Dr. Ashok Dalwai, CEO National Rainfed Area Authority, New Delhi
	Panellists / Lead Speakers:		
	1. Ms. Sithembile Ndema Mwamakamba, Director - Policy Research and Analysis, Food Agriculture and Natural Resources Policy Analysis Network (FANRPAN), South Africa		
	2. Dr. Dilip Kumar, Former Director, CIFE, Kolkata		
	3. Dr. Sahadeva Singh, Chief Policy Advisor, AIASA		
	General Discussion & Concluding Remarks by the Chairman		
11:15-11:30	**Tea Break**		
11:30-13:30	**Technical Session IX**	**:**	***Role of New Education Policy on International Perspective***
	Session Link	**:**	https://us02web.zoom.us/j/5600651234?pwd=eXFkWW1MdktoTU9ZajlLSVFES1dEZz09 Meeting ID: 560 065 1234 Passcode: 22121
	Chairman	**:**	Dr. R.C. Agarwal, DDG (Agricultural Education), ICAR, New Delhi
	Conveners	**:**	1. Dr. K.S. Jagadish, Prof. & Head, Dept. of Apiculture, UAS, Bangalore 2. Mr. Hem Prakash Verma, State President, AIASA, Chhattisgarh

	Rapporteurs	**:**	1. Technical Officer, Dean (PGS), UAS, Bangalore 2. Technical Officer, Dean (Agri.), CoA, GKVK, UAS, Bangalore
	Keynote Speaker	**:**	*NEP in Synch with Agricultural Education* Dr. S. Rajendra Prasad, Hon'ble Vice-Chancellor, UAS, Bangalore
	Panellists / Lead Speakers:		
	1. Dr. (Mrs.) Pankaj Mittal, Secretary, Association of Indian University, New Delhi		
	2. Dr. Tej Pratap, Former Hon'ble Vice-Chancellor, GBPUAT, Uttarakand		
	3. Dr. D.K. Singh, Principal Scientist & Professor of Discipline of Agricultural Engineering, IARI, New Delhi		
	4. Dr. Mohammad Farooq Baqual, Associate Dean, College of Temperate Sericulture, Mirgund, Pattan, Kashmir		
	5. Mr. Vivek Saurabh, National President, AIASA		
	6. Dr. Sandeep Kumar, Founder President, AIASA & Assistant Professor, OUAT, Bhubaneswar, Orissa		
	General Discussion & Concluding Remarks by the Chairman		

* * *

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3	Dr. Basave Gowda, Registrar, UAS, GKVK, Bangalore & Local Organizing Secretary AAFS-2022	Member
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5	Director of Extension, UAS, GKVK, Bangalore	Member
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9	Dean(Agri.), College of Agriculture, VC Farm, Mandya	Member
10	Dean (Seri.), College of Sericulture, Chintamani	Member
11	Dean (Agri.) , College of Agriculture, Hassan	Member
12	Special Officer, College of Agricultural Engineering, UAS, GKVK, Bangalore	Member
13	Special Officer, College of Agriculture, Chamarajanagar	Member
14	Comptroller, UAS, GKVK, Bangalore	Member
15	Estate Officer, UAS, GKVK, Bangalore	Member
16	Administrative Officer, UAS, GKVK, Bangalore	Member
17	Librarian, UAS, GKVK, Bangalore	Member
18	Co-ordinator, PPMC& Nodal Officer to ICAR, UAS GKVK	Member
19	Chairperson of all committees	Members

1. Registration Committee

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UNIVERSITY OF AGRICULTURAL SCIENCES BANGALORE

University of Agricultural Sciences, Bangalore (UAS-B) having collegiate structure is one of the prominent Universities in agricultural education, research and extension. UAS-B was established by the Act No. 22 of the then Mysore Government in the year 1963. The University came into existence on 21st August, 1964, but its conception took birth in 1899 with the establishment of experimental farm on 30 acres, followed by an Agricultural School in the expanded farm area of 202 acres during 1913, which is now the 'Main Research Station (MRS)' located at Hebbal, Bengaluru. Today University of Agricultural Sciences, Bangalore is a tribute to the visionaries who founded and nurtured it over the past several decades. The University of Agricultural Sciences, Bangalore having head quarter at Bengaluru functions with territorial jurisdiction extending over the districts of Kolar, Chikkaballapur, Bengaluru (Rural), Bengaluru (Urban), Ramanagara, Mandya, Tumkuru, Mysuru, Chamarajanagara and Hassan.

The phenomenal growth of the University and needs of the regions of the State, led to bifurcation of the University of Agricultural Sciences, Bangalore through an Amendment to UAS-B Act in 1986 and the University of Agricultural Sciences, Dharwad was established. Considering the importance of subjects and regions, Government of Karnataka through Acts, established 'Karnataka Veterinary, Animal and Fishery Sciences University' at Bidar during 2005; 'University of Agricultural Sciences, Raichur' during 2008; 'University of Horticultural Sciences, Bagalkot' during 2009 and 'University of Agriculture and Horticultural Sciences, Shivamogga' during 2013. The University of Agricultural Sciences, Bangalore and the Mother University has ensured a broad geographic spread of its Teaching, Research & Extension campuses in different regions covering 10 southern districts of Karnataka. The UAS-B has celebrated its Golden Jubilee year during 2013 14 and Golden Jubilee Convocation during 2015-16.

Teaching :

UAS-B has drawn-out its academic programs to meet the requirement of human resources in the face of changing agriculture scenario. A range of new technology oriented six Under-Graduate Degree programs in Agriculture, Sericulture, Food Science & Technology, Agri-Business Management, Agri-Biotech and Agricultural Engineering including 24 Postgraduate programs & 16 Doctoral degree programs are being offered across five campuses namely GKVK, Mandya, Hassan, Chintamani and Chamarajanagara. University places great emphasis on dynamic curriculum that ensures specialized skills and practical experience. The academic programmes are offered under semester system with English as medium of instruction. Two year diploma in Agriculture is also offered under semester system in Kannada medium at College of Agriculture, Mandya. Further, the Directorate of Extension offers various Diploma and Certificate Courses on Distance Education mode. A dedicated student-mentoring programme by teachers is a part of the curriculum in the University to inspire and nurture students at various stages of the degree programme. The student placement cell functioning at GKVK provides career guidance and job opportunities to

graduating students. The International Centre established in the University coordinates all the international activities and facilitates academic interactions outside the Country. The University has established a Skill Development Centre (SDC) under ICAR- SC-SP wherein the Graduates are developed with multi skills of fundamental and contemporary technologies. University efforts during the lockdown period of Covid-19 Pandemic are exemplary.

UAS-B is equipped with modern virtual classrooms of advanced pedagogic support and well equipped laboratories to facilitate both fundamental and applied research of PG and faculty research. University has initiated several initiatives to make the campus greener and free of plastic. The University has separate hostels for boys and girls both at UG & PG level in all the campuses, There is a separate Hostel for Doctoral students (boys and girls) and one International Students' Hostel (Common for boys and girls) at GKVK. In all, the University has more than 700 rooms and few dormitories to accommodate students. All the college hostels are provided with indoor games, gymnasium and network facilities linked to library with LAN/Wi-Fi. All the teaching campuses are having dedicated sports fields.

University has set up a Centralized Computer Laboratory and Agriculture Knowledge Management Unit (AKMU), with the help of ICAR which caters to the needs of postgraduate students/faculty research and data analysis. It is a partner of OCLC / WORLD CAT under the e-Granth project; Subscribed for agricultural information source like; Online journals, online and offline databases; Access to e services like consortia of electronic resources in agriculture (CeRA), digitized thesis abstracts, indiastat.com, Krishikosh and Open access journals.

University has developed UGAM App, which is extensively used by the UG students for the online payment of fees and paperless semester registration. The University has initiated the process of paperless examination (PLEXA) system for all the Under Graduate Degree Programmes. University introduced the 'Decentralized Digital Evaluation' on 24x7 basis so that faculty can perform evaluation from respective colleges, which saves time and resources besides enhancing the speed of digital evaluation.

University Library

University Library established during 1966-67 is the oldest and biggest Library in the field of Agricultural Sciences in Karnataka. Library has nearly 2 lakh documents out of which, Books, Journals, University publications, Government publications, Rare books, Thesis /dissertations, Reports, Pamphlets, Maps, Microfilms, Microfiche, CD ROM's/DVD's etc. University Library is a member of Online Computer Library Centre (OCLC). The Library is completely automated with Koha Open Source Software package and integrated with RFID Technology; Inter library connectivity with constituent colleges of UASB in Library Management software Koha is adopted. University Library has created Video Conference Facility for conducting online meetings, seminars, classes for students and faculty including Constituent colleges of UASB. Library has developed the database of Books, Journals, Thesis, Reports and other Information under the Koha open software. Users can access the

OPAC through Internet. University Library has subscribed several Online Journals, Offline Databases, e books and e-Journals. Library is also offering PGS 501 (0+1) non credit compulsory course on 'Library and Information Service' for Master's Degree Students as per the Guidelines of ICAR.

University Library has implemented and adopted following latest technologies for the benefit of library users.

a) DSpace: A n open source repository application that allows library to capture, store, index, preserve and distribute the digital material including text, video, audio and data.

b) IRINS-Indian Research Information Network System: Is a web based Research Information Management (RIM) service developed by the Information and Library network (INFLIBNET) Centre. The portal facilitates the academic, R&D organizations and faculty members, scientists to collect, curate and showcase the scholarly communication activities and provide an opportunity to create the scholarly network.

c) Sententia Software: Is an English grammar text and style analysis platform with content and certification for learning academy which is adaptive for the UG, PG and Ph.D students, besides staff members.

d) Myloft Software: Is a SaaS based product which allows the users to access the e content anywhere and anytime on single IP range for the entire University jurisdiction for sharing the data of staff and students of UG/PG and Ph.D.

e) NiPA; NIPA database is very much useful for the students who are appearing for ICAR, SRF, JRF and NET exams and online test can also be conducted in this software.

Research:

Agriculture in the State is dominated by small and marginal farmers, who have small holdings. Raising productivity is likely the single most important factor, if income of this group is to be doubled. The research in UAS, Bangalore has a vision to generate cutting edge farm technologies for transforming agriculture to make it profitable for the farmers and to meet the growing demand for food. The emphasis is on developing technologies with local relevance that is both sustainable and environmentally sound. Adaption of new varieties as well as new production technologies can potentially strengthen farmers cropping systems by increasing yields, improving drought resilience, boosting resistance to pests and diseases and also capture new market opportunities.

Climate-smart, low cost, highly efficient, sustainable and environmental friendly crop production technologies are being developed by the University. Research programmes are

planned in 13 Agricultural Research Stations situated in 10 Southern Districts of the state under the jurisdiction of the University of Agricultural Sciences, Bangalore. Issues and necessities of farming community are addressed by the University by developing scientific agricultural technologies that would pave a way for attainment of empowered and proud lifestyle of farmers. The research programmes are oriented towards improving the potentials of various crops and related inputs and resources in agriculture, besides focusing on Bio technology research, cropping system research, farming systems approach. Management of resources, etc., ensuring food security through precision and sustainable agriculture practices. In the last five decades, UAS-B has developed and released 315 crop varieties and seven animal breeds that has substantially contributed for enhanced farm productivity. UAS-B was the first in the Country to evolve hybrid varieties of Onions, Sunflower and Rice which transformed agricultural production in the state. The watershed model delivered by UAS-B has been replicated across the country enhancing productivity levels of dry land cropping systems. UAS-B produces adequate Nucleus seeds to meet the demand of all the released varieties.

A total, 268 research projects are in operation, of which 31 are All India Coordinated Research Projects, 4-Voluntary Centre's,1- Project Coordinating Unit on small millets,1-Network unit on Agricultural Acarology, 14-RKVY projects, 5-Emeritus Scientists, 7-ICAR *Ad-hoc* projects; 85 Governme`nt of India Projects (DST/DBT); 44 Government of Karnataka Projects; 43-projects funded by other agencies and 33 Research projects (UAS Sponsored: 19- Projects on Varietal Development and Value-addition; 6-Farmer Centric& 8-Climate Smart Agriculture) sponsored by the University to tackle the problems of the farmers in the State in general. The University has undertaken the testing of 474 new varieties /lines/ chemicals/ molecules for control of pests /diseases / weeds / soil analysis and agricultural equipment and generated revenue of Rs. 616.49 lakhs.

During 2021-22, Nine varieties viz., 2 in Rice (KMP-225, RNR-15048), 1 each in Maize(MAH-14-138), Browntop Millet (GPUBT-2), Field Bean (HA-5), Niger (KBN-2), Castor (ICH-66), Sesamum (GKVKS-1) and Fodder Sorghum (CNFS-1) were released for different zones. Six patents including 4 Australian patents, one German patent and one Indian Patents have been granted to UAS, Bangalore during 2021-22.

Break through Research

Pioneer in Genome sequencing of Horsegram : Horsegram variety PHG-9, Genome was decoded and sequenced for the first time in the world using the new generation technology (Combination of Illumina and Pacbio technologies). This draft genome sequence provides opportunities to explore the crop for its desirable traits like drought tolerance, antioxidant activity, antimicrobial properties and high protein.

Genome sequencing of Mite species: During 2021-22, a total of 103 (ITS 2 - 78; Mitochandria: Mt COI - 25) DNA sequences of twenty-eight species of mites are submitted to NCBI - GenBank database. It paves a way to study the genetic variability of polyphagous

species across host plants and geographical locations, nuclear gene (ITS2) sequences of the following mite species were deposited and accessioned in the GenBank database

Extension:

The Directorate of Extension is vested with the responsibility to carry out the extension services in 10 districts of Southern Karnataka *viz.,* Bengaluru Rural, Bengaluru Urban, Ramanagara, Mandya, Kolar, Chikkaballapur, Hassan, Tumakuru, Chamarajanagar and Mysuru. The University is catering to the needs of farming community by undertaking various extension activities viz., front line demonstrations, on farm testing's, discussion meetings, farmers field schools, capacity building programmes, krishimela, field days etc., besides publications and supplying agricultural inputs.

The extension education programmes shall ensure technology assessment and refinement and facilitate adoption of technologies by farmers and others for accelerated agricultural growth. It shall conduct demonstrations and training programmes for the benefit of farmers and other stake holders. Director of Extension shall co-ordinate with different units of the University and other appropriate agencies of the centre and the state. The University shall be responsible for developing suitable models of Agricultural Extension in the state.

The University Extension Service has three fold objectives:

a) To provide new, dependable, profitable, socially acceptable, ecologically sustainable and timely information to the farmers
b) To provide feedback on adoption of new technologies by the farmers to research system in order to examine the problems in adoption and modify/re-orient the technologies, if any and
c) To device ways and means for improving the quality and effectiveness of extension work.

In order to accomplish the above stated objectives, the Directorate of Extension is carrying out the following functions:

a) Serving as the primary source of agricultural information to the field extension functionaries and farmers.
b) Rendering advisory services to field extension functionaries and farming community.
c) Conducting farm trials on new research findings and organise front line demonstrations.
d) Organizing training programmes to extension professionals and farmers on latest farm technologies and
e) To stimulate research and impart teaching.

Directorate of Extension in order to carryout various activities is supported by 11 Units viz., Staff Training Unit (STU), State Agricultural Extension Management and Extension Training

Institute (SAMETI), Bakery Training Unit (BTU), Farmers Training Institute (FTI), Farm Information Unit (FIU), Distance Education Unit (DEU), Agricultural Technology Information Centre (ATIC), Agricultural Sciences Museum (ASM), Extension Education Units (EEUs), National Agriculture Extension Project (NAEP) and seven Krishi Vigyan Kendras (KVKs)

Krishimela conducted successfully during 2020 through virtual and offline mode was the attraction amidst the crisis induced by Covid 19. Agri-War Unit established during the lockdown crisis ofCovid- 19, was a boon for the woes of farming community in terms of marketing their produce and for advisory services.

Awards / Recognitions and Significant Achievements of the University :

1) UAS-B has been bestowed twice with prestigious 'Sardar Patel Outstanding ICAR Institution Award

2) Krishi Vignana Kendra, Hassan (during 2002); Bengaluru Rural District (during 2014) and KVK, Ramanagara (during 2021) under the jurisdiction of UAS-B have been bestowed with National Level Best KVK awards

3) University has organized 107th Indian Science Congress with the theme of "Science and Technology: Rural Development". As a part of Indian Science Congress, Women's Science Congress, Children‘s Science Congress, Science Innovators Meet and Farmers Science Congress were organized. The ‘Farmers’ Science Congress’ was first of its kind in the programme of ISC.

4) AICRP on Agro meteorology, Bengaluru centre; AICRP for Dryland Agriculture, Bengaluru centre; AICRP on Forage crops and AICRP on Post-Harvest Engineering & Technology, Bengaluru centres have been conferred with the Best Centre Awards during the last four years.

5) AICRP on Forage crops, ZARS , Mandya was awarded appreciation certificate for the team work at National group Meeting–Kharif 2020 for the development of Production Technologies from the Project Coordinator, AICRP on Forage Crops- IGFRI-Jhansi

6) UAS-B was awarded FIVE STAR institution by the Department of Higher Education, GoK in the category of Specialist University during 2020

7) The Agriculture Today Group has presented the ‘Excellence in Course & Curriculum Design Award’ to UAS, Bangalore adjudicated by the eminent JURY panel of India Agri-Education Awards-2021 for exemplary contribution by UAS-B towards agricultural education in India & beyond. UAS-B was also awarded ‘Institution with Training Program on Organic Farming Award’ by Agriculture Today Group during 2021.

8) UAS, Bangalore received Brand Promising University Award from ATAL Ranking Innovation Institutes during 2021

9) UAS, Bangalore received Red Cross appreciation for Youth Development activities during 2021-22 and support in strengthening Youth Red Cross activities from Hon'ble Governor of Karnataka.

10) UAS-B was accredited by ICAR-NAEAB with overall score of 3.261 out of four, equivalent to grade 'A' in the recent ratings.

11) The Central Instrumentation Facility (CIF) under the aegis of the Centre for Advanced Agricultural Sciences and Technology (CAAST) program of the National Agricultural Higher Education Project (NAHEP) of ICAR; Professor M.D. Nanjundaswamy Research Chair; Centre for Agriculture and Rural Development Studies (CARDS); Karnataka State Agricultural Marketing Board (KSAMB) Chair and Bi-Nest Agri Innovation Centre established at UAS-B have significantly contributed for undertaking various activities under their purview.

12) Based on the existing strengths and research leads, a program on Next Generation Technologies (NGT) in Adaptive Agriculture (AA) in four specific areas has been initiated at UAS-B under the Centre for Advance Agriculture Science and Technology (CAAST) scheme of the National Agricultural Higher Education Project (NAHEP) of the Indian Council of Agricultural Research (ICAR). There are four objectives in this program, which include research component, skill development, training and demonstrations and strengthening infra-structure for post-graduate programmes of the UAS-B.

13) UAS, Bangalore has established Agri-innovation Centre, an incubation centre with the moto of translating the innovative ideas of Start-ups into economically and commercially viable products. The Innovation Centre paves the way for young entrepreneurs, farmers, academicians, agricultural graduates and agriculture Scientists to implement their innovative ideas in developing a successful product/technology.

The awards, recognitions and significant achievementsare a testimony of the quality education, research and extension carried out by the University.

Dr. S. Rajendra Prasad
Vice-Chancellor, UAS, Bangalore

About AIASA

AIASA is a professional organization of present and former students in the field of Agriculture, Veterinary, Dairy, and horticulture, fisheries, forestry, Home science, sericulture, ABM and other allied sciences, registered under Societies Registration Act 1860.

The Association was formally launched on 10th May, 2011 by the then Hon'ble Union Minister of State for Agriculture during the All India Convention on Agricultural Administrative Reforms and the website was launched by the Hon'ble Union Minister of Agriculture on the occasion of 87th ICAR Foundation Day on 25th 26th July, 2015 at Patna, Bihar. The Society was registered on 1st Dec 2011 under the Societies Registration Act 1860, with the approval of Ministry of Agriculture, ICAR and Ministry of Consumer Affairs. Down the course of time, the drift between the technical work force and bureaucracy has increased abysmally harming the cause of farming sector and farmers at the national and state level. Policy making in agriculture has been largely limited to subsidies and loan disbursement, with negligible component of science in it. AIASA envisions a common platform where Agriculturists/technocrats and Bureaucrats will work together for the Indian agriculture with a "right person at right place" mode, to promote more application of science which is often left back. AIASA is established with the prime motto to bridge the drift and strengthen the voice of the agriculturalists, veterinarians, fishery experts and personnel of all allied fields at states, national and international levels.

AIASA advocates for resolving the long pending issues of creation of the All India Cadre of "Indian Agriculture Service" for appointment of right person at the right place and grant of professional status to agriculture sector at par with other professions for better job opportunities and career advancement of the personnel serving the primary sector.

The Society is covered for exemption from Income Tax u/s 80G(5)(vi) vide Order no DELAE27111-19092016 dated 19.09.2016.

Aims and Objectives

- To promote National Integration, Patriotism, Communal Harmony with the development of leadership among members.
- To facilitate and foster the bond between the students & professionals (Teachers, Scientists, Technical officials and Farmers /entrepreneurs).
- Professional status to Agriculture sector and to establish Agriculture Council of India (ACI) with need based administrative reforms.
- Creation of Central/Indian Agriculture Services.
- Granting UPSC status to ASRB for recruitment under Indian Agriculture Services.
- To make efforts for improving the job opportunities by having specialized cadre for agriculture services in center & state.
- Introduction of Agriculture course in CBSE, ICSE and state boards at school levels.
- Granting Fellowship to Agricos on par with UGC, CSIR, DST etc. fellowships.
- To represent the students in the national and international policy making body.
- To eradicate bureaucratic interference and corruption at all the levels and strive for introducing transparent system.
- To find out immediate solution for all problems which may jeopardize the common interest of the members by meeting, discussion and other democratic ways to the concerned authorities and act as a communicator to authorities/govt.
- Attracting and retaining youth in agriculture.
- To make efforts for advancement of agricultural research, education, extension, agricultural trade and development activities and other policy issues for promoting sustainable production and productivity including conservation & judicious use of natural resources.
- To make effort and convince the higher authority for restructuring the entire agricultural administrative system/set up at par with other professions, which remain as it was since its inception in the pre Independence era.

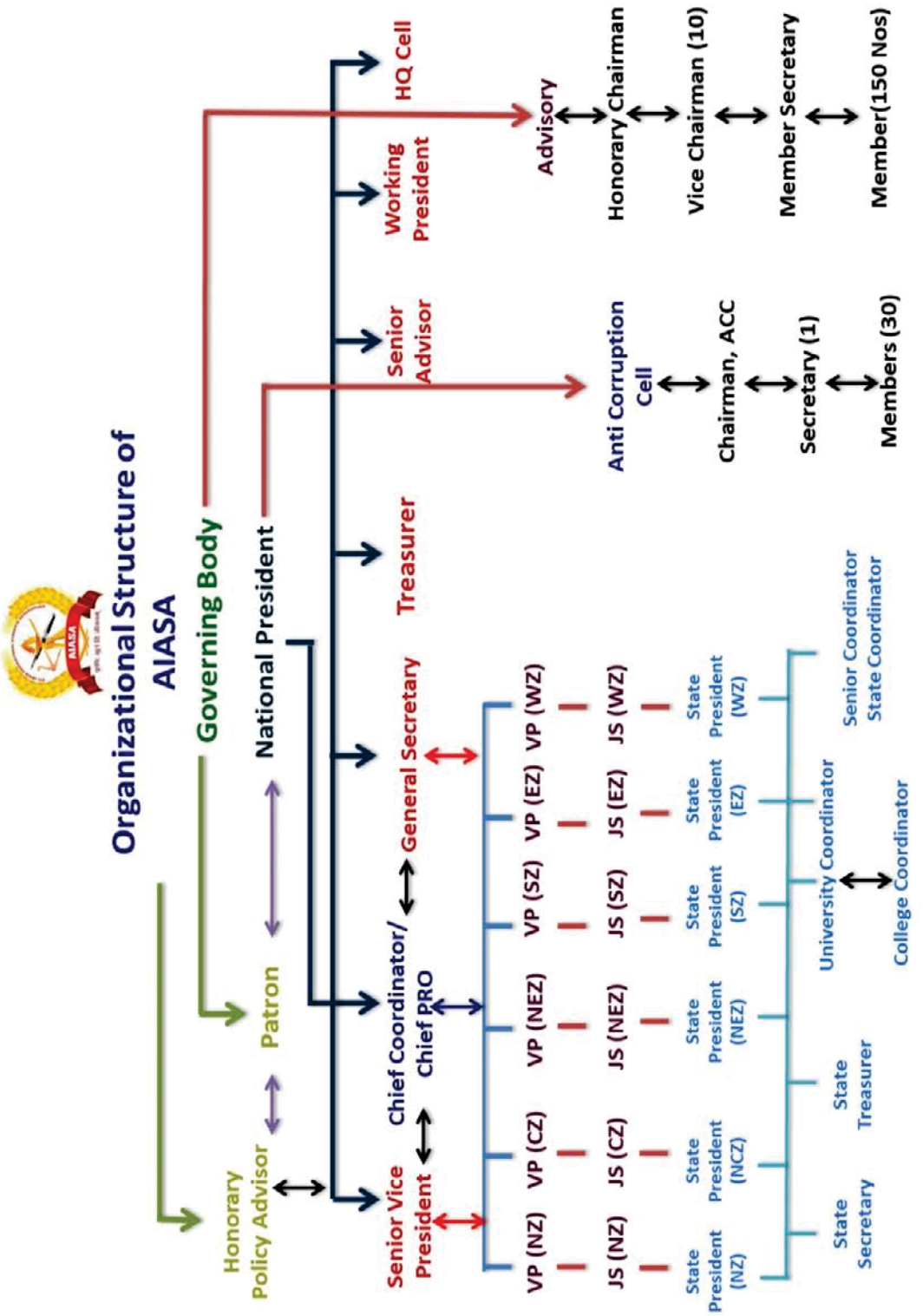
Mission

Empowering youth in agriculture for development of agriculture and the nation.

Vision

To foster the bond between agricultural students & professionals and to raise the

voice for techno administrative agriculture reforms including creation of Indian Agricultural Services and advancement in agriculture by involvement of agriculturists in policy formulation and implementation.



Session - I

BREEDING AND DEPLOYING CLIMATE RESILIENT MAIZE VARIETIES IN THE TROPICS

B.M. Prasanna
Director, Global Maize Program, CIMMYT (International Maize and Wheat Improvement Center) & CGIAR Plant Health Initiative Lead; Email: b.m.prasanna@cgiar.org

Achieving sustainable food and nutritional security, i.e., the basic right of the people to produce and/or purchase the nutritionally balanced food they need, without harming the social and biophysical environment, has to be the funademental goal of any nation. Over the last seven decades, India made immense progress towards food security of the population. Since 1950, the population almost tripled, but food grain production had more than quadrupled. India is now among the largest producers of rice, wheat, pulses, fruits, vegetables, milk, cotton, horticultural crops, dairy and poultry, aquaculture, and spices. Agricultural production in India is valued at US$ 401 billion in 2017, which is more than that of the USA (US$ 279 billion).

Despite this impressive progress, there is no scope for complacency. It is estimated that by 2030, India's population would be 1.52 billion; by 2050, it would be approximately 1.7 billion, which will be the highest in the world and about 400 million more than China, the most populous nation today. By 2050, India needs to step up production of all agricultural commodities by around 30 per cent in food grains and to more than 300 percent in vegetable oils to meet the needs of increased population and rising living standards. Also, by 2050, to meet the diverse demands of the population, it has been estimated that land productivity has to be increased by 4 times, water productivity by 3 times, and labour productivity by 6 times. All this has to be achieved in the context of changing climates, more fargile natural resources, and by staying within the planetary boundaries i.e., without major environmental and ecological footprints.

Climate change is for real, and certainly not fiction, as is unfortunately still believed by some in the world! The negative impacts of frequently occuring climatic extremes/variabilities on agricultural production are most often felt by the resource-constrained smallholders in the tropics, be it in Africa, Asia or Latin America. Abiotic stresses, especially drought, heat, flooding/waterlogging, soil acidity, and combinations of various abiotic stresses have a huge negative impact on the rainfed crop yields. For instance, in South and South East Asia, more than 80 percent of the maize-growing area is rainfed and prone to various climatic extremes/variabilities. While we tend to focus mostly on abiotic stresses in the context of climate change, it is equally important to consider the changing spectrum of pathogens and insect-pests, due to increase in temperature (Deutsch et al., 2018; IPPC Secretariat, 2021; Skendžic et al., 2021).

Building climate resilience in the smallholder farming systems, therefore, requires implementation of an intenisve multi-disciplinary and multi-institutional strategy. This should

include extensive awareness creation and widespread adoption of climate-resilient crop varieties and climate-smart agronomic management practices, strengthening of local capacities, and much stronger focus on sustainability. An array of agricultural production technologies and practices, including stress-tolerant improved crop varieties, conservation agriculture practices, and agroforestry systems, that aim to mitigate climate-induced risks and foster resilience have been developed through national and international AR4D initiatives over the past two decades. In addition, institutional interventions that seek to mitigate risk and build resilience through other mechanisms could play a complementary role to climate-smart agricultural production technologies/practices.

We need to collectively address an array of challenges, including adaptation to the changing climates, alleviating extensive malnutrition, improving soil health, and protecting agrifood systems from devastating diseases and insect-pests. Intensive multi-institutional and multi-disciplinary efforts are required to cocreate and deploy innovative and sustainable technologies that can improve crop productivity, reduce production costs, and improve the incomes and livelihoods of smallholder farmers. Building climate resilience warrants effective integration of climate-resilient crop varieties, climate-smart agronomic management practices, and effective implementation of policies to help reduce environmental and ecological footprints of agricultural practices.

Scientific institutions must enhance the the pace, precision and efficiency of breeding programs through judicious and effective integration of modern tools/strategies, including high-density genotyping, high throughput and precision phenotyping, speed breeding, molecular marker-assisted and genomic selection-based breeding, and knowledge-led decision-support systems. Seed systems need to be further strengthened to become more market-oriented and dynamic, and for providing smallholders with greater access to affordable climate-resilient and nutritionally enriched improved seed. Understanding the smallholder farmers' constraints for adoption of modern technologies, enhancing affordability and access to quality agricultural inputs, and improving their linkages to the input and output markets should be accorded top priority.

My lecture will focus on the following topics:

Breeding multiple stress-tolerant improved maize varieties for the tropics

Accelerating improved varietal development using modern tools/technologies

Deploying climate-resilient maize varieties through public-private partnerships

Protecting agri-food systems from devastating pathogens and insect-pests

WEATHER MONITORING NETWORK AND DATA INFORMATION FOR PRECISION AGRICULTURE IN KARNATAKA STATE

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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 precession 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 dedicated to monitoring of real near time weather conditions and weather forecast with the IoT makes it possible for farmers to retrieve the specific weather related information for their various needs.

Keywords words: Precision Agriculture, Weather Monitoring Network, IoT Genome editing for improvement of Abiotic Stress Tolerance in rice

GENOME EDITING FOR IMPROVEMENT OF ABIOTIC STRESS TOLERANCE IN RICE

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Rice, the principal food crop that feeds more than 60% population in India, is highly sensitive to abiotic stresses and uses more than 50% of the water used by field crops. Genetic improvement in yield, water use efficiency, and drought and salt tolerance are critical for sustainable food security in the climate change scenario. Therefore, identification of genes and genetic improvement of stress tolerance is imperative for sustainable rice production. Several genes from rice have been functionally validated by using EMS mutants and transgenics. Often, many of these desirable alleles are not available *indica* rice which is mainly cultivated, and where available, introgression of these alleles into elite cultivars is a time and labour intensive process, in addition to the potential introgression of non-desirable genes due to linkage. CRISPR-Cas technology helps development of elite cultivars with desirable alleles by precision gene editing.

Our lab is focusing on gene editing in rice for gene function validation and development of rice genotypes with improved yield and abiotic stress tolerance. Rice genes *DROUGHT AND SALT TOLERANCE* (*DST*), Clade A *PROTEIN PHOSPHATASE 2Cs* (*PP2Cs*), *FARNESYL TRANSFERASE* (*FTA*), and *PHYTOMELATONIN RECEPTOR 1* (*PMTR1*) are edited in rice.

To improve the yield and abiotic stress tolerance of rice, *DROUGHT AND SALT TOLERANCE* (*DST*) gene was selected for genome editing of mega rice variety MTU1010 by using CRISPR-Cas9 SDN1 approach. To edit *OsDST* gene, Two SgRNAs were designed to mutate *DST* at two different target sites. These SgRNAs were cloned individually in pSgR-Cas9-Os vector and then pyramided in pCAMBIA1300 vector. Mature embryogenic calli derived from MTU1010 was transformed with *Agrobacterium* mediated genetic transformation. Hygromycin resistant T_0 transgenic lines were confirmed by PCR using Cas9 specific primers. The target region of *DST* was PCR amplified from T_0 plants, sequenced and sequences with degenerate chromatograms were analyzed by using DSDecode. T_0 lines with single base substitutions, one to two base pairs deletions and homozygous, heterozygous and biallelic mutations of DST were obtained.

Homozygous mutants of five different alleles of *DST* gene were obtained in T1 generation. Four different mutant alleles of *dst* produced leaves with broader width and reduced stomatal density, and thus enhanced leaf water retention under dehydration stress. Our study showed that the reduction in stomatal density in loss of function mutants of *dst* is, at least, in part due to downregulation of stomatal developmental genes *SPCH1*, *MUTE* and *ICE1*. Analysis of drought and salt tolerance of homozygous *dst* mutant at vegetative stage in pot culture under greenhouse conditions revealed that these mutants exhibited tolerance to drought and salt tolerance and also enhanced yield. Further, these mutants showed >20% yield enhancement over wildtype plants under field conditions in a transgenic net house. The genome edited foreign gene free mutants of *DST* developed in this study will be useful to release as variety and as a genetic stock for introgression of *dst* mutations in other indica varieties for genetic improvement in yield and climate resilience.

APEDA's ROLE AND INITIATIVES TO PROMOTE EXPORTS

Shri. R. Ravindra

Regional Head, APEDA, Bengaluru

APEDA is a Government of India organization under the **Ministry of Commerce & Industries** established under parliament Act 1986. APEDA has a Head office in **New Delhi** and 12 Regional Offices across the country. APEDA's Mandate is Promotion of APEDA scheduled products through various Financial Assistance Schemes. Creation & Development of infrastructure through Govt. Agencies as well as Private Entrepreneur. Market Access, Market development and promotion. Financial Assistance to Registered exporters. Capacity building through training, R&D and Packaging Standards Development. **Government of India APEDA's Initiatives** are Cluster Development, Country-specific strategy, Virtual buyer-seller meets, Virtual trade fair (VTF), Focus on new Products, Farmer connect portal etc. **Potential Products for Exports from Karnataka** are Minor Millets/value added millets, Value added peanut, Ready-to-eat Boiled vegetables, pulses/sweet corn and Organic products etc. **Financial Assistance scheme (FAS) of APEDA and Common Infrastructure created in Karnataka under APEDA assistance. Traceability systems Implemented by APEDA for the benefits of Exporters.**

MAIZE RESILIENCE TO DROUGHT AND HEAT STRESSES AT DIFFERENT GROWTH STAGES

Raju Bheemanahalli

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Drought and heat stresses are the major abiotic stress factors detrimental to crop production across the globe. With projections of increasing frequency and severity of these events, studying the underlying mechanisms and plant responses is critical for improving food production. However, little is known about the maize responses to combined stressors and varied resource supply. One of the significant factors associated with higher yield potential is early vigor at the vegetative stage and successful reproduction at the reproductive stage. Multiple experiments were conducted to investigate the morpho-physiological and yield responses to stresses using classical physiological and remote sensing methods. To understand the impacts of soil moisture content on maize, functional relationships were developed between soil moisture content and growth traits at different growth stages. Our finding at the reproductive stage indicated that drought and combined drought and heat stress could affect the same physiological processes, such as stomatal conductance, leading to yield reduction. At the same time, stomatal conductance displayed an opposite response between heat and drought or combined stress. Our finding implied that pollen is not the only factor related to reproductive success and seed set in maize. Overall, the responses of maize to interactive stresses are predominantly regulated by drought stress followed by heat stress at the reproductive stage. Knowledge generated towards understanding stress impacts at different growth stages and thoughts on improving yield potential under a sustainable cropping system will be discussed.

Session - II

PERFORMANCE EVALUATION OF IOT BASED AUTOMATIC DRIP IRRIGATION SYSTEM

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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.

Kaywords: Drip, IoT, Irrigation, Sensor, IDE software

''AGRICULTURAL REVOLUTIONARY TIMES''

Sangeeta Bojappa
Chief-Farmeress

''Agricultural Revolutionary Times'' requires Timely interventions through technology, up skilling and maximising our efforts with sustainable inputs and Goals. Currently, More than 27% of the global workforce is employed in Agriculture to meet the expecta tion of a 9.7 billion population reach by 2050. India, Alone has 152 million people working in the Agriculture Sector. Futuristic Agricultural Interventions will be by AI (Artificial Intelligence) and IOT (Internet of things), which work towards growing more food reducing cost and Time. Agri-tech Market potential in INDIA is expected to reach $24 to 35 billion valuation by 2025. Agri-tech is creating new jobs, with many start ups attracting a lot of talent and companies offering diverse career options to bridge the gap between farmers and technology. Sustainable goals in Technology which reaches the common farmer should be applicable/practical/cost-effective will sustain. Sustainable goals in education, should be focused in bridging the gap for employable skill sets, which are critical need for industry academia collaboration'' Sustainable Dimensions positive impacts should be in tangent and maximised with environmental, economic and social aspects of our lives.

Session - III

FOOD AND NUTRITIONAL SECURITY: SUSTAINABLE AQUACULTURE AND FISHERIES MANAGEMENT

Dr. Binay Kumar Chakraborty
Researcher and Consultant
Former P. Director, Department of Fisheries, Bangladesh &
Supervisor, Bangladesh Agricultural University

Food security is the main key to develop the socioeconomic status in any nation of the country to recover malnutrition. Fisheries contribute a significant amount of animal protein to the diets of people worldwide. The aquatic animals are the highly nutritious and cheapest protein sources, by providing essential vitamins, proteins, micronutrients, and minerals, for the human being. Aquaculture is playing a vital role in national economic development, and global food supply of Bangladesh.Aquatic resources of Bangladesh belongs to a. Inland Open Water (Capture) include River and Estuary , Sundarbans, floodplains, Beel, and Kaptai Lake, b. Inland Close water (Culture) include Pond (Integrated fish farming), Seasonal cultured waterbody (Paddy field/Floodplain and Boropit), Baor, Shrimp, Prawn and crab farm, Pen culture and Cage culture

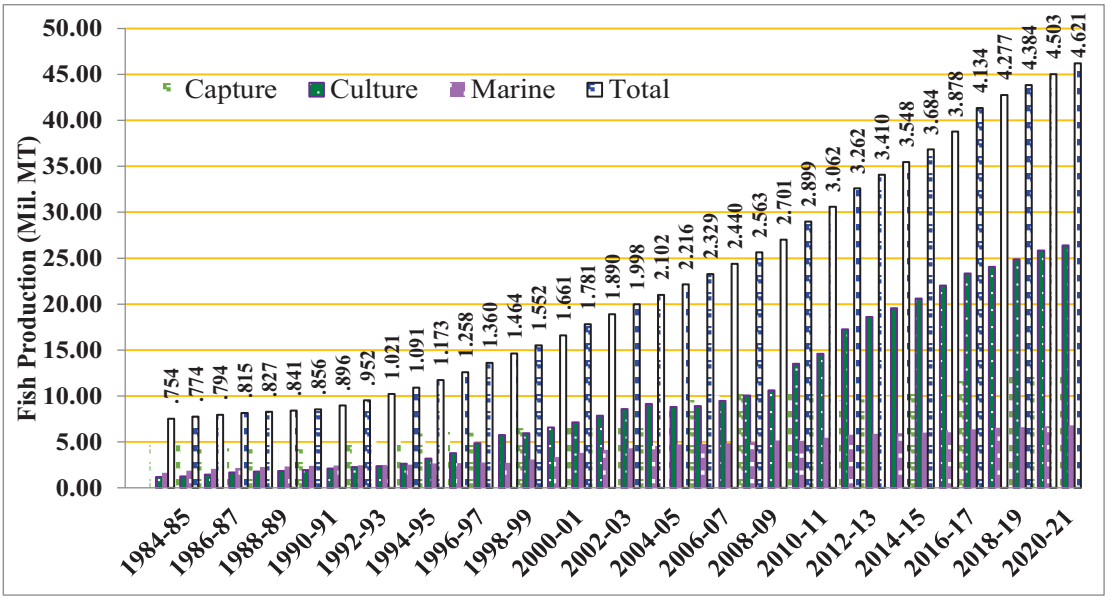

Fig.1: Fish production increased about six times more 0.754 mil.mt in 1984-85 to 4.621 mil.mt in 2020-21 during last 38 years.

Marine Fisheries includes Industrial and Artisanal. Data and information sources are used from the direct interview with individual, publication of the Department of Fisheries (DoF), internet and related non-published grey literature. Fisheries sector contributes 3.57% to the national GDP, 26.50% to the agricultural GDP and more than 2.0% to the total export earnings. The target of fish production was crossed by producing 4.621mil.mt in 2020 21, whereas, inland culture fisheries contribute 57.10% to total fish production (Fig.1). The fisheries sector has been contributing about 60% animal proteins, and minerals in daily

dietary requirement and also supporting social and economic of fish-dependent communities. Bangladesh is enriched aquatic diversity, comprising almost 260 freshwater fish species and 740 marine water fish species with other aquatic lives. Presently, the aquaculture and fisheries is faced with challenges posed by numerous natural and anthropogenic causes by climate change, natural disaster, environmental pollution, industrialization, overfishing, using destructive fishing gears, pesticide and agrochemicals. So, the technologies of sustainable aquaculture and biological management are to be developed for aquaculture and open water management to restrict the declination of resources and enhance production for recovering malnutrition.

Key words: Animal protein, Food security, Global economy, Malnutrition, Ecosystem, Aquaculture, Fisheries management, Production and Livelihood.

ADVANCES IN AQUACULTURE RESEARCH TOWARDS FOOD AND NUTRITIONAL SECURITY

K Riji John and M Rosalind George

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The demand for quality food is increasing constantly in the world proportional to the increase in human population. The concept of food has now changed from mere poverty alleviation to its nutritional quality due to the current eating habits and better understanding of the health concerns. In this context, aquaculture has received special attention due to the fact that foods prepared from fish and other aquatic animals and plants were considered nutritionally superior and healthier. Fish is a low-fat high-quality protein with ample amount of omega-3 fatty acids and vitamins such as D and B2 (riboflavin). In addition, fish is a rich source of calcium and phosphorus and a great source of minerals, such as iron, zinc, iodine, magnesium, and potassium. It is estimated that aquaculture now supplies more than half of the world's fish for human consumption. During the last two decades, aquaculture has grown phenomenally well registering an average growth rate of around 6% per annum. While there has been an increased pressure on the water resources for aquaculture, the practices evolved for better aquaculture productivity has further streamlined and refined the technology of farming aquatic species with lesser quantity of water and increased productivity. Uncontrolled and unscientific expansion of aquaculture had resulted in several detrimental effects through habitat destruction, environmental pollution through application of harmful chemicals and veterinary drugs that causes build-up of antimicrobial resistance, ecosystem damage due to the impact of escapees and undesirable dependence on the fish meal and fish oil for fed-aquaculture. Sustainability of the enterprise environmentally, economically and societally has now come to the fore especially after the UN resolution on the sustainable development goals.

According to FAO statistics, world fish production has reached 179 million tonnes in 2018, with aquaculture fish production at 82.1 million tonnes, 32.4 million tonnes of aquatic algae and 26 000 tonnes of ornamental seashells and pearls, bringing the total to an all-time high of 114.5 million tonnes valued at a total of 250 billion USD. The contribution of world aquaculture to global fish production reached 46.0 percent in 2018, up from 25.7 percent in 2000. In 2018, finfish dominated in aquaculture by contributing to 54.3 million tonnes (USD 139.7 billion) with share of 47 million tonnes from inland aquaculture (USD 104.3 billion) and 7.3 million tonnes (USD 35.4 billion) from marine and coastal aquaculture.

Improved techniques through perpetual research advances in fish and shellfish farming through biofloc aquaculture, recirculatory aquaculture systems, well developed cage culture technology, intensive and efficient in house aquaculture production systems, nutritionally balanced species specific diets, scientifically standardised seed production technologies, sophisticated yet rugged instrumentation and application of artificial intelligence in water quality management, control of microbial population through probiotics and bioremediators,

improved biosecurity measures, better health management practices by stimulating trained immunity through vaccination techniques and innate immunity by application of immunostimulants, innovative system management protocolslike zero water exchange, well designed effluent treatment systems, computer aided underwater observation and individualised intervention measures, species diversification to high value species, genetic improvement of the cultured species, constant surveillance of the aquaculture systems are many of the several measures aimed at increasing aquaculture production from the shrinking water resources by effective scientific management approaches.

Advancement of aquaculture research has improved all those biotic and abiotic inputs directly or indirectly associated with the farming practices taking into consideration of the recycling of generated wastes by integrated multi tropic aquaculture (IMTA), aquaponics, prudent use of coastal oceanic resources, social engineering of stakeholders involved in the sector and supporting background infrastructure development. Responsible fisheries have been the highlight of the current decade with growing concerns in stagnating capture fisheries production and climate change associated water quality degradations through ocean acidification, coastal erosions, flooding of inland water bodies and unpredictable weather alterations, all leading to unforeseen economic losses. Increasing awareness has been the key for creating responsibility in the utilisation of public water bodies, where every user, farmer or entrepreneur need to be taught the significance of environmental protection, ecosystem approach, especially controlled use of drugs and chemicals and economic prosperity for sustainability.

Associated with aquaculture is the necessity of post-harvest management of the fish and fishery products. Being one of the very easily perishable commodities, the fish and shellfish products need to be maintained with utmost care in terms of unbroken cold chain, immediate utilisation of the harvest for value added product development for increasing the income of the farmers. Waste valorisation and a no-waste policy on every single fish is being advocated currently the world over as the smaller fishes, which usually get discarded is considered as the wholesome food for those especially in the developing world where nutritional inequalities exist. While several regulations are enacted by different governments in this direction, a sustained people centric approach need to be evolved so that the results of dedicated efforts of scientists, researchers and academia do not go futile but would lead to the increased quality fish and shellfish production for the food and nutritional security of the masses.

IMPACT OF BLUE REVOLUTION ON FOOD SECURITY

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Food security ensures a healthy food for all and to achieve this, four different dimensions such as availability, accessibility, utilization and stability of food should be critically addressed. In spite of exhaustive efforts undertaken by various global organizations, according to FAO (2022) almost 828 million people globally affected by hunger. This situation would be further worsened by the growing challenges such as rising consumer food price, supply chain disruption due to COVID 19 and war, and severe extreme climate events. Asia will be the most food unsecured region (489 million) due to dense population. In terms of food production sector, India is leading in the production of milk, wheat, sugarcane, groundnut, vegetables, fruit, spices, plantation crops, pulses, live stocks and fish. Still India fights with the issues like undernourishment, stunted children growth, life style diseases and anemia in pregnant women and children. About 974 million people in India are unable to afford a healthy diet which costs about Rs. 230/day/person (FAO 2022).

Blue revolution in India is believed to be a hope of ray for achieving the food and nutritional security in a very sustainable way. Blue revolution aims to rapidly increase the production of fish and marine product through a package program offered by government. Blue revolution or Neel Kranti mission in India started in the 1960 and established a dual economy in India (artisanal fishers and mechanized boat fishers). Blue revolution 2.0 (2016 2020) has been implemented to fully tap the fish production potential, to transform the fisheries into a modern industry, to double the producer income and to triple the export earnings. Because of blue revolution actions, the fish production increased to 14.15 MMT and export earnings reached to 46662 crores. Blue revolution of India offered a large production of nutritious and high quality foods. However, blue revolution is expected to adversely affect the environment if the aquaculture practices employed in an uncontrolled way. Therefore strict regulations and policy frameworks for implementation are mandatory for achieving the sustainable blue revolution. Some of the strategies proposed to enhance the blue food production are- indigenous seed production to ensure self-sufficiency; infrastructure and technological development; enhancing the mariculture; developing genetically improved breeds; addressing quality and safety issues associated with blue food.

In India, fish consumption and associated health benefits needs a nationwide campaign so that the domestic fish consumption could be further enhanced. Initiatives like providing fish in school mid- day meal program and rural child care centers (Anganwadis) would greatly strengthen the food and nutritional security of India. Blue revolution in India has increased the fish production. Most of the fishes are affordable and accessible. Aquatic foods are highly nutritious and possess the human health value. Aquatic food production system is a sustainable option for long term supply of foods. Therefore, the four dimensions of food security could be well addressed by blue food production. The stakeholders who are associated with the fisheries sector directly and indirectly have to work towards achieving efficient, inclusive resilient and sustainable aquatic food systems.

‘SMART’ INTERVENTIONS FOR SUSTAINABLE FISHERIES AND AQUACULTURE DEVELOPMENT TOWARDS FOOD AND NUTRITIONAL SECURITY

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Globally, fisheries and aquaculture contribute a significant role in rural development through food and nutritional security, poverty alleviation, economic development, employment, and livelihood support among rural people. Aquaculture contributes more than 45 percent of global fish food consumption and is the fastest growing food producing sector. The annual growth rate for aquaculture is 8-10 percent compared to 3 percent for livestock and 1.6 percent for capture fisheries. Hand in hand, the global trade in fish and fishery products is expanding day by day. Further, the aquaculture is a very fast-growing sector among the agriculture and highly diverse in terms of species (230 spp.) cultured, culture systems; culture environment; type of operation and scale; the intensity of practice; and type of management. Every year, thousands of fish farmers face innumerable losses, related to unforeseen factors, management and operational errors or technical failures.

The development of effective fish farming projects/ideas requires technological input which refers to a wide variety of subjects and fields. Aquaculture technology does not refer merely to knowing ‘how to grow the fish in the tank’. The intention is to design and construct a sustainable and profitable venture, which will remain in operation over the years. Globally, technological innovations are showing a positive impact on aquaculture diversification success, investment potential, and international technology exchange. Biotechnology is a useful tool in developing disease-free strains of fish seed, highly nutritive fish feed and so on. Newer innovations in culture system designs are paving way for tremendous growth in production in the future.

1. Constraints to Development of Fishery & Aquaculture Sector

There are several constraints to the development of the fishery sector in India. These are categorized as ‘support system constraints’, ‘infrastructural constraints’, ‘financial and technical constraint’, ‘societal constraints’, and ‘Extension constrains’. However, some of the major constraints are as follows:

- The inflow of organo chlorine pesticides and chemical fertilizers used in the agriculture practice in and around the lakes, rivers, ponds, beels, etc. has resulted in the decline of natural stocks of several species of fish.
- Overexploitation and indiscriminate fishing are also the causes of poor fish production.

- The fast growth of aquatic weeds like water hyacinth and other weeds in most of the water bodies and heavy siltation year after year have destroyed the ecology and affected fish production to a great extent.
- Poisoning and poaching, a common problem faced by the farmers.
- Lack of good quality fish seeds (fry/fingerlings) of required size and number at the time of stocking.
- The high cost of inputs like feed, fertilizer, and medicine.
- Lack of a reliable database relating to aquatic and fisheries resources.
- The weak multi-disciplinary approach in fisheries and aquaculture.
- Inadequate attention to the environmental, economic, social and gender issues in fisheries and aquaculture,
- Inadequate HRD and specialized manpower in different disciplines.
- Weak linkages between research and development machinery as well as weak marketing and extension network.
- Poor technology transfer and anthropogenic interventions resulting in loss of biodiversity and the decline in fish catch.
- Age old techniques of production.
- Clandestine introduction and spread of exotic fish species.
- Lack of proper facilities to tackle the issues related to aquatic animal health problems.
- Contamination of indigenous fish germplasm resources, and so on.

2. 'SMART' Interventions for Fisheries and Aquaculture Development

SMART aquaculture management requires-

- Highly qualified staff,
- Strong technological investment, and
- Reliable control of several environment uncertainties.

SMART Farming-

- Not an option, but a must!

2.1 What is 'SMART' Interventions?

Interventions should be smart enough to address the issues for doubling the farmers' income by 2022 as well as overall sustainable development and self-sufficiency of the sector. 'SMART' means, S= Specific, M= Measurable, A= Attainable/Achievable, R= Relevant, and T= Timely which are explained below:

Specific

- Define the goal as much as possible with no nuclear language
- **WHO** is involved, **WHAT** do I want to accomplish, **WHERE** will it be done, **WHY** am I doing this- reasons, purpose, **WHICH** constraints and /or requirements do I have?

Measurable

- Can you track the progress and measure the outcome?
- How much, how many, how will I know, when my goal is accomplished?

Attainable/ achievable

- Is the goal reasonable enough to be accomplished? How so?
- Make sure the goal is not out or reach or below standard performance.

Relevant

- Is the goal worthwhile and will it meet your needs?
- Is each goal consistent with the other goals you have established and fits with your immediate and long-term plans?

Timely

- Your objective should include a time limit. Ex: I will complete this step by month/ day/ year.
- I will establish a sense of urgency and prompt you to have better time management.

2.2 Strategic 'Smart Interventions'

As fish forms one of the essential food items of the majority of the people in the state, it is the responsibility of the state Govt. to meet the demand of the fish. So, for achieving the estimated requirement, it has become inevitable to develop and expand the culture activities properly in all the available fishery resources and to ensure effective exploitation with proper monitoring. Further, geophysical conditions limit the horizontal expansion of cultivable land and water bodies.

Therefore, this is only possible through the formulation of the following **short, medium- and long-term strategic smart interventions** for overall development in the present fisheries and aquaculture scenario of the state:

2.1.1 Short-term smart interventions

1. **Implementation of Women-led Aquafarming Projects**: There are huge work opportunities for women in aquaculture for increasing fish production. The objectives of the project to start the homestead farms, then identifying specific problems such as the selection of species that can grow well in shaded ponds. With the ponds close to the home, women can easily access these resources, have a say over their use and take on roles like fish feeding, monitoring growth rates, regular harvesting for consumption and demonstrating techniques to others in the community.
2. **Horizontal Expansion of Composite Fish Culture Farms**: Spread of six species Carp culture (3-5 tonnes/ ha/ year) with the inclusion of appropriate high value fishes like Pengba (*Osteobrama belangeri*), Pabda, Prawn, Chital, Sarputhi, Japanese puthi, Magur, Singhi, Koi, etc. of local demand.

3. **Adoption of Climate-Smart Integrated Farming System (IFS) Models:** Location-specific climate-smart integrated fish-based farming system models must be practiced to sustain the farm income as well as doubling the farm income by 2022 and which will also provide necessary household nutritional security. This approach involving synergic blending of crops, horticulture, dairy, fisheries, poultry, etc. (A2, A3, A4 or A5 model= Agriculture, Aquaculture, Animal Husbandry, Agroforestry, Apiculture) seems viable option to provide regular income and at site employment to small landholder, decreasing cultivation cost through multiple use of resources and providing much needed resilience for predicted climate change scenario.

4. **Implementation of Integrated Fish Farming and Irrigation (IFFI) Process**: Now-a-days, IFFI process is one of the best sustainable and profitable holistic eeo farming system options for the overall societal development.

5. **Adoption of Good Management Practices (GMPs)** for all types of culture, breeding operations, post-harvest management, value addition, etc.

6. **Establishment of Fish Health Care Centre, Soil-Water Analysis Laboratory, Advisory Service Centre etc.:** To help the farmers about fish health and screening of 'Specific Pathogen Free' (SPF) brood stocks through 'Aquatic Quarantine' facilities, soil, and water analysis-based fish culture and provide a support system as advisory services. This centre will help in monitoring and surveillance of aquatic animal diseases including transboundary diseases in the state and their appropriate control measures.

7. **Community-based Organization (CBO) among the Fishers:** Adoption of other management issues like community-based co-management practices in fish farming can improve the present scenario of composite carp culture and other practices.

8. **Development of Commercial Venture on Fish Culture:** Taking up of private fishery/aquaculture on the commercial line should be encouraged. Of late, people have shown a lot of interest in fish farming in the backyard of the homestead. Given the necessary infrastructure, the fishery would turn out to be a very profitable business since there is a market for the product.

9. **Revamping of FFDAs and involvement of Cooperative Societies and Self-Help Groups (SHGs) and ensuring the Socio-economic welfare of fisherfolk**.

10. **Opportunities for air-breathing fish (Magur, Singhi, Koi, Channa, Eel etc.) culture in wetlands.**

11. **Introduction of genetically improved carp** (*Jayanti* Rohu, Amur carp) for Sustainable Aquaculture Production.

12. **The Popularization of 'Periphyton-based Aquaculture System'** for increasing per unit production.

13. **Production of Fish Seed** specially to meet the demand of private fish farmers should be taken up in each circle headquarters.

14. **Setting up Fish Feed Plant**: The scheme aims at ensuring the target production of fish in intensive and semi-intensive aquaculture programme by providing systematic methods with required quantity of quality fish feeds with fortifications as well as medications.
15. **Open Water Ranching:** The rivers, reservoirs and other large open water bodies should be adequately stocked with advanced fingerlings or yearlings to augment fish production and conserve valuable fish species.
16. **Strengthening of Extension Mechanism and ICT Application:** For organizing effective training and demonstration programmes for proper dissemination of location-specific technology to the farmers, state fisheries extension functionaries have to be reformed with convergence with other development departments and application ICT in the dissemination of new technology/forecasting etc.
17. **One-Stop Aqua Shop (OAS):** Establishment of 'One-stop Aqua Shop'(OAS) as a single outlet in strategic locations to make available all quality inputs required for fish culture at a reasonable price in time.
18. **Smart Floating Farms**: The concept put forth by 'Smart Floating Farms' is one that encourages and embodies "a highly productive floating ecosystem." The project involves several layers – green energy production facilities will be used to power and maintain hydroponics farms, with waste byproducts from the crops feeding the fish being harvested on the lower levels of the ecosystem. These farms can be located near to many mega- cities or densely populated areas with a physical water access.
19. **Implementation of Modern Aquaculture Systems** such as Recirculatory Aquaculture System (RAS), Biofloc Technology (BT), Periphyton Bicfloc based Aquaculture (PBA), Bottom Cleaning Technology (BCT) and so on.
20. **Proper enforcement of Fisheries Rules for the conservation of resources** .

2.1.2 Medium-term smart interventions

1. **Application of Digital Solution in Fish Culture/ Pond Management Solution/ Aquaculture Solution:** It provides full visibility of aquaculture Value Chain and operation from pond to market, where smallholder farmer plays an important role. Enables Farmer Groups, Aquaculture businesses, Government and Non Government agencies working with smallholder farmers make informed decisions, improve overall operational efficiency and traceability. Aqua solution tracks the value chain at the source, even in remote low bandwidth environments.
2. **Establishment of Organic Fish Farm:** Now-a-days, antibiotics, chemicals, and growth- enhancing hormones are used in fish farms to increase the bulk of fish. Use of these chemicals, as well as ovaprim/ ovatide has adverse effects on the environment and other species. On the other hand, there is high disease incidence due to overcrowding in fish farms. Therefore, to avoid the biosecurity issues, Fisheries scientists suggested aquaculture could also be used as a conservation method by

establishing '**Organic Fish Farm**'. We could use some wild stock for breeding and culture purposes. The caveat is that such fish farms should not use any chemicals.

3. **Development of Entrepreneurship:** Strategies for development of entrepreneurship on pond fish production and ornamental fish production is very much essential in the present-day context.
4. **Popularization of Aquaponics** (Growing-Fish-Plants-Together) **Technology in a Large Scale:** This may be set up as Backward Aquaponics/ Portable Farmers' Aquaponics/ Home Aquaponics System. This will minimize the personal/ family demand of fish supply on regular basis to compensate day to day requirement.
5. **Development of Protected Fish Culture:** Establishment of a protected nursery for assured seed supply. Establishment of low-cost Pen culture and Cage culture in large waterbodies /lake/reservoirs and aquatic plant (weed)-choked lakes.
6. **Conservation Aquaculture in the Flood plain Lakes:** The existing derelict water bodies like beels, swamps, wetlands, lakes, etc. should be cleaned and reclaimed to create an effective area for fish cultivation for enhancing fish production and this would require massive investment as well as community participation.
7. **Production and Propagation of Freshwater Prawn and other Prawns.**
8. **Establishment of Fish Farms in Hill Districts:** Creation of multipurpose water harvesting structures with High-Density Polyethylene (HDPE) lining. It is the most common field fabricated geomembrane material with low initial material cost, durable and excellent chemical resistance. This will fulfil the local demand during the rainy season as well as in dry season.
9. **Documentation of Indigenous Technical Knowledge (ITKs) in Fisheries and Aquaculture.**
10. **Internet of Things (IOT) Technology** IOT technologies have revolutionized fish farming processes using sensor networks to measure values such as pH, temperature, DO and other parameters. Fish farm management can be automated to be easily and remotely monitored from other location saving time and money -making aquaculture operations more efficient and even eco-friendly.
11. **SMART Aquaculture System:** A remote feeding system with smartphones , disease control by Drone technology and use of other IT tools.

2.1.3 Long-term smart interventions

1. **Development of Database on Fisheries:** A serious limitation in the growth of the fishery sector is a very poor database. Efforts should be made so that a detail and reliable data on various parameters on fishery is maintained at the block level.
2. **Molecular Techniques in Aquaculture**: Application of genetic principles to increase production (e.g.: Genetically Improved Farming Tilapia, Amur carp etc.). Development of techniques to produce monosex populations. Further, molecular

techniques also show significant promise for aquaculture application viz., specific pathogen free (SPF) brood stock and seed (Vannamei shrimps etc.) and so on.

3. **Agri-Eco-tourism Farm/ Aqua-Exco-tourism Farm:** This type of ventures with a central focus on fisheries should be encouraged by the Govt. to attract the potential youth by framing sound policies.
4. **Appropriate Policy Intervention** is necessary from respective state governments to impress upon the leaseholder so that they not only exploit the harvest but also maintain and manage the water bodies and rivers.
5. **Establishment of Endemic Ornamental Fish Culture Centres.**
6. **Establishment of Weed Fishes/ Small Fishes (Puti, Moka, Murrels, Eels etc.) Culture Farm.**
7. **Establishment of Culture-based fisheries in pats** (1 tonne/ha/year).
8. **Better Provision of Institutional Credit**.
9. **Marketing Support System**: Marketing support system should be created to attract and encourage young entrepreneurs to start aquaculture venture and on the other hand, it will provide better market price realization.
10. **Conservation of Declining Indigenous Endangered Fish Species:** Some conservation measures of the commercial important endangered species and medium carps etc. should be initiated by the fisheries dept.
11. **Setting up of a hygienic fish market/extension of cold chain facilities with the provision of insulated boxes to fish vendors in the state.**
12. **Development of Cold-water Fisheries in the Hill Districts**: Hill Districts have got the privilege of having numerous rivers, streams, rivulets etc. for the culture of cold water fishes by constructing hatcheries/farms and mini dams wherever necessary.
13. **Development of Reservoir / Canal Fisheries**: The scheme envisages the development of reservoir fisheries and canal for production cum beautification at the interest of the public by adopting scientific management of the reservoirs and canal.
14. **Development of Infrastructure for Preservation and Value Addition of fishes**.
15. **Development of Infrastructure for Transportation and Marketing of fish**.
16. **Establishment of State Fish Aquarium and Museum:** To display the colourful fish amusement and educational interest.

Conclusion

The planners, as well as the implementing agencies and stakeholders, should take note of all these things with all sincerity and dedication for the overall development of the sector in a holistic manner. On the basis of priority and need based, above mentioned short-, medium- and long-term planning flexibly can be decided for implementation. Further, one should do the 'SWOT' analysis before implementing or executing any of the 'smart interventions' as

mentioned above in a particular area/ region in view of sustainability and success of such project.

TILAPIA PRODUCTION IN FLOATING CAGES IN DRC, A SUSTAINABLE INNOVATION FOR YOUNG ENTREPRENEURS

Erick Nunda, PPTC-SK Project Leader, YPARD DR

As an international movement of young professionals for agricultural development, YPARD (Young Professionals for Agricultural Development) empowers young people to take action and connect to food systems. With its goals aligned with those of the Sustainable Development Goals (SDGs), YPARD aims to contribute to the achievement of Goals 1 and 2 (No Poverty and Zero Hunger) in its aquaculture activities in DRC.
In the context of the adoption of new technologies in fish farming, a new opportunity has presented itself to YPARD DRC in the eastern part of the country. This region is strategic for a good fish production because it abounds in huge wetlands with a good number of bays suitable for aquaculture by adopting new technologies for intensive fish farming.

YPARD benefited from the Pilot Project for Tilapia Cage Production (PPTC-SK) of the Fund for the Promotion of Industry (FPI) and the International Institute of Tropical Agriculture (IITA), and expanded its activities in Kivu Lake by installing a 144m³ floating cage at S02°29.851' and E02°51.398'. The PPTC-SK project stems from the deficit of fishery products in the region, which is suffering from a high import rate of these products. In the aquaculture production of Tilapia, YPARD aims to contribute to the availability of fish at local level (using locally produced feed from IITA), to allow the accessibility of a quality product on the market, to favor the employability of young people in aquaculture as well as to contribute to the fight against food and nutritional insecurity in DRC.

In developing countries with abundant aquaculture potential (streams, freshwater, rivers, lakes, etc.), this technology is an undeniable opportunity as it contributes to environmental sustainability (preservation and conservation of marine biodiversity) and the socio-economic sustainability of the population.

Furthermore, this technology requires relevant knowledge in aquaculture and tilapia production, which requires material and technical means to ensure the management and transfer of the related knowledge. With these resources in place, it was easy to capitalize on this technology and ensure its scaling up. As a result, IITA, having provided the technical part of the PPTC-SK project, has trained more than 23 youth entrepreneurial organizations (large and small enterprises) in South Kivu province in the technology of tilapia production in floating cages.

As for the results, the fry produced at the IITA station have been caged on Kivu Lake, which has made a significant environmental contribution to conserving the species present in the lake, limiting illegal fishing and encouraging the multiplication of other fish species at risk of extinction (by illegal fishing in most cases) in Lake Kivu (the case of *Limnotricia miodon* or Sambaza). An improvement in the socio-economic life of the unemployed population (youth)

is observed, since the workforce was only made up of young people. The efficiency of the business (composed of young professionals, grouped into agronomists, hydrobiologists, socio-economists and marker) is characterized by the efficiency of the staff in the field of fish farming by pairs having experimental advances in the fields of intervention of the fish value chain (production, processing – packaging and marketing).

For a better sustainability of tilapia production in cages in South Kivu within YPARD and other groups of young entrepreneurs (VDAY, Vijana Nuru, etc.), it will be necessary to overcome the problems of the lack of equipment for the conservation of the product, as well as the fiscal policy, which constitute the major obstacle to competition on the market.

Finally, the tilapia fish sector, which is very promising in developing countries, requires the adoption of technology that is adequate to the conditions of small-scale farmers in the aquaculture sector. Scaling up and capitalizing on the technology of tilapia cage production requires sufficient knowledge management and transfer for young people in DRC.

Session - IV

TRANSFORMING CROPPING SYSTEMS TO IMPROVE ECOSYSTEM SERVICES AND CLIMATE RESILIENCY

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Increasing climate variability, degrading ecosystem services, and increasing global population are creating a challenging environment for agriculture to ensure nutritional security, while reducing its environmental footprint. Water availability, which is the most important factor limiting crops productivity, is decreasing everywhere. Our focus on a very few crops for food production, increasing extreme precipitation events, shifts and uncertainty of rainfall seasons, narrowing water flow in rivers and streams, withdrawalfoground water in excess of recharge and more importantly our inability to conserve rainfall in situ are all affecting water availability and water efficiency of our production systems. Evidence for climate change is seen everywhere and it will affect sustainability of agricultural systems and food production. More than affecting averages of a location, climate change is going to increase the incidences of extreme events such as heatwaves, droughts, floods, unseasonal freezes, etc. Climate change driven extreme events like hurricanes, floods, blizzards, freezes, insect and disease epidemics are all costing global economy heavily and the cost is gradually increasing. Its effect on crops can be direct like rate of growth and development affected by higher temperature and heatwaves or effect of altered water supply to crops or effect of higher CO2 content or interactions with other environmental parameters (Anon, 2011). Alternatively, they can affect soil by increasing soil temperature, reducing soil water retention and infiltration capacity, decomposition of organic matter and increasing CO2 and other greenhouse gas emission. The current exploitative agriculture involves in eradication of natural vegetation leading to loss of biodiversity, organic matter, soil health, and emission of greenhouse gases (CO_2, CH_4, N_2O, etc), increased wind and water erosion, and excessive use of energy, nutrients and water. In these systems, productivity is gradually decreasing and the changes may be irreversible. On one hand agriculture has to tolerate all problems associated with climate change by developing resilient production systems and on the other it has to reduce greenhouse gas either by sequestering or minimizing emission to mitigate greenhouse problem.

One way to improve climate resiliency of agriculture is to mimic nature and developing cropping systems solutions to improve water cycle efficiency (Seddon et al., 2020). Simple water cycle of agriculture involves rainfall or precipitation as the main input of water. Agriculture practice needs to conserve most of the rainfall in the root zone. In semiarid regions, rainfall quantity is low and intensity is often high. As a result, in spite extremely dry profile, soil is often not ready

to soak in the rainfall. Therefore, we need technologies those improve rainfall conservation and preferably in the entire soil profile. Utilization of that soil moisture depends on crop root system and stress the crop faced. Typically, a crop with a deeper, exploratory root system is considered ideal for yield stabilization in a stressful environment. The efficiency of water extraction depends on the size and activity of the root system. Crop rotations with diverse crop types have significant role in utilizing the soil moisture efficiently (Cutforth et al., 2013). Once the moisture is stored in the soil profile next step is to make most of this moisture is used by crops for transpiration and reduce evaporation losses. Stubble management and well-designed intercropping and crops rotations have potential to improve system water efficiency. Concept like Circular Buffer Strips have the potential to improve both conservation and utilization efficiency of water, while improving multiple ecosystem services in center pivot irrigated agriculture (Angadi et al., 2016). Other technologies like tillage management, crop diversification, and cover cropping have the potential to improve water productivity and system resiliency.

1. Conservation Tillage and Stubble Management:

Typically, no-tillage concept involves leaving residue of previous crop on the surface and planting next crop directly into it. It reduces energy use, time, and labor requirements and it can be economically beneficial. It leaves short standing stubble and most of the residue covers the soil surface and is vulnerable to wind blowing and quick degradation. Cropping systems that increase crop residue return and reduce or eliminate tillage have been found to build SOC and improve crop productivity (Ghimire et al., 2014). Crop residue on the soil surface reduces energy for evaporation, intercepts rain drops and increases infiltration by slowing down runoff. Increasing stubble height (double or treble) and direct seeding into standing stubble further improves system efficiency. Standing stubble alters the microclimate, with the magnitude of the alterations dependent upon stubble height (Cutforth et al., 2006; 2011). Crop yields and water use efficiency were also improved with standing crop stubble. This Canadian study showed that compared to seeding into cultivated stubble, tall (30 cm high) standing stubble improved seed yield of canola, pulse and wheat by about 16, 13, and 12%, respectively, and the average increases in water use efficiency (WUE) are about 11, 16, and 12%, respectively.

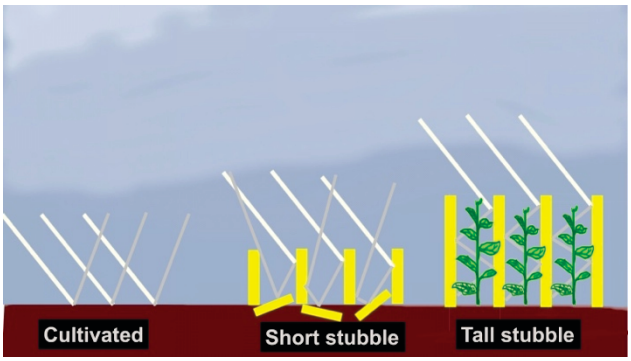
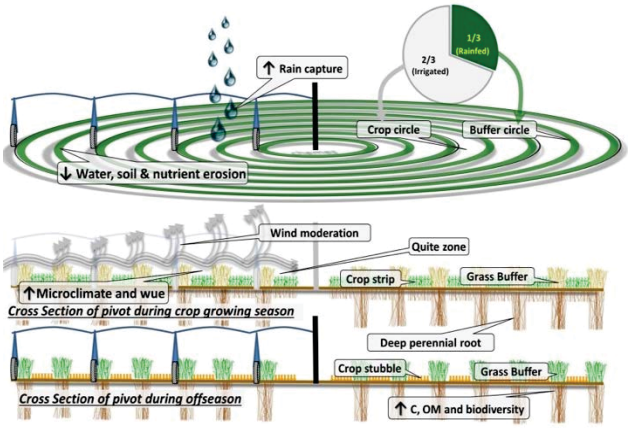


Fig. 1. *Taller stubble improves crop microclimate, resource use efficiency and support early seedling growth much better than short stubble (typical no-till) or cultivated systems*

2. Intercropping or Mixed Cropping

Fig. 2. *Sorghum+legume intercropping can be used to improve above and below ground resources use;*

Typically, growing two or more crops is used as a way to increase productivity and buffer against unfavorable environments in subsistence farming. Rarely, it is assessed to improve resource use. In mechanized agriculture, it is assumed that we cannot use these systems because of harvesting problems.



However, these systems can be used to improve resources use (radiation, water and nutrients) and resource use efficiency of production systems (Umesh et al., 22a,b), while reducing environmental footprints to improve sustainability of agricultural systems. They can be used in wide row spaced forage production (75 to 100 cm; forage maize or sorghum) systems. The success of an intercropping system depends on achieving maximum facilitation and minimum competition, which demands the selection of appropriate crops and/or cultivars as well as management of crops and resources. Once we agree with benefits in principle, we can develop technologies (like developing suitable cultivars, harvesting together and separating with sieves) to work with the system.

3. Circular Buffer Strips of Native Grasses

Circular Buffer Strip (CBS) is a simple concept of using aerodynamic principles to rearrange underutilized portion of a center pivot into circles of buffer strips of tall growing native cool and warm season perennial grass mixtures alternating with crop strips to enhance multiple ecosystem services and improve climate resiliency. Perennial grass strips improve Carbon sequestration by the pivot, while CBS design enhances it further due to improved system efficiency (e.g. better rainfall capture, nutrient retention). Multiple circles of grass strips reduce runoff and improve water quality by filtering sediment and nutrients out of runoff as well as reduce soil erosion by wind. CBS can improve productivity of both corn and perennial grasses through reduced stress (e.g. water, wind, temperature), less crop damage (windblown soil abrasion), and improved resources use efficie(e.g. improved transpiration fraction, reduced input losses). It also improves soil quality (Sk Musfiq-Us- Salehin et al., 2020) (e.g. reduced

Fig. 3. Reintroducing native perennial grasses back into center pivot irrigated agriculture by re-*arranging the unirrigated portion of a partial pivot into circular buffer strips (top). The example here is a partial pivot with 1/3 of the area not irrigated. During the crop growing season (middle) the grass buffer strips offer some benefits. Once the crop is harvested, the grass protects the soil in early spring*

erosion, greenhouse gas emission, improved soil structure, nutrient and organic matter content, infiltration rate, water holding capacity), and biodiversity and wildlife habitat (e.g. pollinators, beneficial insects, birds, etc.) by providing a perennial plant cover (Angadi et al., 2016).

References:

Angadi, S.V, P.H. Gowda, J. Idowu and H.W. Cutforth. 2016. Circles of Live Buffer Strips in Center Pivot Irrigation for Multiple Benefits in the Southern Great Plains and Beyond

Anonymous. 2011.. Position statement on climate change. Working Group Rep. ASA, CSSA, and SSSA, Madison.

Cutforth H.W., Angadi S.V. and McConkey B.G. 2006. Stubble management and microclimate, yield and water use efficiency of canola in the semiarid prairie. Can. J. Plant Sci. 86:99-107.

Cutforth H., B. McConkey, S. Angadi and Judiesch, D. 2011. Extra- tall stubble can increase crop yield in the semiarid. Canadian Journal of Plant Science, 91(4), 783-785.

Cutforth, H. W., Angadi, S. V., McConkey, B. G., Miller, P. R., Ulrich, D., Gulden, R., Volkmar, K. M., Entz, M. H. andBrandt, S. A. 2013. Comparing rooting characteristics and soil water withdrawal patterns of wheat with alternative oilseed and pulse crops grown in the semiarid Canadian prairie. Can. J. Soil Sci. 93: 147_160.

Sk Musfiq-Us- Salehin, R. Ghimire, S. Angadi, O. J. Idowu. 2020. Grass Buffer Strips Improve Soil Health and Mitigate Greenhouse Gas Emissions in Center Pivot Irrigated Cropping Systems. Sustainability 12:6014.

Ghimire, R., J.B. Norton, U. Norton, J.P. Ritten, P.D. Stahl, and J.M. Krall. 2013. Long-term farming systems research in the central High Plains. Renewable Agriculture and Food Systems 28: 183–193.

Seddon N et al. (2020). Global recognition of the importance of nature-based solutions to the impacts of climate change. Global Sustainability 3:1–12. https://doi.org/10.1017/sus.2020.8.

Umesh, M.R., Sangu Angadi, Sultan Begna, and Prasanna Gowda. 2022a. Planting Density and Geometry Effect on Canopy Development, Forage Yield and Nutritive Value of Sorghum and Annual Legumes Intercropping. Sustainability. 14:4517. https://doi.org/10.3390/su14084517.

Umesh, M.R., S.V. Angadi, S. Begna, P. Gowda, L.M. Lauriault, G.R. Hagevoort and Darapuneni. 2022b. Forage cereal-legume Intercropping: Prediction of canopy development and radiation use efficiency. (Accepted in Field Crops Research).

MONITORING AND MODELING APPROACHES TO ASSESS THE IMPACT OF CLIMATE CHANGE ON SUSTAINABLE DEVELOPMENT OF WATER RESOURCES

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Climate Change and anthropogenic activities are two primary drivers that can significantly alter hydrological processes, and thus, can influence water quantity and quality. Although Canada is a water-rich country; spatial variability, seasonal fluctuations, growing population and increasing food demand are some of the factors that are further threating the country's water resources. In recent years, Ontario (a province of Canada) has taken a number of initiatives, including the establishment of an integrated groundwater-surface water monitoring program for climate change detection and extending support to adaptation planning. A number of studies have also been conducted to assess the impact of climate change on hydrologic regimes, including changes in streamflow, precipitation, form of precipitation (snowfall and rainfall), and frost-free days. Further, eutrophication is an ongoing concern, with widespread algal blooms in the Great Lakes, which is the largest group of freshwater lakes in the world and is located in North America. Agricultural watersheds that discharge into the Great Lakes are experiencing water quality issues as well as quantity stress. Watershed modeling tools have been used to investigate nutrient dynamics in surface water, evaluate the impact of agricultural management practices, and to assess the impact of climate change on nutrient losses in agricultural watersheds. The presentation provides a brief overview of some of the past and current efforts focused on sustainable water management and further understanding the impact of climate change.

SUSTAINABILITY – CHOICES OR LIFESTYLE

Ashish Shukla

Enegy System Modeller, Energy System Catapult, Birmigham, United Kingdom; email: ashish.s

According to UN environment programme "Sustainable living means understanding how our lifestyle choices impact the world around us and finding ways for everyone to live better and lighter". It is to note that sustainable lifestyle for the first time appear in the Sustainable Development Goals (4 Education and 12.8 Responsible Consumption). The talk on "Sustainability – Choices or lifestyle" provides insight into how we can percieve and priority the sustainability around us. Considering humans are of the major reasons for climate change sustinable living provide clear pathway for keeping the planet earth habitable for future generation. Some of the main reasons for sustainable livings are i) better air quality ii) conservation of natural resources iii) health and well-being iv) sustained growth v) resource conservation for future generations vi) slows the climate change and viii) helps in sustained economic decelopment.

ENGINEERING THE RHIZOSPHERE THROUGH BIO-PRIMING AND BIOAUGMENTATION: A POTENTIAL STRATEGY FOR SAFEGUARDING THE FRAGILE ECOSYSTEM OF THE INDO-GANGETIC PLAINS

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Managing agrochemicals for crop production always remains a classic challenge for us to maintain the doctrine of sustainability and climate-resilient agriculture that includes sustainbly using existing natural resources to achieve long-term higher productivity and farm incomes under climate variabilities. Intensively cultivated rice-wheat production system without using the organics has a tremendous impact on soil characteristics (physical, chemical, and biological), environmental quality (water, air), input use efficiency, ecosystem biodiversity, and nutritional security. Consequently, crop productivity is found to be either decreasing or stagnating. Rice-wheat cropping system is the major agroecosystem in India feeding millions of people, which is widely practiced in the*Indo- Gangetic Plains*. Microorganisms as key players in the soil system can restore the degraded ecosystems using a variety of mechanisms. Introduction of microbes in seed, soil, and crop through -bio priming and/or bioaugmentationstimulate soil functional stability and can help us in eradicating food scarcity and maintaining sustainability without compromising the ecosystem services. Both -bio priming and bioaugmentation are efficient techniques to utilize bio-agents judiciously for successful crop production by increase in soil carbon stocks, enhancing phytohormones, nutrition status, and stress tolerance levels in plants.

Session - V

ADVANCES IN ETHYLENE MANAGEMENT TO MINIMISE POSTHARVEST LOSSES IN HORTICULTURAL SUPPLY CHAIN TO ENSURE FOOD AND NUTRITIONAL SECURITY

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Food and nutritional security are of prime importance to feed the expanding world population. The horticultural produce significantly contributes to global nutritional security. However, the horticultural fresh produce is highly perishable, and the global postharvest losses range from 30- 44%. Ethylene alone causes 50 % of the total postharvest losses in fresh produce. Ethylene promotes fruit ripening and reduces storage life by promoting senescence and deteriorating quality in fresh horticultural produce. The ethylene-induced postharvest losses can be lessened by managing endogenous ethylene and the exposure of horticultural produce to ethylene will ensure global food and nutritional security. My research group has focused on developing various technologies to mitigate the adverse impact of ethylene during storage and supply chain in fresh horticultural produce. The usage of ethylene biosynthesis inhibitors, antisense gene technology [1-aminocyclopropane-1-carboxylic (ACC) synthase (ACS) and ACC oxidase (ACO)] and overexpression of ACC deaminase have been successful to inhibit ethylene biosynthesis in various horticultural crops. The beneficial effects of technologies involving inhibtion of ethylene biosynthesis are nulified when the horticultural produce is exposed to external ethylene during the supply chain. Genetically modified fruit or vegetables are not accepted by consumers. Cold storage, modified atmosphere packaging and controlled atmosphere storage are used commercially to lessen the adverse effect of ethylene, prolong the storage life, and maintain the quality of fruits and vegetables. The beneficial effects of various ethylene catalytic oxidants (potassium permanganate, ozone, titanium dioxide and film-based packaging containing ethylene scavenger) have been investigated to minimise the adverse effect of ethylene on fresh horticultural produce. The application of ethylene antagonists in the preharvest phase, storage and supply chain has downregulated ethylene production, action, and maintained the quality of fresh horticultural produce. 1 Methylcyclopropene (1-MCP) irreversibly blocks the ethylene receptor sites consequently inhibiting ethylene production and its action. The effectiveness of 1-MCP to block ethylene action depends upon genotypes, concentrations applied, storage conditions and duration. It is very difficult to handle because it is highly unstable at ambient temperature. My research group have discovered new ethylene antagonists including 1H-cyclopropabenzene (BC) and 1H-cyclopropa[b]naphthalene (NC) to inhibit the ethylene action in a similar way to that of 1-MCP. Both compounds are structurally different from 1-MCP and are more stable at room temperature than 1-MCP. The application of different formulations of BC and NC to extend storage life and maintain the quality of horticultural produce will be discussed. In conclusion, effective management of ethylene in the postharvest supply chain will contribute to minimising postharvest losses in fresh horticultural produce ensuring global food and nutritional security.

POST-HARVEST TECHNOLOGY: AGRI -VALUE, SUPPLY CHAIN, BRANDING & POSITIONING FOR SUSTAINABLE PRODUCTION

Jyotsna Kaur Habibullah

Extract

Improve Knowledge and Inputs , calendar of planting to improve soil fertility and give maximum income to farmers

Give low cost methods for organic farming using traditional practices

Maximising yields through traditional methods including bee keeping, growing natural pest repellants

How to maximise the produce that is lost in storms- like raw mangoes before they ripen that fall in unseasonal storms

Maintain the condition of the fruit or vegetable just as picked.No improvement is possible of produce quality after harvest,

Timing your harvest to avoid hot temperatures prevents wilting and spoilage.

Use produce-handling equipment that won't bruise or crush the harvest.

Fast movement of harvest bins from field to packing facility, cold storage where available

Value Addition to products - Millets to millet powdered pancake mix

Low cost eco friendly packaging option

Supply Chain

Tailoring your product so its relevant to the market

Brand Story

Positioning

Marketing

Connecting to your customers

PROGRESS TOWARD SDG 12.3 AND REDUCING FOOD LOSS AND WASTE BY 50% BY 2030

Dr. Lisa Kitinoja
The Postharvest Education Foundation, USA

This presentation will provide background and history of the development of postharvest loss measurements, targets and approaches for reducing global food loss/waste (FLW). While the Sustainable Development Goal 12 and the target of 50% reduction was announced in 2015, to date there have been many issues with obtaining reliable baseline data and with the methods being used to measure and document food loss levels, causes, reduction efforts and outcomes. Several new approaches are currently in development in 2022, and international investments are ramping up in order to achieve the SDG 12.3 FLW goals and targets.

Session - VI

PARTICIPATORY RESEARCH AND EXTENSION ACTIVITIES FOR SUSTAINABLE LIVELIHOOD THROUGH ADVANCES IN ANIMAL HUSBANDRY: EXPERIENCES FROM KARNATAKA STATE, INDIA

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Animal agriculture plays a significant role in the nutritional security of the masses. Indian livestock sector employs 8.8 percent of the population. India holds 535.78 million livestock heads (20th Livestock Census) and is a leading milk producer with 209.96 million tonnes (23 percent of World's milk production). Livestock sector contributes 4.9 percent in the total gross value added (GVA) and 30.13 percent in the agricultural GVA (2020-21 Prov. Est.). India ranks second in fish production with 14.16 million MT per annum. It ranks third in egg and eighth in meat production with 122 billion eggs and 8.8 million MT of meat, respectively. In all the sectors like milk, meat, and eggs, the average annual growth rate is more than 5 percent. Increasing demand for animal protein will positively affect the growth rate further.

In the state of Karnataka, livestock production is emerging as an increasingly important source to further augment incomes of farmers and rural households. Total livestock population in the state is 2.9 crore (Livestock Census, 2019), an increase of 10.5% from 2012. The state ranks 9th in total livestock population but 3rd in sheep, 6th in poultry and 10th in goat population. In 2020-21, the production of eggs in the state was 3067 crore. Similarly, the state ranks 6th in meat production. In Karnataka, agriculture and allied sector contributes about 32 per cent to the state GDP occupying a significant portion in state's economy.

Livestock research and extension activities are delivered by public agencies (AH&VS, KVK, SAU's & SVU's), private agencies (BAIF), Veterinary university, KVKs, Dairy Cooperatives etc. in Karnataka state. These stakeholders have several activities such as the development of cattle, buffalo, piggery, poultry, sheep and goats, besides feed and fodder development, extension and training, implementation of socio-economic programmes etc. However, since animal health care and breeding has been the major focus of these stakeholders, components of livestock extension and capacity building in Karnataka are considerably the weakest links in the overall animal husbandry activities, as like India. In this context, there is a need to undertake livestock based research and extension activities at field conditions for sustainable livelihood through animal husbandry. This study has focused on various participatory research and extension activities undertaken through different projects by different funding agencies and has discussed various strategies for development of animal husbandry sector of Karnataka. Some of the important activities discussed in this paper are based on World Bank funded KWDP-II, Sujala-III project of Government of Karnataka; NAIP Component-III Project of ICAR, New Delhi, Department of Science and Technology. Further, the experience of authors in the areas of conservation and utilization of indigenous breeds, establishment and promotion of rural hatcheries and semen banks, value addition of livestock products etc. needs special emphasis as advancements in animal husbandry.

The greater integration of programmes related to rainfed agriculture and allied activities with innovative and science based approaches at different levels can improve the livelihood of the farming community. The experience of convergence and field level solutions can be applied at a larger scale to improve livestock and fisheries production. A policy shift emphasizing delivery of inputs and regular follow-up for carrying out an integrated research and extension approach is very critical to enhance production and productivity.

LIVESTOCK SECTOR – FULFILLING SUSTAINABLE DEVELOPMENT GOALS

Dr. Rameshwar Singh

Bihar Animal Sciences University, Patna

Animals are a resource of great value, as they offer a sense of security to people and they hold them in high esteem. People in developing countries often live in very close contact with animals on their fields and rear them for food and nutrition; livelihood and economic gains. Livestock are directly relevant to most of the Sustainable Development Goals. India has vast livestock resources that provide employment to about 18.8% of the population. Livestock sector contributes 4.11% to the GDP and 25.6% to total Agriculture GDP and the share is growing. In global economy four of the five highest value agricultural products are livestock products i.e. milk, beef, pork and chicken broiler meat). The growing demand for livestock products in developing countries, driven by The growing population, higher incomes and urbanization are propelling the demand for livestock products. This represents a huge opportunity for millions of smallholder livestock farmers in the developing countries to meet that market demand and rise out of poverty. Dairy and backyard poultry are considered important for side income of rural women empowering them towards gender equity. Use of manure as fertiliser reduces the load of chemical fertilisers produced by using fossil fuels. Biomethane is a clean source of energy and it's large scale production can help reduce the power demand and also generation of electric power without using the fossil fuels like coal and petroleum. Improving the efficiency of livestock production in developing countries through better disease control, efficient reproduction, proper nutrition, use of sex-sorted semen and genetic improvement through genomic selection can easily double the productivity per animal, connecting poor farmers to markets, can double the farmers income while significantly reducing the adverse impacts caused to the environment.

GLOBAL CLIMATE CHANGE AND THE ROLE OF DAIRY SECTOR IN A LOW CARBON FUTURE

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Controlling greenhouse gas (GHG) emission following UN climate change protocols is one of the most important challenge facing the dairy sector. Linking dairy production to circular processing is guiding the already beneficial reduction of GHG emission intensity, kg O2 / kg milk. Enhancing carbon capture and storage in soils are to be emphasized for promotion of circular economy to reduce GHG. Anaerobic digestion, precision farming, synthetic fertilizer substitution with organic manure, financial incentives for green milk marketing have been implemented already, but the extent of these actions need to be scaled up for reaching the goal of total carbon neutrality by 2050.

Production of methane, nitrous oxide and carbon di – oxide are to be reduced to a zero net accumulation. India, being in south Asia has been delivering handsome growth in milk production. However, average annual milk yield in kg / animal is one of the lowest in global scenario. Emission intensity in kg CO2 eq. per kg FPCM is also on the higher extent for South Asia. This figure needs to be brought down on par with developed economies. Proper feed and fertilizer management, breeding management and better animal hygiene can achieve the target set.

ADVANCES IN DAIRY & VETERINARY SECTOR TOWARDS SUSTAINABLE DEVELOPMENT GOALS

Sanjeev Kumar

Managing Trustee, The Goat Trust, Uttar Pradesh

With over 535 million Livestock and 851 million poultry largely owned by landless and marginal farmers, Livestock sector provides an opportunity to mitigate poverty, ensure family nutrition, decent work life and generate rural employment on significant scale, which are major SDG goals.

There have been enough evidences of positive correlation between **livestock ownership** and **household nutrition**, women earned income, regular income and livestock diversify, stabilize and enhance income when done in integration of crop farming. Livestock can be a tool for gender empowerment, promoting rural entrepreneurship in livestock value chain and ensure sustainable farming and environment by proper and balance integration between land and livestock use pattern. "One Health concept" further highlights how health of land (soil), livestock, food crops and humans are interrelated and why an integrated approach is critical need of time.

However grass root realities show a different picture and market forces and short sighted approaches has created a significant imbalance between desired and existing state of affair. One of the critical gap in livestock farming system changes in sustainable practices has been weak livestock extension system and gap between lab & land still continuing.

Livestock keepers are largely in difficult agro climatic zone, remote areas, hills, deserts, outskirt of villages and most often low formally educated, aloof from mainstreams and significant pastoralists especially in case of small ruminants and camels.

Five major approach changes experimented by The Goat Trust and its over 100 partners across 18 Indian states has been –

1. Promotion of Pashu Sakhies (Women Livestock Service Provider) as trained livestock extension services provider backed with Televet support services and app based data collection
2. Extending Alternative Insemination (A.I) in goats and setting up Goat/Sheep Kids /Lambs Nursery to conserve and replicate best genes and making it available for further replication
3. Setting up Entrepreneurship based "Livestock Clinics" for worm load testing, blood testing
4. Building fodder markets and hydroponic fodder production and sales
5. Building online markets for high graded livestock to build focus on quality specially in small livestock

Case study – A field assessment study from a tribal dominated Gondia district of Maharashtra has shown annual mortality of goats has been reduced from 27% to 7% within 18 months efforts through Pashu Sakhies by ensuring regular vaccination and deworiming of goats, adoption of 12 improved practices and similar findings has been in Tripura where study sample with 4000 goat farmers has shown drastic reduction in mortality, increase in weight of goats and overall Rs 10000 incremental income to sample farmers within 12 months of implementing Pashu Sakhi model.

In purnea district of Bihar over 500 A.I in goats has been done successfully on fee basis and over 400 kids born in 3 selected villages having 22% higher birth weight and estimated Rs 1500 per improved kids born within 12 months of A.I program implementation.

About Speaker

Academically A graduate from BHU and post graduate from NDRI in Livestock Production and Management has been a social entrepreneur and Ashoka Fellow since 2013. I had been elected as finalist for Social Entrepreneur of The Year 2019 by Swab foundation and Jubiliant Bhartiya Foundation.

Appointed as member of Advisory Committee for Goat & Sheep by a Government of India.

Chronology

2008 – Founding The Goat Trust (www.thegoattrust.org) - A National Resource organization on pro poor small livestock business working in 18 Indian states with over 100 national and international partners and winner of National and international Grand challenges including recent Grand challenge on Vet extension and Market place by Bill & Melinda Gates

2014- Founding www.pashubajaar.com as first formal company N.N breeds & seeds India private Limited in community based goat trading with transparent pricing and IT enabled platform

2016 – Founded TGT Global Development Services PVt Ltd as dedicated training organization in Livestock value chain to work across globe , has been largest training organization around small livestock value chain

2018 – Set up International Institute of Goat Management and launched courses in Livestock business management

2022 – Set up Institute of Livestock Business Management & Research (ILM) at Lucknow by registering a section 8 company Foundation for Incubation in Livestock Entrepreneurship Research (FILER)

Session - VII

Role of Biologicals in Food and Nutritional Security

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Biologicals (biofertilzers, biopesticides, microbial biostimulants) are environmental friendly and have the potential to boost crop yields ve caught the attention of researchers, extension specialists , private enterprises and farmers all over world . Because there are no pesticide residues on crops grown with biological method, they are safe and nutritious. Biofertlizers/Biostimulants based on living microbes and their bioactive compounds have been promoted as alternatives to chemical fertilizers and pesticides that encourage the plant growth However, the lack of efficacy, uneven field performance, short shelf lives and a lack of regulatory guidelines, however, have mostly consigned them to niche markets. B iostimulants still make up a small portion of plant growth regulators, despite significant improvements in market penetration. A unique set of regulation for biostimulants has recently been created by the Indian government. Biostimulant registration are outlined in detail in the notification on "Fertilizer (Inorganic, Organic or Mixed) (Control) Amendment Order 2021", which was published on February 23, 2021. In accordance with the new regulation, biostimulants are substances or microorganism or a combination of both, whose primary function when administered 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, but does not include pesticides or plant growth regulators which are regulated under the Insecticide Act, 1968 . Till date, about 970 microbial based biopesticides products are registered with CIBRC (http://cibrc.nic.in/bpr.doc) under section 9(3B) and 9(3) of the Insecticides Act, 1968 Government of India. CIBRC has registered 568 fungal based products under section 9(3B) provisional. Further under section 9(3), 45 fungal based products are registered.

We have studied the potential of various agriculturally important microbes (*Trichoderma, Bacillus, Pseudomonas*, ar buscular mycorrhizal fungi), to promote plant development and to act as biocontrol agent both in the lab and in the field.

Only when we market and register products based on improved microbial strains will microbial research be productive. To accomplish this, it is necessary to adhere to a number of government of India specified rules.

Biological and Technological Interventions from ICAR-IIHR for safe horticultural produce & nutritional security

Dr. Debi Sharma

Director
ICAR-Indian Institute of Horticultural Research,
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In our effort towards attaining sustainable development goals, horticultural crops play major role especially in attaining nutritional security. Increasing the consumption of vegetables and fruits that are rich sources of vitamins, minerals, dietary fibre, anti oxidants and other beneficial phytochemicals, will help in meeting nutritional requirement of youth, children and women. Crop protection in horticultural crops has evolved over years from dominance of agro-chemicals based management to integrated management inclusive of biological components. The biological interventions developed at ICAR-IIHR have helped in achieving management of major insect pests and diseases of horticultural crops with few agrochemicals to ensure food safety. The important non-chemical technological interventions in managing insect pests are pheromone based insect traps for fruit flies in mango and cucurbits; neem-based products like need seed extract pellets for sucking pests and diamond back moth in crucifers, neem and pongamia soaps for sucking pests in various crops; microbial bioagents like *Metarhizium anisopliae*, *Beauveria bassiana* and *Lecanicillium lecanni* for the management of hoppers in mango and other crops. A hot water treatment development at IIHR for reduction of fruit fly and anthracnose incidence during storage has facilitated the export of Alphoso mangoes to European countries. IIHR has been a pioneer in facilitating the registration of biocontrol agents *Trichoderma* species, *Pseudomonas fluorescens* and *Bacillus subtilis* that help in biological management of soil borne diseases and help in plant growth promotion. The nematode incidence in field and polyhouses have increased over years and IIHR products viz. *Paecilomyces lilacinus* and *Lecanicillium chlamydosporium* (*Pochonia chlamydosporia*) have enabled many farmers to manage this perpetual problem. For the safe production of fruits and vegetables, besides the formulations of these bioagents, plant health products with microbial agents have been developed at IIHR. Arka Microbial Consortium that comprises of three beneficial bacteria is a flag bearer of IIHR technologies and has been well adopted not only in fruit and vegetable crops but also in plantation crops such as coffee and pepper. The residues from chemical pesticide use pose serious health

hazard risk. There are many reports of use of spurious chemicals for the post -harvest treatment of fruits and vegetables. To encounter this problem, the Arka Herbiwash developed at IIHR can help in removing the agrochemicals and human pathogenic bacteria from surface of fruits and vegetables. To achieve the nutritional security, there are many lines of vegetables and fruits developed at IIHR with improved contents of the nutritionally important components. Many vegetable crops viz. beans, tomato, cucurbits and fruit crops like papaya, mango and guava with enhanced carotene or anthocyanin content have been developed. In addition, vegetable varieties with multiple disease resistance have been developed which would require lesser application of chemical pesticides. Iron enriched Elm oyster mushroom as well as vitamin-D enriched mushroom powders (*Hypsizygus ulmarius*) developed at ICAR-IIHR can supplement the nutritional requirement of children, women and elder people and can be included in mid day meal programmes of schools. The various technological interventions thus developed not only help the end-users, but also help in creating IP rights of the Institute and in revenue generation in way of technology transfers. The importance and impact of these biological interventions in obtaining safe horticultural produce and attaining nutritional security are discussed in the presentation.

Agronomic biofortification of micronutrients for food and nutritional security

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Malnutrition globally, the devil of hidden hunger has already gained prime importance after the setting of Millennium Development Goals (MDGs) followed by Sustainable Development Goals (SDGs). The problem of malnutrition is prevalent in every corner of the globe. Worldwide, it has been reported that around 2 billion people are affected by malnutrition (Tulchinsky, 2010). Among them, nearly 850 million individuals experience the ill effects of undernourishment on this planet (UN MDGs, 2006). In low-income countries like Africa and Asia where the estimated risk for micronutrient deficiencies is high for Zn (40%), Se (28%), I (19%), and Fe (5%) (Joy et al. 2014). Malnutrition mainly affects women and younger children in different forms in developing countries. An abysmal estimate of 151 million children under the age of 5 years is reported to be 'stunted' and 51 million falls under the 'wasting' category, that is, no proportionate weight as per the height (Ramadas et al. 2020). It is estimated that nearly 79.1% of India's children between the ages of 3 and 6 years, and 56.2% of married women (15-49 years) are anemic (Krishnaswamy, 2009). Various factors are responsible for malnutrition, but the unavailability of a balanced diet is the prime cause of this evil. The increasing deficiency of micronutrients in soil reduces the essential elements like minerals, and vitamins in food and lead to malnutrition. Micronutrient deficiencies, even mild to moderate ones, can cause serious human health issues, such as impaired metabolic function, decreased immunity, and thus higher susceptibility to infections, growth failure, cognitive impairment, and, eventually, reduced productivity (Tulchinsky, 2010).

Overcome malnutrition and hidden hunger for micronutrients can be tackled by different interventions viz. genetic biofortification, agronomic biofortification, food fortification, and diversity in the diets. In a country like India where people have diversity in their food preferences and also affordability, all these approaches will work. However, Agronomic biofortification, the process of increasing micronutrient content in food crops through agronomic approaches, is seen as an important process to improve the status of desired micronutrient, vitamins, and antioxidants, protein content, etc. to overcome malnutrition in India. It is seen as the quickest, safest, cost-friendly, and moreover complimentary approach to providing iron, zinc, and other micronutrients in our everyday diet. Unlike molecular/genetic approaches, agronomic biofortification is done on existing crops and varieties and hence the product is easily accepted by the consumers. Approaches like integrated nutrient management involving inorganic and organic sources of nutrients , intercropping, mixed cropping, use of microbial inoculations , seed coating, and foliar spray of nutrients, can substantially increase the level of micronutrients, vitamins, protein, folic acid, etc. in our food (Prasad and Shivay, 2020). In the fertilization approach, the foliar application performs better than soil application in terms of grain Fe and Zn enhancement in staple crops like rice, wheat, maize, and chickpea. Again, it requires a lesser amount of fertilizers. Seed priming or coating onto seeds with Zn has not been able to increase Zn concentration in grain significantly in most of the cereal crops except oats. With innovative, pragmatic, and also sufficient research interventions and awareness programs about

agronomic biofortification can serve as a major option to improve the nutritional status of the globe.

References

Joy, E.J.M., Ander, E.L., Young, S.D., Black, C.R., Wattsm M.J., Chilimba, A.D.C, et al. 2014. Dietary mineral supplies in Africa. Physiologia Plantarum. 151:208–229.

Krishnaswamy, K. 2009. The problem and consequences of the double burden-A brief overview. Programme and abstracts. In: Symposium on Nutritional Security for India-Issues and Way Forward. New Delhi: Indian National Science Academy, pp. 5–7.

Prasad, R. and Shivay, Y.S. 2020. Agronomic biofortification of plant foods with minerals, vitamins and metabolites with chemical fertilizers and liming. *Journal of Plant Nutrition* 43(10): 1534–1554. DIO: 10.1080/01904167.2020.1738464.

Ramadas, S., Vellaichamy, S., Ramasundaram, P., Kumar, A. and Singh, S. 2020. Biofortification for enhancing nutritional outcomes and policy imperatives. Elsevier pp. 310–312.

Tulchinsky, T. 2010. Micronutrient deficiency conditions: Global health issues. Public Health Reviews. 32:243–255.

United Nations Millennium Development Goals Report. 2006. Available from: https://www.un.org/zh/ millenniumgoals/pdf/MDGReport2006.

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ICAR Certified Farm Advisor – Forages Accreditation from MANAGE (ICAR) Hyderabad. He Is 48 Years' of Age and Has 26 Years of Rich Experience in Agri. Input Industry and 10 Years of Forage Industry Experience. Mr. Prabhakar is the person who introduced high yield forage crops for animals for improving animal health and milk production. With the intervention, milk production increased significantly among many the dairy farms and farmers got profit from their dairy farms. He Was Part of UPL and Advanta Team for 20 Years. His Tenure in Advanta, Introduced Many High Yield and High Nutritive Forage Products in India and other Global Forage Markets. He Is Guest Lecture in Many Govt. Research Institutes, Universities and Private Companies. Mr. Prabhakar Is the Key Person Behind Commercial Silage Baling Technology Introduction in India Which Is Now Almost 3000 Cr. Business Opportunity.

He Is Well Known Person In Forage Industry As Well As Dairy Industry As Technical Consult. He Promotes Balanced Diet Forage Feeding Which Controls All Expenses and Keeps Animals Healthy. Thus Dairy Industry Can Be Profitable and Small Farmer's Livelihood Secured. India Is Rich Crop Museum Where 365 Days We Can Get Crops with All Essential Nutrients for Fodder Purpose. Objectifying the gaps in Fodder Production, Educating the Dairy Industry Is the Major Activity. Legume and Cereal Fodder Growing as inter Crops Is the Latest trend that team Prabhakar has Taken Up and Motivating the Industry Towards the Goal. This Will Be Benefiting the Farmers and Soil. Mr. Prabhakar Babu Received many Prestigious Awards from Private Seed Industry and Government Research Agencies and Farmer Groups for His Contribution in Introduction of New Generation Crops for Dairy Animals.

Certain key management practices to minimise pesticide residues in food commodities

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In this talk, the current scenario of food safety in India at domestic and international trade will be presented.

There are several challenges in managing food safety in agricultural commodities. The farmers face MRL non-compliances due to the lack of good agricultural practices (GAP) recommendations in many crops. Residue testing facilities are mostly located in major cities only, and hence, it is often not possible to evaluate whether a food consignment is compliant to MRLs. There are lack of awareness of regulatory requirements at the grower levels. And finally, there are lack of product traceability and control on pesticide applications.

For implementation of GAP, it is important to establish product traceability, either at pre-harvest or post-harvest levels. Once product traceability is established at the pre-harvest level, it is important to regulate the usage of pesticides by maintaining the dose recommendations and pre-harvest intervals (PHI). In an ideal package of practice, the applications of pesticides are staggered in such a way that the chemicals with longer PHIs are always applied at early growth stages and the faster degrading pesticides with shorter PHIs are applied at later growth stages. In every case, it is important to ensure that the residues get degraded to below the MRL (and preferably below the limit of quantification) before harvest.
Plot level traceability (at the pre -harvest level) has been established for Indian grapes to regulate residue control in export consignments since 2004. Similar traceability is being developed in many of the fruits and vegetables under Hortinet program of APEDA. In all cases, residue testing, Agmark quality gradation and phytosanitary certification have been comprehensively integrated through active participation of all stakeholders. The major information what a GAP document provides include insect/disease/weed specific recommended pesticides, their application rates, the latest MRLs and PHIs. The GAP recommendations are never successful unless those are validated at a large scale and communicated to farmers. Field level inspections by state horticulture department officials are necessary to implement the GAP recommendations. Location-specific weather advisories help in rationalizing and minimizing the pesticide applications. Besides frequent training programs for stakeholders are necessary to implement safe use of pesticides.

In Maharashtra state, the stakeholders' participation in residue control in various agricultural crops is noteworthy. There are several instances of progressive farming that witness controls on cultivation practices, pesticide applications, formulation testing to avoid spurious materials, and training to develop food safety culture and GAP for small growers. Such programs need to be replicated in other states to ensure food safety in relation to domestic as well as international trade.

Role of Nano Urea in Sustaining Indian Agriculture

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ABSTRACT

Nano Urea hold potential to fulfil plant nitrogen requirement along with imparting sustainability to crop production systems and that too without compromising the crops yield. Indian Farmers Fertilizer Cooperative Limited (IFFCO) the farmers' own fertilizer cooperative has been in the forefront for promotion of agro technologies and novel agri-inputs to mitigate problems faced by the farmers. Nano Urea has indigenously innovated at its Nano Biotechnology Research Centre (NBRC) at Kalol, Gujarat and succeeded in R&D. Independently, Nano Urea, have also been tested for bio efficacy-bio safety-toxicity and environment suitability. IFFCO Nano Urea meet all the current national and international guidelines related to Nano technology or Nano scale agri-inputs. Nano Urea is in sync with

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EVOLUTION OF INDIA'S FOOD SYSTEM SINCE INDEPENDENCE

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Ever since the settled agriculture commenced 12,000 years ago, its primary mandate, rather its moral responsibility has been responding to the food security of the society. Food security can be considered to be in place, when it evolves into a 'Food System', which is defined as "*the complex web of activities involving the production, processing, transport, and consumption of food*".

The topic chosen for the address will examine and, trace the path of evolution of India's agriculture sector since independence and against the background of pre-independence colonial agriculture system through the last 75 years. The focus would be to evaluate the different stages and processes through which India's agricultural sector has graduated to a near-complete food system.

However, it would be seen, that the country is yet to realise the status of fully compliant 'Food System'. The work is still underway, and when this goal is arrived at, it would be able to serve the best interests of the consumers, as also the producers.

Further, the talk would look at other mandates that India's agriculture sector would need to own, so as to upgrade the importance of agriculture the primary economic sector as a creator of gainful jobs and dignified incomes for the farmers. As this dimension is dissected, it would lead to a logical conclusion that the country has to adopt Bio economy as the new basis of industralisation. Agriculture sector in such a case will benefit from a functionally expanded market for its produce. Today, creation of new demand beyond the conventional food market and, in the far-range markets is the need of the hour. Simultaneously, this transformation will need to be achieved by adhering to the principles of ecological health & sustainability.

HUNGER AND FOOD INSECURITY CHALLENGES AND INDICATIVE POLICY INTERVENTIONS.

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"Eradicate extreme poverty and hunger" are the top two of the 17 SDGs and as such hunger and food insecurity have gained significant attention around the world. However, these two goals are intricately linked with one another. In attaining zero hunger, achieving food security and improved nutrition, and promoting sustainable agriculture, there must also be progress on the other SDGs. In this context, the State of Food Security and Nutrition in the World, an annual flagship report jointly prepared by FAO, IFAD, UNICEF, WFP and WHO, becomes highly relevant. The report is to inform on progress towards implementation of SDGs with a core focus on ending hunger, achieving food security and improving nutrition and also to provide an in depth analysis of key challenges for achieving this goal in the context of the 2030 Agenda for Sustainable Development. Highlights of the report indicate that contrary to our expectation that the world would emerge from the Covid 19 pandemic and the food security situation would begin to improve, world hunger rose further in 2021. The prevalence of undernourishment jumped from 8 per cent in 2019 to 9.8 per cent in 2021. Globally, almost 3.1 billion people cannot afford a healthy diet. A recent report prepared by CARE indicates that even when both men and women are technically food insecure, women often bear bigger burdens. Inflation and soaring food prices and political conflicts further threaten access to healthy diets.

We also need to look at who are the worst sufferers and who can contribute to attaining the goal. There is 63 per cent of the people living in the poverty globally work in agriculture, the majority on small farms. There are over five hundred million small-scale farms worldwide growing one-third of the world's food on less than 11 per cent of the world's farmland. Further, global population relies onsmall- scale farms for their food including almost all of the world's 3.2 billion rural including almost all of the people living in developing countries. On the other hand, they have great potential to contribute to achieving food and nutritional security. By producing more diverse crops than big farms they can promote healthier and more nutritious

diets. They also harbour greater biodiversity than larger farms which is crucial for reducing carbon in the atmosphere, as well as for boosting climate resilience.

With the above observations in mind, the following policy recommendations deserve consideration.

- We must transform food systems to provide good food for all and decent livelihoods for the people who grow that food and increase financing to help small-scale producers build climate resilience. With the same public resources but by repurposing and introducing supporting proactive policies governments can improve the availability and affordability of healthy diets. Available evidence suggests that farmers and farm enterprises engaged in diversification have positive impacts in terms of spreading financial, climate change and human risk, increasing product diversity, food security, income stability and employment opportunities, enhancing rural development and improving natural resource management.
- Diversification of food systems and empowering the small scale food farming communities through effective extension services, appropriate technologies and skills need to be considered a top priority public investment to ensure timely progress in attaining the first two SDGs.
- Besides creating a conducive policy environment desired institutional reforms are also a must. Integration of institutions / functional cooperation among various institutions in the food farming/water resources/cooperative sectors to provide wide ranging support to the primary producers.
- Need for integration of aquatic foods in an overall diversified Food System
- Integrate actions to deliver Zero Hunger into national development plans, with targets and indicators for hunger, food security, nutrition, and sustainable agriculture that are ambitious, appropriate to national contexts, and adequately financed.

Session - IX

NEP CREATED OPPORTUNITIES FOR AGRICULTURE UNIVERSITIES TO EARN A PLACE AS ONE OF THE GLOBAL UNIVERSITIES

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National Education Policy launched by Govt of India in 2020, is framed in ways that envisaged permitting all Universities, including Agriculture Universities, an environment of free growth and development to aim for a place of reckoning in the national and global arena. NEP has empowered ICAR as the Professional Standards Setting Body (PSSB) for Agriculture Education in India, that now includes all institutions imparting agriculture education, namely, State Agriculture Universities, ICAR institutes having Academic programs in their subjects, General Govt Universities, both central and state, which have included agriculture education as one of their academic programs, private Universities and colleges involved in agriculture education and research. Following this, ICAR set up a committee which prepared the implementation strategy, which was approved and notified in Sep 2021. As follow up to this ICAR set up 6 th Deans Committee, and it mandated to restructure the ACADEMIC PROGRAMS for AGRICULTURAL EDUCATION as per NEP -NHEQF. Deans Committee is expected to submit its report very soon.

That is going to be the starting point for implementation of NEP in agriculture education, a whole new academic environment is waiting to be unleashed, affording several new opportunities to those institutions who are willing and capable to transform into NEW AGE AGRICULTURAL UNIVERSITIES.

As a key person, who was entrusted with responsibility to lead the teams for preparing both the Implementation Strategy as well as the Academic Programs, I find myself in good position to share key insights into the strategy and restructured academic programs, that we consider as driver of change process aimed by NEP for Agricultural Education.

i. The present institutional structure of agriculture universities is in for change to large multidisciplinary institutions. That means single subject based or few subjects based universities will make way for multidisciplinary universities. Student strength in a university will be minimum 3000 students. That is the lower limit. The upper limit is open and a SAU / CAU can now aim to become as large a University with 20,000 to 50,000 students with as many ACADEMIC PROGRAMS as is possible for it. Globally Universities are considered global/ world class for their number of students, faculty and academic programs. WE WERE CONSTRAINED in this regard. It is for this reason that when the farm universities in India were never allowed, as a matter of policy, to grow themselves to admit large number of students student number in agriculture education is as low as one percentof national figure for higher education enrolled students. You can now think of enlarging your size to become as big as other global universities, is thus a clear message.

ii. Agriculture Universities will have the freedom under NEP regime to admit foreign students in as much numbers as they can accommodate. That is in contrast to the past practice of a few foreign students allotted by ICAR, supported by GOI funding. SAUs /CAUs, particularly can plan big to serve agriculture education needs of African and East Asian countries. That will serve two purposes, one boost university finances as well as academically registering the university in international ranking as one of the, good- better- best, places for agriculture education.

iii. NEP is creating an interestingcategorization of institutions, based on their leading roles; namely A. RESEARCH UNIVERSITIES, B. EDUCATION UNIVERSITIES, C. EDUCATION and RESEARCH UNIVERSITIES (MERU i.e. Model Research and Education University). One can choose to develop excellence in any of the areas and claim its place in that category. Today, most Agriculture Universities essentially fall under RESEARCH and EDUCATION category because of AICRP work linkage with ICAR. However, future will be different, universities will have to make place in research work and outputs that is globally recognized. In future name and fame in research will be earned by the university through high quality research outputs measured by scale of IMPACT FACTOR. Total score of impact factors of all research outputs by all staff of a university divided by total staff in position will determine the research efficiency and quality. Better performance will naturally lead to good global rankings. Therefore, the challenge for universities will be to plan best reshaping strategies w.r.t. staff and students, infrastructure, governance, management and funding.

iv. Upcoming environment of international collaborations, both in academics and research, will be such that Universities will have the freedom of as many international collaborations in academic and academic research as it can accommodate. Such as an international partnership, international campus / college of a foreign university in a particular subject, student exchange programs, degree sand which programs etc, will be possible.

v. More significant, NEP is allowing universities to access donations, private funding from business houses / companies, not common so far. The only source of funding was Govt grants in aid that are in constant decline. It has already made most Universities vulnerable and some are even sick institutions today, not even able to pay salaries of staff and maintain its infrastructure at the level of standards necessary to claim global status of university. Agriculture Universities will thus have new opportunity of widening the network of sources of funding and upscale budgets many fold. Research / product partnerships with agro companies, trained HR as per their need, In campus research laboratories of agriculture companies funded by them or even managed by them but where research is conducted/ planned / governed by university staff and students. Many prominent foreign universities, like Cambridge university and Harvard University, maintain this practice on their campuses.

vi. Academic programs under NEP provide other opportunities to universities. It is about innovations in developing the academic programs. Opportunities at each level are briefly deliberated below;

i) ONE YEAR CERTIFICATE COURSE, Entering first year in the university. It is being designed in such a way that will qualify the UC holder (under graduate certificate

holders) as the one who has gained the necessary practical experience to call himself as skilled HR in a field of his choice. Namely, mushroom farming, bee keeping management, floriculture, nursery development, to name a few among host of agriculture technologies. Here Universities have the freedom to develop their capacities and be the niche leaders for several unique Certificate Courses which only they will be offering. Over the years such universities who take this opportunity seriously, will become leaders and attract students from as many states and countries.

ii) TWO YEAR DIPLOMA COURSE; (U DIP) it is being designed to build the knowledge part of the same subject in which the students have gained practical experience and skills.

Many developing countries as well as inside the country many states, this HR product will fulfil very specific needs of skilled workers. The institutions can aim to be known for producing best quality HR at these levels and for that focus on developing a variety of, off line and on line academic programs, to build a niche in these two academic levels. Many universities will, I fear, take it casually or undermine these two opportunities and thus may not make serious efforts, and that leaves much scopes for the smarter few to capture the opportunity.

A) General Undergraduate Degree, Semester five and six constitute one year of intensive studies to earn a general degree.

B) Undergraduate Degree with Honours/Research. Such students who would opt for higher studies will study through semester seven and eight to receive a graduate degree with specialization. New graduate degree is different from the past degree in the sense that it will be, B.Sc. Hons with specialization. Here the choice for universities is not as much in launching ever new degrees but creating facilities for imparting unique specialization opportunities to students. Smarter farm universities may look at the needs of a state or a country to design and develop specializations, that will serve the purpose at two levels i.e. for specialization at degree level as well as for offering UC and UDIP programs. If customers (companies/countries) demand tailor made training of HR, universities can accommodate these demands under specializations, UC and U Dip programs.

C) While one and two years of Masters programs are designed which will earn the students post graduate degrees. Scopes for sandwich M.Sc. program in collaboration with foreign university or vice versa will be possible.

D) However, it is in Ph D programs where NEP offers universities opportunities to strengthen international research partnerships. In the past universities faced several policy constraints but those limitations have been removed now. Agriculture universities will be treated at par with other universities in terms of seeking / developing international partnership programs focused on academic research and Ph D.

In nut shell, the new academic programs should be seen by the universities as new opportunity for out of box thinking on developing skill development courses and specializations, so as to attract students from across states / nations and build a name in international / national rankings for that academic strength.

To conclude, the bottom line, however, is that even though in ACADEMIC PROGRAMS DESIGN, NEP is offering opportunities for growing as a reputed university of national and international ranking but much depends on how much honesty and sense of purpose is exhibited by the states and Union Govt in implementing NEP recommendations on changes in Governance and management structure, including initial financial assistance.

If the Govts show honesty of purpose in implementing the NEP guidelines for transforming present University Governance structures that will be the key stepping stone to creating the kind of environment universities need today to transform themselves from sick vulnerable institutions into financially healthy, academically vibrant mega institutions required for earning global name. The response to the if, I wonder will be very variable from different Govts, and therefore so will be the FATE OF THE DREAMS OF UNIVERSITIES TO EARN A RESPECTABLE PLACE FOR THEMSELVES IN GLOBAL UNIVERSITY RANKINGS. The universities on their may need to do many things but the first few necessary initial steps are to be taken by the Govts.

There is no harm in making hope, it may happen that India will have some agriculture universities of international repute.

IMPLEMENTATION OF NATIONAL EDUCATION POLICY -2020 IN HIGHER AGRICULTURAL EDUCATION INSTITUTIONS OF INDIA: OPPORTUNITIES AND CHALLENGES

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Agriculture education in India started with the establishment of agriculture colleges and institution in early part of the 20th century. Indian Agricultural Research Institute (IARI) in 1923 started two year Post Graduate Course leading to Diploma of Associateship of IARI (Associate IARI) and offered programme in Agricultural Bacteriology, Agricultural Botany, Agricultural Chemistry, Agronomy, Entomology, Horticulture, Mycology and Sugarcane Breeding. Diploma course was recognized as equivalent to the M.SC. degree of Indian Universities by the Ministry of education in 1949. IARI was granted the status of A Deemed University in 1958. Diploma was discontinued and M.Sc and PhD programme were started. Central College of Agriculture located in thecampus was merged with IARI in 1951. IARI was perhaps the first institution in the country to adopt the course credit system of instruction modeled after the Land Grant College of USA. Efforts to establish the rural universities in India began following the recommendations of Radhakrishnan University Education Commission in 1949. After the visit of an Indo-American team in 1954 process of establishing Rural University in India on the -land grant pattern of USA was initiated. Subsequently UP Agricultural University was established in 1960 by an Act of legislation, which in 1972 was renamed as Govind Ballabh Pant University of Agriculture and Technology by an state Act. As of now agriculture education in many institutes/ universities is at par to the leading universities in the world.

The NEP-2020 emphasizes on ancient education system where large multidisciplinary universities provided quality education in all disciplines to the student of not only India but also to the student of other countries. At the same time NEP-2020 gives due considerations to education system in developed countries where large multidisciplinary universities are providing quality education in all disciplines to their students as well as to the students of other counties. It will not beexaggeration that the universities in many countries at some point of time followed ancient education system of India and many of them are now global leaders in the field of education and research. Ancient Indian literature suggests that Indians had more knowledge about agriculture, agricultural operations and value addition in agricultural produce. It is worth to mention that in USA in 1862, when land grant colleges were instituted there were virtually no persons trained either in agriculture or in the sciences relating to agriculture; and so the colleges, often by trial and error, had to develop their own faculty members, sometimes by recruiting highly skilled farmers. In 20th century till independence the treasure of Indian knowledge either got vitiated or not used properly in India under foreign rule, though it had provided lead to universities in many countries to develop their education system.

NEP-2020 emphasizes on reviving agricultural education with allied disciplines and increasing intake in Higher Agricultural Educational Institutions. As proposed in National Education Policy deemed to be university shall be replaced by 'university' and the Higher Educational Institutions (HEIs) will now be grouped as Research-intensive Universities, Teaching-intensive Universities and Autonomous degree-granting College. This provides a great opportunities to existing universities, deemed to be university and autonomous degree-granting College to transform into multidisciplinary research/teaching universities. In USA, agriculture colleges were instituted in 1862 following the provisions made in Morrill Act. Over the decades with the growing economy demands for education and scientific pursuit grew. As more and more U.S. citizens began to attend college, most land grant colleges of agriculture were transformed into full-fledged universities. In the states like California, Maryland, Minnesota, and Wisconsin, land grant universities are now leading public institutions of higher education and scientific research. In North Carolina, Michigan, and Oregon, higher education and research functions are shared with other prominent public institutions. Most of the land-grant colleges of agriculture established in US under land-grant system in 1860s, focused on agriculture education in the beginning. Now these have been transformed into full-fledged multidisciplinary universities with large number of students. Many land grant universities are now leading public institutions of higher education and scientific research.

Agriculture Educational Institutions in India too need to reorient themselves into multidisciplinary institutions. This will not only help in increasing Gross Enrollment Ratio (GER) but also trained man power in other subjects. NEP has observed that the enrollment in agriculture universities is 1% though they constitute 9% of the total universities. The GER is an indicator of the educational system's ability to enroll students of a specific age range and growth in higher education. GER can be calculated for a geographic region for different level of education, gender, religion, caste etc. It is calculated from the number of students enrolled in a given level of education regardless of age and population of the age group which officially corresponds to the given level of education. GER for higher education is calculated taking 18-23 as age group. GER for higher education in India is 27.1 %.

Multiple entry and exit option envisaged in NEP-2020 can help Higher Agriculture Educational Institutions to widen the scope of education and increase enrollment in Higher Agriculture Educational Institutions. For example, the syllabus of BSc (Ag) could be restructured in such a way that the students are taught the subjects of agriculture, physics, chemistry, mathematics and biologyin first 3 years. In the fourth year they may be taught specialized courses. If they opt for agriculture they need to study the specialized courses in agriculture to obtain BSc (Ag) honours degree after completing four years. If they opt for BSc (ZBC) they need to study specialized courses in zoology, botany and chemistry in the fourth year to obtain B.Sc honours. These will promote greater interactions among basic science and agriculture disciplines. Courses may be restructured and designed in such a way that students can exit with certificate, diploma and 3 years B.Sc without research after 1, 2

and 3 years; respectively as envisaged in NEP- 2020. Similarly, courses of other disciplines may also be restructured.

Modern agriculture requires knowledge of all related disciplines. Use of electronics, robotics, other engineering disciplines, AI/ML, data science and chemical processes in the field of agriculture is increasing day by day. Though many agriculture educational institutions are collaborating with the other institutions which are experts in these fields but many times these collaborations do not give desired results. In house faculty and facilities in a multidisciplinary university for education and research as envisaged in NEP-2020 in these fields will add value to the education and research in agriculture and allied subjects. These would require investment in existing agricultural universities and institutions. NEP -2020 provides opportunities to Higher Agricultural Education Institutions in India to integrate ancient Indian knowledge with emerging and frontier areas. HAEIs can develop a system for imparting knowledge to increase agricultural productivity through better skilled graduates and technicians, innovative research, and market-based extension linked to technologies and practices as envisaged in NEP-2020.

NEP-2020 has brought vocational education under higher education system. HAEIs can now enroll the students in well designed vocational education programme. This will help in increasing GER in higher education. Government of India is giving emphasis on skill development. Proposed National Higher Education Qualification Framework (NHEQF)in sync with the National Skills Qualifications Framework (NSQF) will provide opportunities to HAEIs to integrate the vocational education with higher education to offer a degree/diploma/certificate through well defined norms. Provisions for credit transfer, equivalence, etc. shall be facilitated through the NHEQF. Provision of multiple entry and exit as suggested in NEP-2020 provides opportunities to HAEIs to integrated UG and PG programmes with vocational courses (Diploma and Certificate) in such a way that credits completed by students are reserved in Academic Credit Bank (ACB) and when students rejoin, they can complete remaining credits required for getting degree.

NEP-2020 emphasizes on introducing new and interdisciplinary courses to keep pace with national and global requirements. Courses on Bio -systems Engineering; Systems, Synthetic, and Quantitative Biology and Systems Biology may be initiated in HAEIs/ Multidisciplinary Education and Research Universities (MERU). Bio -systems Engineering integrates engineering science and design with applied biological, environmental and agricultural sciences. HAEIs/ MERU may introduce collaborative programme between the college of Engineering & Technology, College of Agriculture, College of Biological, College of Humanities, Social Sciences & Management Studies focusing on bio environment & health of people and animals, controlled environment agriculture, food security and safety, renewable energy & bioproducts and water. The systems biology is the study of the biological, chemical, and physical processes within living organisms which produce life-supporting behaviours that are not easily reducible to the properties of the individual components. Such course will train students on quantitative, computational, and systems-

level approaches that connect the biochemical and genetic properties of individual macromolecules with the physiological behavior of living cells and tissues. Systems, Synthetic, and Quantitative Biology is a emerging cross-disciplinary subject to study the development of higher level properties of complex biological systems from the interactions among their parts through the fusion of concepts from the disciplines namely biology, computer science, applied mathematics, physics, and engineering.

The great Indian scholars in ancient India made tremendous contributions to world knowledge in diverse fields. Indian culture and philosophy have had a strong influence on the world. National Education Policy-2020 has emphasized not only to nurture and preserve the rich legacies to world heritage for posterity but also to research, enhance, and put to new uses through our education system. Centre for Ancient Indian Knowledge and Ethics (CAIKE) may be initiated in HAEIs impart knowledge on the rich Indian legacies to the all students enrolled HAEIs.

A national level Committee was constituted by the ICAR for developing strategy to implement NEP-2020 in Higher Agricultural Education Institutions (HAEIs) of India. Committee has made recommendations for implementing NEP-2020 in HAEIs of India in the phased manners, which were approved by the Hon'ble Union Minister of Agriculture & Farmers Welfare. The proposed changes in Agricultural Education System include structural changes in the governance of HAEIs, making HAEIs multidisciplinary research-intensive universities/ Institutions (HEis), revision in course curricula, provisions for degrees/diplomas/certificate courses as option under multiple entry and exit system, introduction of Academic Bank of Credit (ABC), collaboration with industry and other provisions as envisaged in NEP-2020.

Implementation of NEP-2020 in HAEIs would require a massive efforts. There would be several challenges in its implementation. Agricultural education and research is placed in the State List and is exclusive responsibility of the States. Though ICAR regulates the agriculture education in the country, implementation of NEP would require consent from each states as agricultural education and research is not in the Concurrent List. Tranformation of existing universities into multidisciplinary would require creation of infrastructure. Enough fund has to be provided to the HAEIs either by the Central Government or by the State Government or by both. A careful planning has to be done for introducing multiple entry and exit option and transfer of credit accrued in ABC. Syllabus of various level courses along with the credit has to be developed in such a way that the multiple entry and exit options for awarding certificate, diploma, bachelor and master degree are smoothly implemented. A foolproof system of "Equivalence" for migration from one HAEI to another has to be developed so that students do not face problem. There could be some issues in implementing NEP-2020 in HAEIs in the beginning but with careful planning and cooperation from the State Governments and stakeholder it can be implemented in phased manner. National Education Policy- 2020 aims to address the Goal 4 (SDG4) of the 2030 Agenda for Sustainable Development, adopted by India in 2015 which to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" by 2030. The NEP-2020 sets

direction to bring the glory back to Higher Educational Institutions once existed in world class institutions of ancient India such as Takshashila, Nalanda,Vikramshilaand Vallabhi which had highest standards of multidisciplinary teaching and research and hosted scholars and students from across the globe.

References

1) Indian Council of Agricultural Research (2021) Implementation Strategy for National Education Policy-2020 in Agricultural Education System. Education Division, Indian Council of Agricultural Research, Krishi Anusandhan Bhavan II, Pusa, New Delhi-110 012. www.icar.gov.in
2) Ministry of Human Resource Development (2020) National Education Policy 2020. Government of India, New Delhi
3) National Research Council (1995) Colleges of Agriculture at the Land Grant Universities: A Profile. A Profile. Washington, DC: The National Academies Press. https://doi.org/10.17226/4980.
4) Indian Agricultural Research Institute (1980) Scientific basis of Indian Agriculture: Seventy Five Years of Service. Indian Agricultural Research Institute, New Delhi.

NATIONAL EDUCATION POLICY FOR INCREASED LITERACY AND CAPACITY BUILDING

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National Education Policy which was rolled in the month of July 2020 has a greater promise for the students in particular and for improvement and development of education system of our country in general. Uniqueness of education policy lies in the fact that after its implementation in totality our every district of country will turn to be knowledge hub as long as there will be institutions with multidisciplinary approach offering different programmes where they could impart instructions to the students in any field of their interest. The policy envisages that all higher education institutions (HEIs) shall aim to be multidisciplinary by 2040. By 2030, there shall be at least one multidisciplinary Higher Education Institute (HEI) in or near every district catering to the needs of students. The policy aims for the Gross Enrolment Ratio in higher education to increase to 50% by 2035. The existing colleges have to choose between two things either they will have to turn into multidisciplinary ones or they shall have to close. The good things about the policy include that it extends the right to education eligibility from 6-14 years to 3- 18 years, filling of teacher vacancies in a time bound manner with a priority to disadvantaged areas and sections of the society, encourages local languages to be the medium of instruction at least up to 5th grade promoting bi-lingual education and textbooks for learning. Policy strongly suggests promotion based on merit and performance rather than on seniority and teaching level. There are also options for vertical mobility of teachers, where high-performing teachers can be promoted to work at a district or state level which is the need of hour and this besides encouraging the teachers will also result in their exponential improvement. In order to provide equitable and quality education to girl students and transgenders the government of India shall constitute a Gender-Inclusion Fund. States shall use this fund to implement the central government's policies for assisting female and transgender students, provisions for toilets and sanitation, conditional cash transfers and bicycles. The fund will enable states to support community-based interventions. The policy suggests establishing school complexes consisting of a secondary school and other schools offering lower grades of education. Such a complex will have greater resource efficiency and more effective functioning, coordination, leadership, governance, and management of schools in a cluster. The details are discussed.

NEW EDUCATION POLICY – THE STUDENTS' PERSPECTIVES

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New Education Policy has replaced the thirty-four-year-old National Policy on Education and creates multiple opportunities by envisioning a broad-based, multi-disciplinary, holistic education with flexible curricula, creative combinations of subjects, integration of vocational education and multiple entries and exit points with appropriate certification. Agriculture contributes a significant part in GDP of India. For this capacity and quality of agriculture and allied disciplines must be improved to increase agricultural productivity through better-skilled graduates and technicians, innovative research, and market-based extension linked to technologies and practices. NEP in Agriculture education will shift towards developing professionals with the ability to understand and use local knowledge, traditional knowledge, and emerging technologies while being cognizant of critical issues such as declining land productivity, climate change, food sufficiency for our growing population, etc. This will be helpful for the person for entrepreneurship. To make NEP more efficient in agriculture education needs to be initiated at the middle level and secondary school which will benefit the students to gain basic knowledge in agriculture at a younger age. Education departments should be initiated in each of the Agricultural universities. After graduation level, students should be encouraged to conduct research on Agro-industry and demand-driven and market linked research should be given more weightage. The need for financial support is very crucial to stay long and give productive output as well as the easy method to receive the same. The New Education Policy (NEP) of India focuses on the internationalisation of education. Post graduate students should be encouraged to an internship during their degree programmes in India and abroad. Moreover, the involvement of youth in policy making and creating a specialized service may also change the scenario of agriculture in the coming years.

SCIENTIFIC TEMPER AND SPIRITUAL PHILOSOPHY IN MAKING THE EDUCATION IN INDIA TO INTERNATIONALIZE & INTERNALIZE AND IN FULFILLMENT OF LEARNERS

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In the 21st century it is needless to talk about the importance of education. However, if one wants to know the power or potential of education then it can be better to understand it in the words of Late Mr. Nelson Mandela where he says, "Education is the most powerful weapon you can use to change the world." The dictionary meaning of education, as per the meaning, is that it is the process of receiving or giving systematic instruction, especially at a school or university. The real purpose of education is to make every human being to be better person in any aspect of life. Despite being so important, we rarely find education as a whole in the manifesto of political parties during elections in India and even if it has found any place in a political manifesto, people very rarely discuss it. Recently, after 34 years, the Government of India introduced the New Educational Policy in July 2020, only the third such policy since independence. Under this policy many new and good things from around the best education systems of the world have been incorporated in Indian contexts. The main purpose of NEP 2020 is to design a vision and framework for school and higher education. It aspires to provide quality education to all which is a sweeping change from the policy on education in 1986, modified in 1992, wherein the focus was on access and equity i.e. to provide education to all including the people from disadvantaged or underprivileged groups. A major emphasis of NEP2020 has been to make the education in India of international standards not only in physical sense but also in qualitative aspects. It talks about following the international practices of early childhood care and organizing olympiads and competitions in various subjects from local to national levels. To ensure widespread participation these will also be made in rural areas and in regional languages. It also discusses adopting the international pedagogical approaches after having a comparative study of the best global pedagogies. Further, it mentions the professional development of teachers to at par with international standards wherein a provision of 50 hours per year of continuous professional development has been there. Some other efforts of giving quality of international standards have been to align the Indian standards of vocational training to the global levels, organization of multiple conferences and workshops by National Educational Technology Forum (NETF) to solicit inputs from national and international stakeholders. It also talks about advancing international research efforts using artificial intelligence so that global challenges in the areas of agriculture, healthcare and climate change can be tackled. Additionally, the document also

discusses restoring some of the ancient Indian approaches adding values to quality such as multidisciplinarity of the institutes, particularly of higher educational institutes (HEIs) and holistic development of the learners. In ancient time such approaches were practiced in India but somehow, these days, in the guise of craving for too much of specialization, they have largely been lost from Indian institutes and curricula. Furthermore, the policy has an ambition to make Indian education, particularly the higher education as international in physical sense by means of (a) attracting more number of international students to Indian institutes; (b) providing access to learners from India to learn and earn from the foreign institutions; (c) encouraging collaborations of Indian HEIs with foreign HEI; (d) allowing Indian HEIs to open campuses outside India and vice-versa. NEP2020.

As mentioned earlier the purpose of any education is to make the better version of the learners and scientific temper has an important role in bringing this tangible change in any learner. Scientific temper is nothing but having a scientificbent of mind. If a person imbibes the essence of scientific methods in his outlook and uses them in his everyday life, we can say that the particular person possesses the scientific temper. Though the term was first used by a Jesuit scholar Thomas Aloysius Hughes, it was given impetus by Pandit Jawaharlal Nehru once he discussed it in his seminal work*The Discovery of India* , published in the year 1946. Pt. Nehru explains scientific temper as an individual and social process of thinking and acting which uses a scientific method which may include questioning, observing reality, testing, hypothesising, analysing and communicating. He went a bit further by terming it as a way of life. NEP2020 mentions the term 'scientific temper' five times, twice in "Principles of this Policy" section, once each in the sections of "Curriculum and Pedagogy in Schools"; "Quality Universities & Colleges"; and "Holistic and Multidisciplinary Education". The major attributes of scientific temper are perseverance, critical thinking, logical thinking, respect for evidence, objectivity, open mindedness, honesty in reporting, healthy skepticism, rationality and universalism. In addition to citing scientific temper directly, almost all traits of scientific temper have also found their places either directly or indirectly in the policy document. All of them together have the potential to make the education of India of international quality. These attributes of scientific temper, if implemented properly, can help in making the learners internalize i.e. assimilate the teachings in a better way. Spiritual philosophy, irrespective of religions, will not only help in achieving the objectives of the policy but also help in implementing the policy in a better and meaningful way. The policy also discusses giving logical framework for making ethical decisions which in turn will become background for making them aware of themes cheating, violence, plagiarism, littering, tolerance, equality, empathy, honesty in reporting, giving due credits to the collaborators etc. A recent study showed how some of the spiritual texts are having potential in designing pedagogy. NEP2020 also talks about fulfillment of the learners and preparing them for gainful fulfilling employment. These two i.e. fulfillment from learning and from the employment they get after getting educated/trained should be the utmost objectives of any education and spirituality has an important role in making the learners realize that fulfillment.

References

Dhar, PL. 2009. Developing scientific temper. National Resource for Value Education In Engineering Indian Institute of Technology, Delhi Retrieved from http://pldhar.files.wordpress.com/2009/09/scientific-temper.pdf. Accessed on August 12, 2022.

Maharaj G, M Ahuja, and A K Malhotra. 2021. Implementation of National Education Policy (NEP) 2020 of India: A Perspective on Pedagogy from Bhagwad Gita. *European Journal of Educaton Studies*. 8 (8): 144–161. DOI:10.46827/ejes.v8i8.3844

MoE. 2020. National Education Policy 2020. Ministry of Human Resources Development. Accessed on August 12, 2022. https://www.education.gov.in/sites/upload_files/mhrd/files/nep/NEP_Final_English.pdf.

Yenugu S. 2022. The new National Education Policy (NEP) of India: will it be a paradigm shift in Indian higher education. *Perspectives: Policy and Practice in Higher Educatio*n https://doi.org/10.1080/13603108.2022.2078901

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