AIASA Agriculture Magazine

ISSN: 2582-6980

AGRI MIRROR FUTURE INDIA

aiasanewdelhi aiasa5 AIASA www.aiasa.org.in

Volume 02 | Issue 03 | March 2021

A Voice for Agriculture

A Voice for Agriculture

AGRI MIRROR : FUTURE INDIA

Volume 02 | Issue 03 | March 2021

CONTENTS

Article Id:137

POTATO CYST NEMATODE (*GLOBODERA spp.*): POTENTIAL PEST OF POTATO IN HILLY REGIONS

Vijay Joshi* and Satya Kumar

Department of Plant Pathology, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) – 263145, India

vij.joshi94@gmail.com

Introduction

Potato, *Solanum tuberosum* L., a perennial in the nightshade family, Solanaceae, is one of the most important root and tuber vegetable crop. It globally ranks the fifth most important staple food crop, with its most production in the temperate zones, followed by numerous subtropical and tropical regions globally. Potato, is native to the South America, originated in modern-day Peru. Potato production is affected directly or indirectly by many abiotic and biotic factors. Major constraints in potato production are insects, fungus, nematodes and other pathogens. Among nematodes, Potato Cyst Nematodes (*Globodera* spp.) are well known for their adverse effects on potato cultivation globally causing yield losses of up to 80% (Turner and Subbotin, 2013).

Globodera pallida and G. rostochiensis both PCN's coevolved with potato and other native *Solanum* species in the Andean Region of South America, but have subsequently spread to other potato-growing regions of the world (Hockland *et al*., 2012). They were first observed on potato roots in Germany (1881), before spreading worldwide. During the 1850s, PCN were introduced into Europe along with the breeding and planting materials brought for late blight resistance, from where they spreaded throughout the world through the import of improved varieties developed in Europe (Evans and Stone, 1977). PCN's are known to be present in North, South and Central America, North and South Africa, Australia, New Zealand and Asia, the exceptions are the warm tropical areas. According to a recent survey *G. rostochiensis* has been detected in 72 countries and *G. pallida* in 48 countries (CABI 2018).

Economic Importance

Quarantine regulations have been imposed in many countries to restrict the movement of PCN infected seed potato tubers, in order to prevent its further spread to non-infested areas. In India, PCN was first detected in 1961 from a field in Vijayanagaram, Nilgiris district, Tamil Nadu. Since 1971, Government of Madras (Tamilnadu) enforced domestic quarantine in India to restrict further spread of PCN within the country. Later PCN was intercepted in adjoining areas of Nilgiris i.e., Kodaikanal hills, Tamil Nadu (1983), adjoining hills of Karnataka (1986), and Pazhathotam, Idukki district, Kerala (1988) bordering Tamil Nadu. Now, recently it has been intercepted from some parts of Himachal Pradesh, Jammu & Kashmir and Uttarakhand (2018) hills as a result of which, Government of India on October 2018 restricted the movement of potato tubers used as seeds from the infested areas of these states to rest of the country.

As a sedentary endoparasitic nematode, PCN's usually provide entry portals for fungi and bacteria which aggravate potato yield losses via development of disease complexes. Such interactions have already been recorded between *Globodera pallida* and *Ralstonia (Pseudomonas) solanacearum; Rhizoctonia solani;* and *Verticillium dahlia*.

Symptoms

Foliar symptoms caused by PCNs are not specific and are often overlooked by growers. General symptoms include the patches of poor growth of crop in fields where nematode population is high in soil, plants sometimes show chlorosis, wilting or death of foliage. The tuber size is usually reduced and roots are extensively branched. Cyst and young females can be found on the root surface when the plants are uprooted which are visible to the naked eyes, visible as tiny white, yellow or brown pin-heads on the surface of roots. Mature female cysts containing eggs and juveniles can be detected in soil samples from the field.

Histopathology and Life Cycle of Potato Cyst Nematode

Globodera species are among the most highly specialised and successful phytoparasitic nematodes. The active part of the life cycle begins with hatching of the second-stage juvenile from the egg, usually, after stimulation by exudates from the host plant roots. The second-stage juvenile invades the root near the growing point or a lateral root, and puncture cell wall leaving a trail of ruptured cells. Eventually, it settles its head towards the stele and begins feeding, on vascular cells. By inducing cell enlargement and breakdown of the wall, the saliva causes the formation of a large, syncytial cell with dense, granular cytoplasm known as Syncytium.

The nematode keeps feeding from Syncytium, until its development is complete, for about three months. The now sedentary juvenile moults through the third and fourth juvenile stages to the adult. Sexes can be distinguished at the third juvenile stage and, unlike root-knot nematodes, once sex is determined, probably through availability of food, it is irreversible. Fourth stage males remain coiled within the sac-like third stage cuticle and emerge from the root after the final moult. They seem not to feed after the third stage and require less than one hundredth the quantity of food needed by the females. The adult female enlarges as the gonads increase in size, eventually rupturing the root cortex so that the spherical body lies exposed, with only the head and neck embedded in the root held in place by a cement produced behind the head.

Receptive females release a secretion which attracts many males and they may mate repeatedly, fertilisation is essential in *Globodera* species. The embryos develop within the egg as far as the formation of the second-stage juvenile while still within the female's body. The female dies when mature and the cuticle tans to form a tough, protective cyst containing 200 to 500 embryonated eggs. Eventually the cyst becomes detached from the root and free in the soil.

Management

PCN's spread passively via potato crop residues, PCN-contaminated machinery, soil mulching, especially to modify soil texture in newly reclaimed areas, infested-potato seeds, irrigation

water, and field supplies (e.g., contaminated bags or containers).

Cultural Control:

PCN's being confined to temperate regions can be managed by integrated nematode management measures to maintain the population of PCN below economic threshold level, like-

- Use of disease-free and disinfected seeds.
- Resistant crop varieties like Kufri Swarna.
- Crop rotation with non-host crop i.e., avoid planting crop of Solanaceae family.
- Intercropping with crops that cause natural biofumigation i.e., Brassica family.
- Trap crops like *Solanum nigrum, S. sisymbriifolium, S. dulcamara* and *Datura stramonium*, have been reported to show promising results.

Chemical Control:

- Broadcasting, Fluensulfone (Nimitz) @ 1kg a.i./ha can be effective during field preparation.
- Apply Fluopyram (Velam Prime) @ 625ml/ha as soil drench, one day before sowing potato and second dose can be applied after 20-25 days to control the population of PCN's in soil that were activated from dormant phase within cyst by host root exudates.

Biological Control:

Compost enriched with biocontrol agents like *Pochonia chlamydosporia, Pseudomonas fluorescens, Trichoderma harzianum, Paecilomyces lilacinus* can be applied to the infested fields during field preparation. These bioagents are well known for managing PCN's by parasitization, antibiosis and induction of systemic resistance enhancing the yields.

References

1. Turner, S., and Subbotin, S. 2013. Cyst nematodes. *Plant Nematology*. 2:109–143.
2. Hockland, S., Niere, B., Grenier, E., Blok, V., Phillips, M., Nijs, L. D., Anthonie, G. and Pickup, J. 2012. An evaluation of the implications of virulence in non-european populations of *Globodera pallida* and *G. rostochiensis* for potato cultivation in Europe. *Nematology*. 14(1):1–13.
3. CABI. 2018. *Globodera pallida* (white potato cyst nematode). Online publication. *Centre for Agriculture and Biosciences International*.
4. Evans, K. and Stone, A. R. 1977. A review of the distribution and biology of the potato cyst nematodes *Globodera rostochiensis* and *G. pallida*. Proceedings of the National Academy Sciences. USA. 23, 178–189.

Article Id:138

NANO FERTILIZERS AND THEIR ROLE IN AGRICULTURE

Lahari Shagam, Y.S.Parameswari, S.A.Hussain

Introduction

In developing countries fertilizers have a prominent role in enhancing the food production especially after the introduction of high yielding and fertilizer response crop varieties but application of higher doses than optimum of these fertilizers leads to several problems like environment pollution (soil, water, air pollution), low input use efficiency, decrease in the quality of food material, soil degradation, nutrient deficiencies , toxicity to different beneficial living organisms present above and below the soil surface etc. In spite of of these problems, there is a challenge to feed the growing population of the world. Hence, there is need to produce nutritive agricultural produce rich in protein and other essential nutrients required to the human and animal consumption that is why emphasis should be laid on production of high quality food with the optimum consumption of fertilizers. For solving these problems in crop production nano-fertilizers is an effective tool in agriculture for better nutrient management. Because these nano-materials having more penetration capacity, surface area and use efficiency which avoid residues in environment. Hence, these agricultural useable nano-particles developed with the help of nanotechnology can be exploited in the value chain of entire agriculture production system.

Nanotechnology

A group of emerging technologies in which the structure of the matter is controlled at the nanometer scale to produce materials having unique properties.

Nanoparticles: Particles with size in the range of 1-100nm. Small objects which behave as a whole unit.

1 Nanometer =0.000000001 metres (10^{-9} m)

Nanotechnology applications in agriculture

Now a days nanotechnology providing different nano devices and nano material which are having a unique role in agriculture such as nano biosensors to detect moisture content and nutrient status in the soil and also applicable for site specific water and nutrient management. Efficient nutrient management can be attained with nano fertilizers, selective weed control with the use of Nano herbicides, seed vigor can be enhanced with use of Nano nutrient particles, efficient pest management with the use of Nano pesticides. Alginate/ chitosan nano-particles can be used as herbicide carrier material for herbicides such as paraquat. Therefore , nanotechnology have greater role in crop production with environmental safety, ecological sustainability and economic stability.

What is nano fertilizer?

Nano fertilizers are synthesized or modified form of traditional fertilizers, bulk fertilizer materials or extracted from different vegetative or reproductive parts of the plant by different chemical, physical, mechanical or biological methods with the help of nanotechnology used to improve soil fertility, productivity and quality of agricultural produces. At nano scale physical and

chemical properties are differ than bulk material.

Unique Properties of Nanoparticles

- Smaller size
- Larger surface area
- Increased surface area to volume ratio
- Nanoparticles can even pass through the plant and animal cell, which is the main clue through which nanotechnologists able to achieve the phenomena of delivering the required product at cellular level
- Slow release
- Specific release

These properties make nanotechnology advantageous over conventional method.

Achievements of nano-fertilizers

Nano fertilizers providing greater role in crop production and several research studies revealed that nano fertilizers enhanced growth, yield and quality parameters of the crop which result better yield and quality food product for human and animal consumption. This interprets into an improvement to three major areas of production.

Yield: Several research studies revealed a significant increase in crop yield over control with the application of nano- fertilizers. The yield enhancement is mainly because of increasing growth of plant parts and metabolic process such as photosynthesis leads to higher accumulation and translocation to the economic parts of the plant. Foliar application of nano particles as fertilizers resulted in significant increase in yield of the crop (Tarafdar *et al*., 2012).

Nutritional Value: Nano fertilizers provide larger surface area and improve the availability of nutrient to the crop plant which help to increase the quality parameters of the plant (such as protein, oil content, and sugar content) by enhancing the rate of reaction or synthesis process in the plant system. Total carbohydrate, starch, IAA, chlorophyll and protein content in the grain are increased with the foliar application of nano Zn and Fe (Rajaie *et al*.,2009), Nano Fe_2O_3 enhance photosynthesis and growth of the peanut plant (Liu *et al*.,2005).

Health: Some nutrients are required for promoting the disease resistance of the plant and due to the more availability of nutrients with the application of nano nutrient to the plant it prevents from diseases, nutrient deficiencies and other biotic and abiotic stress which indicate that nano fertilizers enhance overall health of the plant. ZnO nano-particles are also helpful for plant under stress conditions (Tarafdar *et al*., 2012). Aqueous solutions of Ag^+ and Au^+ drastically reduced the body weight of *P. ricini* larvae (Sahayaraj *et al*., 2014).

Cons of Nanotechnology:

- These nanoparticles produce toxic waste materials which may result in contamination and environmental pollution
- It need safety measures during its handling, because it has a lots of potential to cause respiratory disorder and carcinogenic effect on human. So it needs to expertise persons during its application.

Future prospects:

- Understanding nanoparticles in agro-ecological consequence (plant specificity, dose dependancy and biotoxicity)
- Physiological explanation of mechanism of uptake and translocation by plants
- Influence of nanoparticles in rhizosphere and on root surface

- Effect on environment and human health
- Minimizing the residual effect
- Lab to land

REFERENCES:

Tarafdar J. C., Agarwal A., Raliya R., Kumar P., Burman U and Kaul R. K. (2012b) *Advanced Science, Engineering and Medicine,* 4, 1-5.

Rajaie M. and Ziaeyan A. H. (2009) *Int. J. Plant Product*, 3(3), 35-440.

Liu X.M., Zhang F.D., Zhang S.Q., He X.S., Fang R., Feng Z. and Wang Y. (2005) *Plant Nutr. Fert. Sci.,* 11, 14-18.

Tarafdar J. C., Raliya R. and Tathore I. (2012a) *Journal of Bionanoscience*, 6, 84-89.

Sahayaraj K. Madasamy M. and Anbu R. A. (2014) *J. Biopest*., 9 (1), 63-72.

Article Id:139

INCOMPLETE GAMMA DISTRIBUTION OF RAINFALL FOR SUSTAINABLE CROP PRODUCTION STRATEGIES AT PONNANIYAR BASIN OF TAMIL NADU

Guhan.V[*], V.Geethalakshmi[1], K.Bhuvaneswari[2],K.Senthilraja[2]

[*1]Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

[2]Director of Crop Management, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

Corresponding author's email: guhanthiran@gmail.com

Rainfall data of Ponnaniyar river basin of Tamil Nadu for 48 years (1971-2018) were analysed by Incomplete Gamma Probability method in Weathercock software to estimate seasonal and weekly rainfall probability. The result revealed that the average rainfall of Ponnaniyar basin over the period was 774 mm. During South West monsoon Ponnaniyar basin received 251 mm (32.4%) rainfall, whereas rainfall during North East monsoon, winter and summer were received 410 mm (53.0%), 17 mm (2.2%), and 96 mm (12.4%), respectively. The total annual predicted rainfall of the Ponnaniyar basin at 90%, 75%, 50%, 25% and 10% probability are 487 mm, 602 mm, 750 mm, 921 mm and 1094 mm, respectively. Based on the results millets and Short duration vegetables can be recommended at Ponnaniyar river basin.

Keywords – Incomplete gamma probability, Rainfall, Weather cock.

Introduction

Rainfall is the single most important factor in crop production, of all the climatic factors and it is of greatest concern in rainfed agriculture. The variation of monsoonal and annual rainfall in space and time are well known and this inter-annual variability of monsoonal rainfall has considerable impact on agricultural production, water management and energy generation. Analysis of annual, seasonal and monthly rainfall of a region is useful for water harvesting and crop planning. Similarly weekly rainfall analyses give more useful information in crop planning Shrestha, A. B., and Aryal, R. (2011). Rainfall analyses are helpful for proper crop planning under changing environment in any region. Therefore, in this paper, an attempt has been made to analyze 48 years of rainfall (1971–2018) recorded in Ponnaniyar basin, Vaiyampatti block, Tiruchirappalli district of Tamil Nadu, for prediction using in-complete gamma distribution were the best-fit probability distribution.

Material and Methods

Study area

Ponnaniyar basin is situated in Tiruchirappalli district of Tamil Nadu, Considering the geographical location, Ponnaniyar basin is situated in 10.5801° North latitude and 78.2565° East longitude. It is nestled in the gorge between the hills with an aerial extent of 83 sq.km. The area receives an annual rainfall of 773.8 mm, with maximum precipitation during northeast monsoon. The climate is semi-arid with hot from March to May, the temperature varies from 26 to 38° C. The dam supports ayacut

in Mugavanurpanchayat, Maniyarampatti, Periyaanaikarapatti and Manpaththai villages of Vaiyampatti block, Tiruchirappalli district.

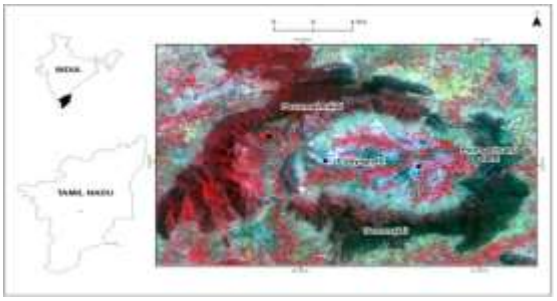


Fig.1: Landsat Satellite image showing Ponnaniyar basin Area

Rainfall Probability

The probability of rainfall enable us to determine the expected rainfall at various chances. Forty eight years of rainfall data recorded in Ponnaniyar basin of Tamil Nadu was collected from Ariyaru Basin Division, Public Works Department, Government of Tamil Nadu, are used to find out seasonal and weekly rainfall probability. It was estimated using WEATHER COCK software version 1 which is developed by CRIDA, Hyderabad for analysis.

Analysis of weekly rainfall probability

Annual and Weekly rainfall probabilities were calculated through the module named as "incomplete Gamma Probabilities.Exe". Weekly rainfall data is used as an input to obtain weekly probability of rainfall at a level of 90, 75, 50 and 25%. The amount of rainfall at four probability level has been computed for each standard week by fitting Incomplete Gamma Distribution model.

Results and Discussion

Table 1: Average monthly rainfall of Ponnaniyar basin

Month	Rainfall (mm)
January	10.4
February	6.6
March	9.4
April	17.0
May	42.9
June	45.0
July	20.3
August	48.0
September	79.9
October	111.4
November	199.5
December	234.4

Monthly average rainfall analysis for 48 years of Ponnaniyar basin shows a variation from 6.6 to 234.4 mm. The analysis shows in the month of December receives highest rainfall of 234.4 mm and February month receives lowest rainfall of 6.6 mm **(Table 1)**.

Table 2: Average seasonal rainfall of Ponnaniyar basin

Month	Rainfall (mm)
Winter season	17

Summer season	96.1
South west monsoon season	250.5
North east monsoon season	409.9

Seasonal rainfall was calculated based on rainfall data of Ponnaniyar basin for four seasons. Among the seasons North east monsoon receives highest rainfall of 409 mm, followed by Southwest monsoon (250 mm), summer (96 mm) and winter (17 mm) season respectively **(Table 2).**

Table 3: Weekly rainfall probability of Ponnaniyar basin

Week	Probability					Mean (mm)
	90%	75%	50%	25%	10%	
1	0.1	0.7	2.6	6.9	13.3	4.1
2	0.2	0.7	2.2	5.5	10.2	3
3	0.2	0.7	2.2	5.4	10.1	3
4	0.4	0.7	1.2	1.8	2.5	0.3
5	0.2	0.7	1.8	3.8	6.5	1.7
6	0	0	2.6	10.5	16.8	2.6
7	0	0	2	9.2	14.8	2
8	0	0.3	0.3	2.3	3.2	0.3
9	0.3	0.7	1.7	3.2	5.3	1.3
10	0.1	0.6	2.8	8.1	16.5	5.1
11	0.2	0.7	1.9	4.1	7	1.9
12	0.2	0.6	1.5	2.9	4.8	1.1
13	0.3	0.7	1.6	3	5	1.2
14	0.1	0.6	2.1	5.3	10	2.9
15	0.1	0.7	2.6	6.8	13.1	4
16	0.1	0.9	4.4	13.1	27	8.9
17	0.2	1.0	3.4	8.1	15.1	4.9
18	0.2	1.3	5.2	14.4	28.8	9.8
19	0.2	1.5	6.9	20.2	41.5	14.3
20	0.3	1.7	7.1	19.9	40	13.9
21	0.6	2.8	10.1	26	49.7	18.1
22	0.6	2.1	6	13.3	23.6	8.7
23	0.4	2.0	6.8	16.9	31.9	11.4
24	0.2	1.0	4	10.6	20.6	6.8
25	0.3	0.9	2.5	5.5	9.7	3
26	0.4	0.8	1.6	2.8	4.2	1
27	0.2	0.9	3.6	9.7	18.9	6.2
28	0.3	1.5	5.7	15	29.1	10.1
29	0.2	1.2	4.8	13	25.6	8.7
30	0.2	1.3	5.6	15.9	32.1	11
31	0.3	1.6	6.7	18.8	37.7	13.1
32	0.3	1.9	7.9	21.7	43.1	15.2
33	0.7	3.5	12.9	33.2	63.7	23.5
34	0.8	3.3	11.5	28.7	54.1	20.1

Week	Probability					
	90%	75%	50%	25%	10%	Mean (mm)
35	0.7	3.1	10.6	26.5	50	18.5
36	0.8	3.3	10.7	25.8	47.5	17.8
37	1.4	5.7	18.1	43.2	79.5	30.5
38	1.3	5.2	16.1	38	69.3	26.6
39	2.2	6.9	18.3	38.8	66.8	27
40	1.9	6.4	17.8	39.2	68.8	27.3
41	2.7	8.1	21.1	44.1	75.3	30.8
42	2.2	7.2	19.9	43.6	76.2	30.5
43	2.9	9.5	26.1	56.5	98.3	39.8
44	4.1	12.3	31.8	66.6	113.8	47.1
45	3.4	11.5	32.6	72.3	127.7	51.3
46	0.5	3.0	13.5	38.8	79.1	28.3
47	0.5	3.6	17.2	52	108.4	38.7
48	0.7	4.3	18.7	53.4	108	39.2
49	0.9	4	13.8	34.7	65.8	24.5
50	0.2	1.8	8.9	27.5	57.7	20
51	0.2	1.7	10.4	35.8	79.5	27.2
52	0.2	0.9	3.3	8.4	16.2	5.2
Annual	**487.1**	**602.1**	**750.1**	**920.6**	**1094.2**	**773.8**

The predicted total annual rainfall of Ponnaniyar basin was 487, 602, 750, 921 and 1094 mm respectively at 90, 75, 50, 25 and 10% probability **(Table 3)**. In 90% probability Ponnaniyar basin receives meagre rainfall (<5mm) for all the standard weeks, at 75% probability chance for onset of rainfall from 37th standard week, it continues up to 45th standard week and declines, at 50% probability chance of onset from 18th to 23rd standard week and from 30th to 51st standard week, at 25% probability shows onset starts from 14th standard week to 52th standard week, at 10% probability chance of onset from 10th to 24th standard week and again from 27th standard week there is a chance of occurrence of rain and it peaks up to 45th standard week after that declines slowly.

Therefore, the chance occurrence of rainfall at 50% probability alone practically possible for effective farming Dawson, A. (2016). Less rainfall is recorded during summer and pre-onset of south west monsoon season (18th standard week to 23rd standard week) at 50% probability level. Therefore the surface soil would become dry with rare chances of getting adequate soil-moisture in the seeding zone, if possible, water harvesting should be done to ensure a pre-sowing irrigation. It was also revealed that the short duration crops like pulses, sorghum have to be raised under moisture stress conditions (Pooniya *et al.,* 2015). The crops should be able to use residual soil profile moisture more judiciously as reliability of getting adequate weekly rainfall is low. If irrigation facilities are available, then early sown varieties may be grown with the application of pre-sowing irrigation Minhas, P. S. (1996). After the onset of monsoon (30th standard week), raising of rice nursery can be started in dry bed nursery so that the transplanting may be

done during 32nd- 35th standard week (Rai *et al*. 2014) for effective cropping. As there is very high chances of rainfall occurrence from 30th to 51st standard week the crops like rice, maize, groundnut, vegetable crops can be recommended with the availability of ground water irrigation facilities.

Conclusion

Ponnaiyar received about 750.1 mm rainfall at 50% probability level during monsoon season. It is distributed, with the period from 18th to 23th weeks and 36th to 51th weeks. During 18th to 23th standard weeks giving rise to or length of growing season 42 days or 6 weeks, short duration crops like pulses, sorghum can be recommended under moisture stress conditions. During 36th to 51st standard weeks with length of growing season 110 days or 16 weeks, crops like rice, maize, groundnut, vegetable crops can be recommended with the availability of ground water irrigation facilities.

Reference

- Dawson, A. (2016). *Simulated impact of climate change adaptation strategies on productivity in smallholder farms in Southwest Madagascar* (Doctoral dissertation, Masters Thesis, Wageningen University, Netherlands).
- Minhas, P. S. (1996). Saline water management for irrigation in India. *Agricultural water management*, *30*(1), 1-24.
- Pooniya, V., Choudhary, A. K., Dass, A., Bana, R. S., Rana, K. S., Rana, D. S., ... & Puniya, M. M. (2015). Improved crop management practices for sustainable pulse production: An Indian perspective. *Indian Journal of Agricultural Sciences*, *85*(6), 747-758.
- Rai SK, Kumar S, Rai AK, Palsaniya DR. Climate Change variability and rainfall probability for crop planning in few district of central india, Atmospheric and climate science 2014; 4:394-403.
- Shrestha, A. B., & Aryal, R. (2011). Climate change in Nepal and its impact on Himalayan glaciers. *Regional Environmental Change*, *11*(1), 65-77.

Article Id:140

FERTIGATION IN VEGETABLE CROPS FOR ENHANCING RESOURCE USE EFFICIENCY

Archana Brar, Sumit Deswal, Devender Singh and Renu Yadav

Department of Vegetable Science, CCS Haryana Agricultural University

Hisar, Haryana, India

brararchanaarch@gmail.com

Introduction

India is the brick of a Golden Revolution in Horticulture with a total annual production of 149 Million tonnes. Vegetables are important constituents of Indian agriculture and nutritional security due to their short duration, high yield, nutritional richness, economic viability and ability to generate on farm and off farm employment. Our country is blessed with diverse agro climates with distinct seasons, making it possible to grow wide array of vegetables. Today, India is the second largest producer of the vegetables (90.8 Million tonnes) in the world, contributing 14.45 per cent of the total world production. Moisture is maintained in the medium through application of water at critical stages of crop. There is vital need to decrease the consumption of water in irrigation by developing new technologies and methods that could help to apply costly input in an effective way. Fertigation is such an innovative technology of applying water soluble fertilizers through drip irrigation. Drip irrigation is having 90 per cent irrigation efficiency. This method increases the crop yield in general to the tune of 25 to 30 per cent with saving of irrigation water to the extent of 50 to 60 per cent, when compared to conventional irrigation method. The fertigation permits application of right quantities of plant nutrients consistently to the wetted root volume zone where most of the active roots are concentrated and this helps in enhancing nutrient use efficiency. It has been found that the productivity and quality of crop produce along with improved resource use efficiency. Fertigation saves fertilizers up to 25 per cent, thus fertigation results in appropriate and efficient use of precious commodities such as water and fertilizer. As the water soluble fertilizers are very expensive inputs, therefore the efforts are made by various researchers to reduce the quantity of water soluble fertilizers (nitrogen and potassium) in conjunction with straight fertilizer (single super phosphate) to enhance the yield potential of vegetable crops and fertilizer use efficiency. The key point which measured is that changing from single product to creating value added product through a balanced and crop specific plant nutrition concept. The crop competency for nutrients will become more and more crucial, but even more significant to transmit the greater knowledge to the end user is essential. Thus, fertigation is an important concept and the key focus of this article is on supporting the horticulturist in general and vegetable crops in particular.

What is fertigation?

The practice of providing crops in the field with fertilizers via the irrigation water is called fertigation. In fertigation, timing, amounts and concentration of fertilizers applied are easily controlled. Fertigation allows the landscape to absorb upto 90% of the applied nutrients, while granular or dry fertilizer application typically results in absorption rates of 10 to 40%. Fertigation confirms saving in fertilizer (40-60%), due to “better fertilizer use efficiency” and “reduction in leaching”. Drip irrigation is often preferred over other irrigation methods because of the high water application efficiency on account of reduced losses, surface evaporation and deep percolation. Because of high frequency water application, concentration

of salts remains adaptable in the rooting zone. The regulated supplies of water through drippers not only affect the plant root and shoot growth but also the fertilizer use efficiency. Fertigation through drip irrigation reduces the wastage of water and chemical fertilizers, optimizes the nutrient use by applying them at critical stages and at proper place and time, which finally increase water and nutrient use efficiency. Moreover, it is well accepted as the most effective and appropriate means of maintaining optimal nutrient level and water supply permitting to crop development stage, specific needs of each crop and type of soil.

Fertilizer used in fertigation

Urea, potash and greatly water soluble fertilizers are accessible for applying through fertigation.

Application of super phosphorus through fertigation must be escaped as it makes precipitation of phosphate salts. Thus phosphoric acid is more appropriate for fertigation as it is accessible in liquid form. Special fertilisers like mono ammonium phosphate (nitrogen and phosphorus), poly feed (nitrogen, phosphorus and potassium), Multi K (nitrogen and potassium), Potassium sulphate (potassium and sulphur) are highly suitable for fertigation as they are highly soluble in water. Fe, Mn, Zn, Cu, B, Mo are also delivered along with superior fertilisers.

Hypothesis for fertigation techniques

- Fertigation boosts fertilizer use efficiency by 40-60%, hence recommended doses of fertilizers may be reduced proportionally.
- Drip irrigation encourages root growth in surface layer (about 70-80%) hence the nutrients from sub-surface layers may not be extracted.
- Drip irrigation leads to moisture content around above field capacity hence may encourage leaching of nutrients.
- Use of water soluble fertilizers may lead to leaching losses beyond surface layer, hence frequent split application of water soluble fertilizers is desirable.
- The frequency of fertigation may increase with fertilizers doses in order to escape leaching losses or toxicity if any.

Need of fertigation

Rapid increase in area under micro irrigation, now fertigation is getting momentum in number of the countries. The idea of fertigation is new to the Indian subcontinent. Growing popularity to accept of this concept making it easy to adopt Fertigation. This fertigation is the practice to applying water soluble solids or liquid fertilizers through the drip irrigation on weekly or monthly basis so as to reach each and every plant regularly and uniformly. It is the most active, suitable and convenient means of maintaining optimum fertility level and water supply permitting to the specific requirement.

Fertigation permits application of a nutrient straight at the location of a high concentration of active roots and as required by the crop. Planning fertilizer applications on the basis of need offers the opportunity of reducing nutrient element losses related with predictable application. Methods that depend on the soil as a reservoir of nutrients thereby increasing nutrient use efficiency.

Through fertigation fertilizers savings can be upto the tune of 25-50 per cent. Fertilizers and pesticides applied through a drip irrigation system can improve efficiency, save labour and increase flexibility in scheduling of applications to fit crop needs. However, all chemicals must happen the following criteria for the efficacious conservation of the drip irrigation system.

However, increasing water scarcity and value crops and green houses to confirm higher increasing fertilizer prices may lead to greater effectiveness of the two most serious inputs in crop adoption of the technology especially in high production. We should be aware about that "per drop more crop".

Fertigation scheduling

Fertigation is the technique of supplying dissolved fertilizer to crops through an irrigation system. Fertigation is the technique of supplying dissolved fertilizer to crops through an irrigation

system. Small applications of soluble nutrients save labour, reduces compaction in the field, thereby enhancing productivity. Fertigation allows nutrient placement directly into the plant root zone during critical periods in the required dose. Application of high dose of fertilizers not only causes economic loss but also leads to chemical changes in the soil and reduces the yield. Fertilizer requirement can be reduced by 15-25 per cent with fertigation through drip without affecting the yield. Factors that affect fertigation module are soil type, available NPK status, organic carbon, soil pH, soil moisture at field capacity, available water capacity range, aggregate size distribution, crop type and its physiological growth stages, discharge variation and uniformity coefficient of installed drip irrigation system. The efficient fertigation schedule needs following considerations i.e., crop and site specific nutrient management, Timing nutrient delivery to meet crop needs and Controlling irrigation to minimize leaching of soluble nutrient below the effective root zone.

Benefits of fertigation

Higher nutrient use efficiency

Nutrient use efficiency by crops is greater under fertigation associated that under conventional application of fertilizers to the soil.

Less water pollution

Intensification of agriculture led by use of irrigation water and indiscriminate use of fertilizers has led to the pollution of surface and ground water by chemical nutrients. Fertigation helps lesser pollution of water bodies through the leaching of nutrients such as N and K out of agricultural fields.

Higher resource conservation

Fertigation helps in saving of water, nutrients, energy, labor and time.

More flexibility in farm operations

Fertigation provides flexibility in field operations e.g. nutrients can be functional to the soil when

.

crop or soil conditions would otherwise prohibit entry into the field with predictable equipment.

Efficient delivery of micronutrients

Fertigation provides opportunity for efficient use of compound and ready mix nutrient solutions containing small concentrations of micronutrients, which are otherwise very hard to apply precisely to the soil when applied alone.

Healthy crop growth

When fertigation is applied through the drip irrigation system, crop foliage can be kept dry thus avoiding leaf burn and delaying the development of plant pathogens.

Helps in effective weed management.

Fertigation helps to reduce weed hazard mainly between the crop rows. Use of plastic mulch along with fertigation through drip system allows effective weed control in widely spaced crops.

Effective use of undulating soils

The ability of micro irrigation system to irrigate undulating soils makes it possible to bring such land under cultivation, which otherwise remain as wastelands or used as pasturelands.

Reduced soil compaction

In micro irrigation system reduced need for surface traffic movement during irrigation and nutrient application helps to reduce soil compaction.

Effective use of undulating soils

The ability of micro irrigation system to irrigate undulating soils makes it possible to bring such land under cultivation, which otherwise remain as wastelands or used as pasturelands.

Reduced soil compaction

In micro irrigation system reduced need for surface traffic movement during irrigation and nutrient application helps to reduce soil compaction.

Fertigation provides a variety of benefits to the users like high crop productivity and quality, resource use efficiency

Article Id:141

QUALITY COCOON PRODUCTION

G. Swathiga and K. Thanga Roja
Forest College and Research Institute, TNAU,Mettupalayam- 641 301
swathiga.g@gmail.com

Introduction

Quality is a general term applicable to any trait. It can be defined as measure of excellence or a state of being free from defects, deficiencies and significant variations. Superior cocoon quality can be brought about by the strict and consistent adherence to measurable and verifiable standards. The cocoon output achieved should satisfy the silk reeling requirements.

It has been established that cocoon quality contributes to the tune of about 80 per cent of the raw silk quality. Cocoon quality is governed by several parameters; each of them has importance at certain level. Some of the important quality parameters usually considered is Shell percentage, Defective Cocoon Percentage, Average Filament Length, Average Non Broken Filament Length, Denier, and Reelability percentage. Of these, Shell percentage and Defective Cocoon percentage have been identified as the most significant ones especially because these are relatively easy to determine. It has been established that each of the quality parameters has its own relative significance on the reeling efficiency and raw silk quality.

A series of natural circumstances will produce variations in cocoon quality. Some of the most noteworthy include:

- Difference in the cocoon quality in the same batch
- Difference in the cocoons produced in the same location by different farmers who have reared the same hybrid
- Seasonal influence and the environmental conditions such as temperature and humidity affect cocoon reelability
- Processing technique in reeling will impact reeling efficiency as well as raw silk quality
- Bivoltine cocoons are superior in quality compared to Multivoltine x Bivoltine cocoons

Key Factor

Temperature, humidity and aeration during mounting

Maintain temperatures at or near 25°C and relative humidity around 65 percent for silkworms to spin good quality cocoons with a high reelability. Due to heavy urination before the onset of spinning and due to oozing of silk and its driage during spinning humidty will be more in the rearing house. To drive out the excess moisture in the rearing house,it should have good cross ventilation and also exhaust fans. Sufficient spacing should be there for mounting either inside or outside rearing. Further, the management and the manipulation of the environmental conditions play a major role.

Mounting device

Although different mounting practices are employed among rearers, rotary mounting frames provide good ventilation resulting in improved reelability of cocoons.

Harvesting and handling of fresh cocoons

Cocoons should be harvested only after complete pupation. In practice, the appropriate harvesting day would be the fifth day and the seventh or eighth day in winter from the mounting date. If premature harvesting is done , the silkworm will still be in its larval stage, weigh more, have fragile skin and could likely be crushed which would cause stains to the cocoon and also may lead to melting during handling and transportation.

Transport of fresh cocoons

After proper harvesting and removal of diseased or damaged cocoons, the fresh cocoons are taken to the market. For short distances, the farmer can carry the cocoons in baskets or bags. If the distance is longer, cocoons are to be transported in a van or a bus. Caution should be exercised when loading fresh cocoons on to the van to ensure that containers are loosely packed in tiers to avoid damage. Vibration and shock during long trips can spoil fresh cocoons. If there are defective cocoons, the fresh cocoon quality will be harmed. It is advisable to avoid carrying cocoons over long distances, however, in case of transportation, use of P.V.C. containers with 15kgs capacity is recommended. Shock absorbers, such as sponge can prevent damage over long distances. To minimize the risk of heat deterioration, transportation should be done only during the night or early morning. Ideally, the fresh cocoons should arrive at the stifling unit within two to three days after harvest.

Classification of defective cocoons

When cocoons are sold at the market, price is assessed on the basis of cocoon quality. This is judged by grading shell percentage and the percentage of defective cocoons. If the percentage of defective cocoons is high, the price will be less.Therefore it is necessary to know different kinds of defective cocoonsand ways and means to avoid their occurrence. An account of defective cocoons is given under.

1. Double cocoons

A double cocoon is spun by two worms, producing a filament, which does not unwind smoothly and tangles easily. As these cannot be reeled along with normal cocoons, double cocoons are used for manufacture of a coarse, non-uniform yarn called "dupion". Double cocoons are due to crowded mounting conditions, high temperature and high humidity.

2. Inside Stained/Melt cocoons

Dead cocoons are also known as melted cocoons. In this case, the pupa is dead and sticks to the inside shell of the cocoon causing a stain. Melted cocoons are called mutes because they do not make a sound when shaken. These cocoons are difficult to process and will result in silk which is dull in colour.

3. Outside stained cocoons (dead cocoons)

These are recognized by a rusty colour spot on the cocoon shell caused by absorption of intestinal fluid/urine of the mature worm formed during mounting. Reelability is very poor in this case.

4. Mountage pressed cocoons

This defect may happen due to improper mounting frames. These are also called scaffold pressed cocoons

5. Deformed cocoons

These are abnormally shaped cocoons. This defect may be due to racial characteristics

6. Flimsy cocoons

Here, the shell is loosely spun in layers and has a low silk content. These cocoons are easily overcooked and produce waste

7. Thin end cocoons

One or both ends of the cocoons are very thin and there is a risk of bursting when processed. The cause of this defect may be attributed to racial characteristics or improper temperature and humidity during rearing and mounting. Certain silkworm breeds are prone to thin type of damage. Low temperature and high humidity during the grownup silkworm rearing stage and low temperature and dry conditions during cocooning can also produce this type of defect. These cocoons get water logged and become unreelable when put into cooking basin.

8. Multi layered cocoons

Cocoon having two or three layered shell. The cause of this defect may be attributed to racial characteristics

9. Pierced cocoons/Uzi infected

This happens when a moth has emerged or in the case of the emergence of uzi fly. Pierced cocoons are until for reeling and can be used only for hand spinning or as raw material of machine spun silk yarn

10. Immature cocoons

This is a defect of untimely harvesting. These cocoons produce muffled thudding sound when shaken.

11. Black stained cocoons

These are dotted with black stains outside. These cocoons when gently squeezed exude a bad smell due to putrifucation of pupa. These cocoons spoil healthy cocoons.

12. Rusts

The cocoons show rusts colour on the silk shell. These cocoons are formed when the intestinal fluid of mature worm falls on cocoons already formed. This produces patches of rusty colour.

13. Spotted cocoons

These cocoons are normal and healthy but spots or stains are found. These spots are due to various reasons. These are storing in badly ventilated and damp store rooms, defective ventilation of cocoon conditioning chamber. Brownish black or yellow spots are due to the development of common green mould.

14. Undersize cocoons

These are below normal size and contain thin silk shell. These cocoons are to be separated and reeled separately.

15. Calcified Cocoons

These cocoons contain pupa or chrysalides which are destroyed by fungus ***Botrytis bassina*.**

16. Thin shelled cocoons

These are cocoons with a thin cocoon shell layer. A large number of cocoons of this type are produced when the cocoon crop is generally poor.

17. Loose Knit or fragile

These cocoons are also called as straw bag. This indicates that the shell loosely woven with open spaces between groups and layers making up the shells. These cocoons contain poor silk and get water logged. These cannot be reeled.

18. Fumigated Cocoons

Some rearers adopt to fumigate formalin in mounting room to prevent the fungus which causes calcification of cocoons. The fumes of formalin makes the sericin layer insoluble making imperfect for reeling. When sulphur is used as fumigant, it greatly damages the silk shell. Such cocoons become water logged and become unfit for reeling.

19. Mould

Stifled or dry cocoons are generally stored. Mould fungus attacks on cocoons when store room is badly ventilated and damp. These cocoons are not reeled properly and results in more waste.

QUALITY OF GOOD COCOONS

The cocoon quality is an important factor for any sericulture. It is vital for grainage, rearing and reeling aspects. Since most of the activity in sericulture is confined to silkworm rearing, the quality cocoon production adds to good crop results and good price. However, good quality cocoons have good market. And these cocoons fetch more to the reeler also. Quality cocoon production is influenced by various factors starting from silkworm seed race. The rearing activities are main for obtaining better quality cocoons. One should not forget about quality leaf production, preservation and feeding. Above all the farmers' concentration, interest, management, involvements are other aspect that favours good cocoon production.

Good cocoons should have the following features.

1. Uniformity in colour, shape, size
2. Good hardness, wrinkles
3. Less floss
4. Tightness at the ends of the cocoon
5. Fully matured pupa within the cocoon

6. Good shell ratio, reelability, filament length, denier
7. Presence of fewer defective cocoons
8. High silk content, renditta

Conclusion

The quality of silk cocoons depends on many characteristics and each of these measure different aspects of quality of cocoons. All these aspects are important at different stages of further processing such as reeling, weaving, etc., However, the permissible limit of defective cocoons in any given lot is only 5 per cent beyond this the rate/kg of cocoons get reduced. Therefore, utmost precaution needs to be taken to avoid the occurrence of defective cocoons.

Article Id:142

THE CRISPR/CAS GENOME-EDITING TOOL: APPLICATIONS IN CROP IMPROVEMENT

Dr. R. Vinoth

Institute of Agriculture, Tamil Nadu Agricultural University, Kumulur, Trichy

Corresponding Author:rvinothagri@gmail.com

Introduction

Improved agricultural production through innovative breeding technology is urgently needed to increase access to nutritious foods worldwide. Recent advances in CRISPR/Cas genome editing enable efficient targeted modification in most crops, thus promising to accelerate crop improvement. Here, we review advances in the Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) associated Cas9/sgRNA system is a novel targeted genome-editing technique derived from bacterial immune system. It is an inexpensive, easy, most user friendly and rapidly adopted genome editing tool transforming to revolutionary paradigm. This technique enables precise genomic modifications in many different organisms and tissues. Cas9 protein is an RNA guided endonuclease utilized for creating targeted double-stranded breaks with only a short RNA sequence to confer recognition of the target in animals and plants. Development of genetically edited (GE) crops similar to those developed by conventional or mutation breeding using this potential technique makes it a promising and extremely versatile tool for providing sustainable productive agriculture for better feeding of rapidly growing population in a changing climate.

The emerging areas of research for the genome editing in plants include interrogating gene function, rewiring the regulatory signaling networks and sgRNA library for high-throughput loss-of-function screening. In this review, we have described the broad applicability of the Cas9 nuclease mediated targeted plant genome editing for development of designer crops. The regulatory uncertainty and social acceptance of plant breeding by Cas9 genome editing have also been described. With this powerful and innovative technique the designer GE non-GM plants could further advance climate resilient and sustainable agriculture in the future and maximizing yield by combating abiotic and biotic stresses.There are mainly three tools of genome editing which are generally used for this purpose, namely,

1. Transcription Activator-Like Effector Nucleases (TALENs).
2.Zinc-Finger Nucleases (ZFNs).
3. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/Cas systems.

CRISPR/Cas is a Clustered Regularly Interspaced Short Palindromic Repeats of genetic information that was found in some bacterial species as an adaptive immune system. It represents a family of DNA repeats in the majority of archaeal (~90%) and bacterial (~40%) genomes provide acquired immunity against invading foreign DNA such as viruses and phages. The size of CRISPR repeats and spacers varies between 23-47 base pair and 21- 72 base pair, respectively. Generally, CRISPR repeat sequences are highly conserved within a given CRISPR locus.

CRISPR/Cas Technology – An Overview

Clustered regularly interspaced short palindromic repeat/Cas system was discovered in bacteria as an adaptive immune system which helps the bacteria in protecting itself against invading foreign DNA, such as that of a bacteriophage. This system comprises of CRISPR loci in the genome and a Cas9 protein. CRISPR, i.e., Clustered Regularly Interspaced Short Palindromic Repeats (CRISPRs) – is a genomic locus of tandem direct repeat sequences and protospacers, the spaces in between repeat sequences, both of which are derived from the invading elements (Kim and Kim, 2014). The CRISPR loci contains a combination of Cas9 genes; sequences for non-coding RNA elements called CRISPR RNA (crRNA) and sequences for small trans-encoded CRISPR RNA, i.e., trans-activating crRNA (tracrRNA). This revealing of molecular mechanism of the CRISPR/Cas system in 2012 opened up its vast area of applications as a promising component of genome editing termed as RNA-guided engineered nucleases (RGENs), which were used as sequence specific nucleases for precise genetic modifications

The Cas9/sgRNA System for Plant Genome Editing

There are broadly three categories of applications of the RNA guided endonuclease particularly in plants. First, in which DSBs created by Cas9 were repaired by non-homologous end joining (NHEJ) method for generation of *indels*, which leads to frame-shift mutations similar to natural variants, or those produced by physical or chemical mutagenesis as in mutation breeding (Chen and Gao, 2014; Saika et al., 2014). In second category, a short DNA repair template or a transgene has been used with Cas9 to repair DSB by homologous recombination (HR) for generation of the point mutations or targeted transgene insertion, gene replacement and gene stacking at predetermined sites. This avoids the position effects associated with random insertion of genes into plant genomes using genetic engineering. Here, we have briefly reviewed the achievements of Cas9 mediated genome editing in plants.

Components of CRISPR-Cas System

1. crRNA (CRISPR RNA):

It comprises the guide RNA to detect the correct sequence of the host DNA along with a region that binds to tracrRNA.

2. tracrRNA (trans activating crRNA):

It binds to crRNA to make an active complex.

3. sgRNA:

It is a combination of tracrRNA and crRNA.

4. Cas9:

It is a protein associated with CRISPR loci having endonuclease activity thus able to cause double stranded break at targeted site.

5. Repair template:

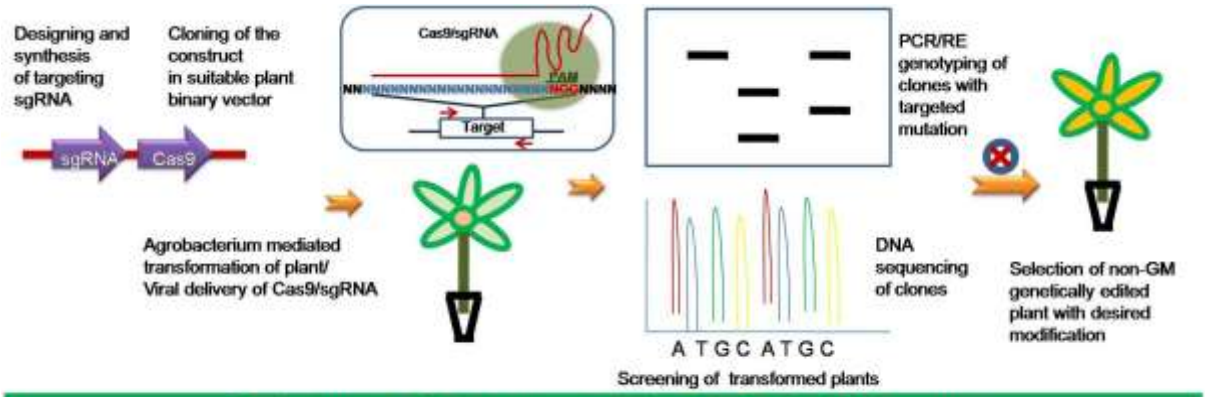
It is a DNA that guides the cellular repair mechanisms allowing insertion of a specific DNA

sequence.

Strategy of using plant genome editing by Cas9/sgRNA system

Starting from the selection of the target gene, the available online resources has been utilized for designing and synthesis of sgRNA. The target sgRNA along with the suitable Cas9 variant have been cloned into a plant binary vector for transformation of the target plant species with *Agrobacterium* generally. After

transformation the putative transformed plants would be selected for the presence of the Cas9 and sgRNA. Then screening of the plants with the desired mutation or editing would be done using PCR/RE genotyping and DNA sequencing.



Basic strategy of plant genome editing with Cas9/sgRNA system

Classification of CRISPR-Cas System

All CRISPR-Cas systems are divided into two distinct classes, on the basis of the design principles of the effector modules.

1. Class 1 systems: The multi-subunit effector complexes comprising several Cas protei ns. Eg. Type I, III and IV CRISPR-Cas system.

2. Class 2 systems:

The effector is a single, large, multidomain protein. Eg. Type II, V and VI CRISPR-Cas system.

Applications of CRISPR/Cas in improvement of crops:

1. Crop yield improvement strategies:

Crop species	Target gene	DNA repair type	Trait improved	Reference
Rice	Gn1a, GS3, DEP1, IPA1	NHEJ	Enhanced grain number, larger grain size, panicle architecture, plant architecture	Li et al., 2016
Wheat	GW2	NHEJ	Increased grain weight and protein content	Zhang et al., 2018
Tomato	SP5G & SlAGL6	NHEJ	Earlier harvest time & Parthenocarpy	Soyk et al., 2017 Klap et al., 2017

2. Disease resistance:

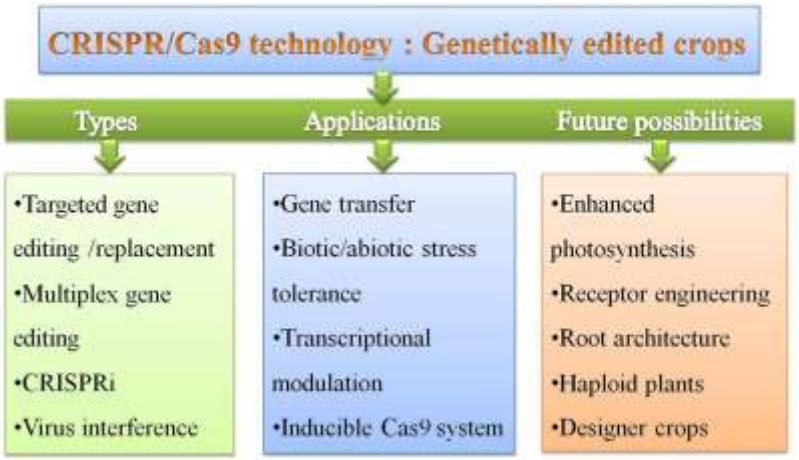
Crop species	Target gene	DNA repair type	Trait improved	Reference
Rice	1.OsERF922 2.OsSWEET1	NHEJ	1.Enhanced rice blast resistance, 2.Bacterial blight resistance	1.Wang et al., 2016 2. Zhou et al., 2015
Wheat	1.EDR1 2. TaMLO-A1, TaMLO-B1, TaMLOD1	NHEJ	Powdery mildew resistance	1.Zhang et al., 2017 2. Wang et al., 2014
Cotton	GhERF	NHEJ	Bacterial blight	Cacas et al. 2017

3. Quality traits improvement:

Crop species	Target gene	DNA repair type	Trait improved	Reference
Rice	SBEII	NHEJ	High amylose content	Wagh et al., 2016, Sun et al., 2017
Maize & Potato	Wx1	NHEJ	High amylopectin content	Wang et al., 2017

Available online resources for CRISPR/Cas system.

Name	Remarks	Reference
Addgene	Reagents and resources	https://www.addgene.org/crispr/
sgRNA Designer	Guide RNA Design tool	http://broadinstitute.org/rnai/public/analysis-tools/sgrna-design
Cas9 Design	Guide RNA DesignTool	http://cas9.cbi.pku.edu.cn
CHOPCHOP	Target sites finding tool	https://chopchop.rc.fas.harvard.edu
CRISPR Design	Design and analysis of Guide RNA	http://crispr.mit.edu
CRISPR Genome Analyzer	Genome editing experiment analysis plateform	http://crispr-ga.net
CRISPR-PLANT	Genome-wide gRNAs prediction tool in plants	http://genome.arizona.edu/crispr
CRISPRseek	Target-specific guide RNAs design tool	http://bioconductor.org/packages/release/bioc/html/CRISPRseek.html
DNA 2.0 gRNA Design Tool	gRNA Design tool	https://dna20.com/eCommerce/cas9/input
E-CRISP	Target sites design tool	http://e-crisp-test.dkfz.de/E-CRISP
RGEN Tools	Potential off-target sites prediction tool	http://rgenome.net/cas-offinder
sgRNAcas9	sgRNA design and potential off-target sites prediction tool	http://biootools.com
CRISPR MultiTargeter	Multiplex design tool	http://multicrispr.net/
CRISPR-P	Guide RNA design in plants	http://cbi.hzau.edu.cn/crispr/
AGEseq	Analysis of Genome Editing by Sequencing	https://github.com/liangjiaoxue/AGEseq
Stupar Lab's CRISPR Design	Target sites identifier	http://stuparcrispr.cfans.umn.edu/CRISPR/



Future Prospects

The potential future crops for sustainable productive agriculture by genome editing are those which have better pest resistance, with enhanced nutritional value, and that are able to survive in changing climate.Genome editing will play very important role in developing new bio-energy crops, which could give maximum yield on wastelands and changing climate. This technology could offer any possible novel genome-editing concept for plants in order to improve crops for better nutrition and food security. The generation of large-scale whole-genome targeted sgRNA library for high-throughput loss-of-function screening applications based on the CRISPRi system like that of RNAi is particularly feasible for model plants in future.

Conclusion:

The applications of genome editing for trait improvement, development of techniques for fine-tuning gene regulation,strategies for breeding virus resistance, and the use of high-throughput mutant libraries. Climate resilient agriculture for combating abiotic and biotic stress is the future of crop improvement using genome editing for both the targeted mutagenesis mediated manipulation and study of transcriptional control by dissection of physiological and molecular cross talk under combined stress. We outline future perspectives for genome editing in plant synthetic biology and domestication, advances in delivery systems, editing specificity, homology-directed repair, and gene drives. Finally,the challenges and opportunities for crop improvement and its bright future in agriculture.

Reference:

- Cai, Y., Chen, L., Liu, X., Sun, S., Wu, C., Jiang, B., et al. (2015). CRISPR/Cas9-mediated genome editing in soybean hairy roots. *PLoS ONE* 10:e0136064. doi: 10.1371/journal.pone.0136064
- Chen, K., and Gao, C. (2014). Targeted genome modification technologies and their applications in crop improvements. *Plant Cell Rep.* 33, 575–583. doi: 10.1007/s00299-013-1539-6

- Khatodia S, Bhatotia K, Passricha N, Khurana SMP and Tuteja N (2016) The CRISPR/Cas Genome-Editing Tool: Application in Improvement of Crops. *Front. Plant Sci.* 7:506. doi: 10.3389/fpls.2016.00506
- Kim, H., and Kim, J. S. (2014). A guide to genome engineering with programmable nucleases. *Nat. Rev. Genet.* 15, 321–334. doi: 10.1038/nrg3686
- Kumar, V., and Jain, M. (2014). The CRISPR–Cas system for plant genome editing: advances and opportunities. *J. Exp. Bot.* 66, 47–57. doi: 10.1093/jxb/eru429
- Liang, Q., Huashan, L., Yunhan, J., and Chunsheng, D. (2015). The molecular mechanism of CRISPR/Cas9 system and its application in gene therapy of human diseases. *Yi Chuan* 37, 974–982. doi: 10.16288/j.yczz.15-109
- Shan, Q., Wang, Y., Li, J., Zhang, Y., Chen, K., Liang, Z., et al. (2013). Targeted genome modification of crop plants using a CRISPR-Cas system. *Nat. Biotechnol.* 31, 686–688. doi: 10.1038/nbt.2650
- Wang, Y., Cheng, X., Shan, Q., Zhang, Y., Liu, J., Gao, C., et al. (2014). Simultaneous editing of three homoeoalleles in hexaploid bread wheat confers heritable

Article Id:143

MODERN, ORGANIC AND ECO-FRIENDLY METHODS FOR PLANT DISEASE MANAGEMENT

P. Lakshmidevi, R. Vinoth and E. Sujitha

Institute of Agriculture, Tamil Nadu Agricultural University, Kumulur, Trichy

lakshmidevisp@gmail.com

Introduction:

Agricultural chemicals have an important role in the efficient and economic production of wholesome food and fibre products. Agricultural chemicals are also known as pesticides include herbicides, insecticides, fungicides etc. (ACUM, 2005). Pesticide based strategies among the various strategies available for pest management has been so far dominating. Use of synthetic pesticides has led to the emergence of several problems (chemical hazard) like environmental pollution, residual effect in grain and killing of non-target organism(s). Plant protective tools play important role in healthy crop production. Modern agriculture mostly dependson chemicals i.e., fertilizers and pesticides. Indiscriminate use of chemicals in agriculture is risky due to environmental pollution and health hazards to human beings, animals and beneficial microbes. For second green revolution, it is necessary assimilate alternative management strategies which are eco-friendly but sustainable for long duration. Eco-friendly strategies i.e., management of pests and disease through bio agents, botanicals and agronomic practices play important role in sustainable agriculture.

Indigenous technical knowledge (ITKs) has been very popular among the rural communities as they have been in practice from generations. These practices have been put in use by the people after conforming their effectiveness and practical utility in managing a number of pests and diseases. Among a number of ITKs in practice, cow's milk, cow dung and cow urine have been used by almost all the rural communities for controlling diseases in crop plants. The antagonistic properties of cow's urine are well known. Various formulations of cow's milk and its other products have been in use where people adopt traditional and indigenous knowledge-based formulations for diseases management. In other words, it is an organic way of disease management. A number of diseases have been reported to be controlled by use of cow dung and its urine-based formulations.

Why need of Eco friendly biological agents?

Environmental safety is one of the leading drivers of bio agent usage because chemical pesticides also kill beneficial insects (bees, butterflies etc.) and microbes (Rhizibium, entomopathogenic fungus etc.). Non-toxic to non-target organisms, including beneficial insects and wildlife, many bio agents also are biodegradable. They decompose quickly and do not negatively impact surface water and groundwater. Bio agents typically are effective in small a quantity which eliminates pollution concerns sometimes associated with traditional chemicals. In addition, bio agents are manufactured from naturally occurring raw

materials in an environmentally responsible and sustainable manner.

Panchagavya

In Sanskrit, Panchagavya means the blend of five products obtained from cow. It contains ghee, milk, curd, cow dung and cow's urine. Panchagavya was mentioned in the scripts of Vedas and Vrikshayurveda. In our ancient literature of Ayurveda, it is described as Panchgavya Chikitsa. When these products are suitably mixed and used with its miraculous effects not only on plant but on humans too. Panchagavya is used in different means such as foliar spray, soil application along with irrigation water, seed or seedling treatment etc. Panchagavya has been tested for different crops and found to enhance growth, vigor of crops, resistance to pest and diseases and improvement of keeping quality of vegetable and fruits. It contains beneficial microbes like lactic acid bacteria *(Lactobacillus)*, yeast *(Saccharomyces)*, actinomycetes *(Streptomyces)*, photosynthetic bacteria *(Rhodopsuedomonas)* and certain other fungi *(Aspergillus)*.

For making approx. 2 litres of panchagavya the following ingredients are required (Shilaja et al., 2002).

1. Fresh cow dung – 0.5 kg.
2. Fresh cow's urine – 0.3 litres.
3. Cow's milk – 0.2 litres.
4. Cow's curd – 0.2 litres.
5. Cow's ghee– 50 gms.
6. Jaggery – 50 gms.
7. Water or sugarcane juice –0.3 litres.
8. Ripe banana fruit– 2-3 nos
9. Tender coconut water – 0.3 litres.
10. Toddy – 0.2 litres.

(If toddy is not available, we can ferment 0.3 litres of tender coconut water by keeping it in a pot for 1 week. That will become toddy.)

First day:

Mix 300 ml of cow urine and 300 ml of coconut water in container.

Fourth day:

Add cow ghee to cow dung and mix thoroughly in earthen container.

Sixth day:

Add cow urine to ghee and cow dung mixture.

Eight day:

Mix the remaining ingredients like curd, cow milk (boiled and cooled), jaggery, ripe banana, tender coconut, water and toddy. Stir the prepared panchagavya twice daily in morning and evening. Panchagavya will be ready by 19th day. Filter the contents to remove the debris.

Panchagavya in Plant Disease Control

Panchagavya is effective in controlling wilt of banana and reduction in plant disease index. Increase in plant vigor and fruit yield in tomato using Panchgavya have also been noticed. Drenching with Mahapanchgavya @10% successfully controlled the wilt of tomato. Modified panchagavya mixture (mixture of cow milk, curd, ghee, dung and urine supplemented with yeast and common salts) have been found most effective for the management of panama disease of banana. Panchagavya has also been found to suppresse the disease caused by *R. solani*. Three sprays of either cow urine (1: 10), cow milk (1:10) and vermiwash 1:2 and panchagavya (3%) was best in reducing rust severity in soybean when

applied at ten days interval starting from the onset of the disease.

Cow Milk

Cow milk contains mainly proteins, "lactoferin B" which is antimicrobial against various fungal species. The curd and buttermilk are enriched with a high proportion of lactic acid bacteria. The presence of lactic acid bacteria also produces antifungal metabolitese.*g.,* cyclic dipeptides, phenyllactic acid, proteinaceous compounds, and 3-hydroxylated fatty acid. The amino acid proline present in milk also induces resistance in crop plants. Spraying of half liter of milk mixed in 4.5 liters of water sprayed at weekly intervals act as a preventive control measure against mildew, mosaicvirus and blights.

- Cow milk have also been found effective in controlling*Tilletia tritici* in wheat and powdery mildew in pumpkin.
- Cow milk and 10% bougainvillea leaf extract reduced the incidence of *zucchini yellow mosaic virus* (ZYMV) when it is applied from plant emergence until initiation of flowering on zucchini (*Cucurbita pepo*).
- Cow milk spray controlled powdery mildew caused by *Sphaerotheca fuliginea* on Zucchini under greenhouse conditions.

Cow Urine

Cow urine is one of the ingredients of "Panchagavya" (urine, dung, milk, curd, and ghee) which is capable of treating many diseases as it has several medicinal properties and it is the best remedy to cure fungal and bacterial diseases.

It has some excellent germicidal properties with antibiotics and antimicrobial activity as well. Therefore, cow urine is capable of killing variety of germs and also act as immunity booster. Cow urine contains many beneficial properties i.e., chemical properties, potentialities and constituents which help in removing all the ill effects and imbalances of body caused by infectious agents.Cow urine contains 95% water, 2.5% urea, and the remaining 2.5% a mixture of salts, hormones, enzymes, and minerals. It has been considered that cow urine is very useful in agricultural operations as a bio-fertilizer and bio-pesticide as it can kill number of pesticide and herbicide resistant bacteria, viruses, and fungi.

Cow urine is used in agricultural system as a pesticide from time immemorial. Basically, it contains Quninolones and Flavoquinolnes. It showed antifungal activity against plant pathogens like *Fusarium oxysporum, Claviceps purpurea, Rhizopus oligosporus, Aspergilus oryzae, Curvularia* spp., *Alternaria helianthi* and *Cladosporium spp*. Cow urine has been proved to be inhibitory to the mycelial growth of *F. oxysporum* f. Sp *Cucumerinum, F. solani* f. sp. *Cucurbitae* and *S. sclerotiorum* that cause disease in cucumber.

Cow urine sprayed in fig plot had less incidence of rust and defoliations and application of 50 ml of cow urine in 500 ml of water reduced the virus, fungus and bacterial incidence in vegetable crops. Spraying of 200 ml of cow urine mixed with 2 liters of water was found effective in controlling the brinjal damping off in nursery. Spraying 10% cow urine three times at 10 days interval, exhibit good control of chilli leaf spot followed by half-liter cow urine along with half-liter sour buttermilk mixed with nine litres of water once in seven days twice

Liquid extracts for disease management

Disease Type of compost	Disease Type of compost
Late blight of potato	tomatoHorse compost extrac
Gray mold on beans	Cattle compost extract
Downy and powdery mildew of grapes	Animal manure straw compost extract
Powdery mildew on cucumbers	Animal manure-straw compost extract
Gray mold on tomato, pepper	Cattle and chicken manure compost extrac

Benefits of Organic Farming

Organic farming is beneficial for both the humans and the nature. Some of the known benefits of organic farming are:

•In organic farming, no fertilizers and pesticides are used, hence, no harmful synthetic chemicals released into the environment.

•Organic farming improves productivity of land by healing it with natural fertilizers.

•Organic farms provide support to the diverse ecosystem by producing safe and healthy environment for humans, plants, insects and animals as well.

•Organic farming is highly beneficial for soil health. Due to the practices such as crop rotations, inter-cropping, symbiotic associations, cover crops and minimum tillage, the soil erosion is decreased, which minimizes nutrient losses and boosts soil productivity. The beneficial living organisms used in organic farming also help to improve the soil health.

•It helps to promote sustainability by establishing an ecological balance. If organic farming techniques are used for long time, the farms tend to conserve energy and protect the environment by maintaining ecological harmony.

•When calculated either per unit area or per unit of yield, organic farms use less energy and produce less waste

.**Reference:**

- Agricultural chemical user's manual. Queensland Government, Department of Primary Industries and Fisheries (ISBN:0734503210), 2005.
- Ciancio A,Mukerji KG. eds., General Concepts in Integrated Pest and Disease Management. Springer, Netherland. 2007, XV.
- Kumar A, Azad CS, Kumar R,Kumar R,Imran M. Soil Solarization: An eco-friendly and effective disease management approach for soil borne diseases. Journal of Pharmacognosy and Phytochemistry.2017; SP1:513-51
- Rani VD,Sudini H. Management of soilborne diseases in crop plants: An overview.International Journal of Plant, Animal and Environmental Sciences.2013; 3(4):156-164.

अखिल भारतीय कृषि छात्र संघ

ALL INDIA AGRICULTURAL STUDENTS ASSOCIATION

A-Block/G-4, National Agriculture Science Centre (NASC) Complex,
DPS Marg Pura, New Delhi-110012

AIASA Proudly Announces

ELEVATE

Thoughts for Transformation

Celebrating The 10 Years Of Glory For Successful Involvement In the Agriculture & Allied Sector

Exciting Events under ELEVATE 2021

- SMART VILLAGE
- Ignite
- Focus
- Agri Journalist
- Empower

About AIASA

All India Agricultural Students Association (AIASA) is a professional society of current and former students of India having a degree in the field of agriculture, fisheries, horticulture, forestry, biotechnology, veterinary, dairy, home science, agri-business management and other allied sectors and registered under societies registration act 1860. Since inception, the association is continuously thriving for the benefit of students of agriculture and allied sectors and working as a stake holder in framing better policies for development of agriculture through seminars, workshops, training programs and conferences and also by giving its input in important policy issues for the benefit of Indian agriculture, The association has also carried out many programs for rural development, employment generation and economic growth of rural areas for last 10 years.

About the "ELEVATE"

The event "Elevate" is focused on the stream of Atma-Nirbhar Bharat and Doubling Farmers' Income (Farmers First) in environmentally sustainable way. The name of the event "Elevate" signifies elevating/ uplifting the agricultural communities in rural areas. "Thoughts for Transformation" and the bulb signify that we are thriving for the innovative ideas and thoughts for transforming the rural economy based on agriculture and allied professions. The leaf in the bulb depicts agriculture discipline while the colors used in the logo and the rays on bulb depict different revolutions in sectors of agriculture i.e. Green (Food Grains), Yellow (oil seed Production), Blue (Fish Production), Brown (Leather / Cocoa / Non-Conventional Products), Golden (Fruits and Honey Production), Grey (Fertilizers), Pink (Onion Production / Prawn), Silver (Egg / Poultry), Silver Fiber (Cotton), Red (Meat / Tomato) and White revolution (Milk).

National level Video Making Competition

Theme: Smart Village for Smart India

Objective of Event	:	To develop a village or a village cluster for doubling farmers' income: a step towards Atma-nirbhar Bharat.
Eligibility	:	Student / Young professionals below 35 years. Participation may be Individual/Group of 2-5 members.
Mode of Submission	:	Video (Max. 20 mins), Concept note of innovative ideas and economic statistics in word file. (3 pages). A title and name of the participants must be mentioned on the top of the word file.
Participation fees	:	AIASA Members: INR 100 Non-AIASA Members: INR 250
Convenor	:	Mr. Sudhir Kumar, Senior Advisor, AIASA
Co-convenor	:	Mr. A. Mohan K. Chowdry, Vice President (SZ), AIASA
Submit to	:	smartvillage.elevate@gmail.com

National level Photography Contest

Theme: My Farmer : My Pride, Women in Agriculture, Innovation in Agriculture, Agricultural Biodiversity& Microclimate

Objective	:	Click for a change
Eligibility	:	Must be a student of Agriculture and allied discipline. Entry will be for individual only.
Mode of Submission	:	Raw Photograph with date and time.
Participation fees	:	AIASA Members: INR 50 Non-AIASA Members: INR 100
Convenor	:	Ms Sonica Priyadarshini, Senior coordinator, AIASA
Co-convenor	:	Mr. Priyank Sharma, State PRO (HP), AIASA
Submit to	:	focus.elevate2021@gmail.com

IGNITE : Young Scientist Hunt

Thrust Areas : Farmers' Prosperity, Clean Environment, Food & Nutritional security, Climate Smart Agriculture, IOT and ICT

Objective	:	To provide a platform for agriculture and allied students to present their research outcomes on thrust areas.
Eligibility	:	Research scholars below 35 years from Agriculture and allied discipline, Individual / Group up to 3 members. Group may include one advisor from faculty.
Mode of Submission	:	Summary of Research work including major findings/ publications focusing on thrust areas in word file. (3 Pages). Additional information (if any) may be submitted in a PPT.
Participation fees	:	AIASA Members: INR 100; Non-AIASA Members: INR 250
Convenor	:	Mr. Ashish Khandelwal, Chairman, NEB, AIASA
Co-convenor	:	Mr. Maruthi Prasad B.P., Senior Vice President, AIASA
Submit to	:	ignite.elevate@gmail.com

National Level Agriculture Journalist Hunt

Focus interviewee : Progressive Farmers, Cooperative groups, NGOs, Self– Help Groups and Farmer Producer Organizations working in agriculture and allied sectors

Objective	:	To enhance the interview skills of agriculture and allied students and highlighting success story of different stakeholders.
Eligibility	:	Must be student of Agriculture and allied discipline, Individual /Group of 2 members. Interviewee should be engaged in agriculture and allied fields, made outstanding contribution for rural development in respective states and recognized at various platforms for his/her professionalism, innovation and contribution to rural development.
Mode of Submission	:	Interview Video in MP4 format (Maximum 20 minutes), details regarding interviewee must be mentioned in the video/ in separate word file. interviewee.
Participation fees	:	AIASA Members: INR 100; Non-AIASA Members: INR 250
Convenor	:	Dr. Sandeep Kumar, Senior Coordinator, AIASA
Co-convenor	:	Mr. Neeraj Dixit, Vice-President (NZ), AIASA
Submit to	:	agrijournalist.elevate@gmail.com

Empower

Young Agribusiness Entrepreneur Hunt

Objective	:	To hunt innovative Young Agribusiness Entrepreneurs engaged in agriculture and allied sectors.
Eligibility	:	Young Agribusiness Entrepreneur below 40 years.
Mode of Submission	:	Pdf/ word document/ video/ PPT elucidating the innovations implemented and significant outcome for the welfare of farming community and meeting the consumer demands.
Participation fees	:	AIASA Members: INR 100 Non-AIASA Members: INR 250
Convenor	:	Mr. Pankaj Thakur, Chief PRO, AIASA
Co-convenor	:	Mr. Ankit Soni, National Coordinator - NABIIC, AIASA
Submit to	:	empower.elevate2021@gmail.com

Last date of Submission : 30th June 2021
Announcement of Result : 31st July 2021

Participation Procedure (step wise)

- ✓ Choose the competition (s).
- ✓ Pay the registration fees through payment link.
- ✓ Register for Elevate 2021 through registration link.
- ✓ Fill the instamojo payment ID you received.
- ✓ Submit your project (Photo/video/any other as required by competition) to the specified email ID.
- ❖ If participated in a group, all the participants in the group need to register themselves with the same payment ID.
- ❖ Participants need to register and pay separately for different competitions.
- ❖ Preferred languages for all kinds of submissions (Videos, PPT, PDF/Word files) are Hindi and English. If local language is used in videos, then the participants need to submit a minute to minute transcript (in English or Hindi).
- ❖ For updates regarding Elevate 2021 be in touch with us.

aiasanewdelhi *aiasa5* *AIASA* *www.aiasa.org.in*

Payment Link
https://imjo.in/9gDWWw

Registration link
https://forms.gle/qiSJQTtGTVkBfd9B9

National Organizing Committee

Patron

Dr. R. B. Singh, Ex-Chancellor, CAU, Imphal

Dr. R. P. Singh, Ex-Executive Secretary, IAUA

Chairperson

Ms. Shreya Gupta, National President, AIASA

Co-Chairperson

Mr. Tapas Paul, National General Secretary, AIASA

Organizing Secretary

Mr. Asish Kumar Padhy, Chief Coordinator, AIASA

Advisory Committee

Dr. B. K. Das, Director, ICAR-CIFRI

Dr. Ravishankar C.N., Director, ICAR-CIFT

Dr. Sahadeva Singh, Chief Policy Advisor, AIASA

Dr. M. K. Verma, Principal Scientist, ICAR-IARI

Dr. P. Adhiguru, Principal Scientist, ICAR-IARI

Dr. R. Vinoth, National Secretary (GC), AIASA

Dr. Prakash Jha, Post-Doctoral fellow, KSU, Kansas, USA

Publication Committee

Mr. Praveen Verma, Vice Chairman, National Editorial Board, AIASA

Dr. Ajay Verma, Scientist, ICAR-CIAH, Bikaner

Contact details

Chairperson

Ms. Shreya Gupta
National President, AIASA
Mob: 8505908080
nationalpresident@aiasa.org.in

Co-Chairperson

Mr. Tapas Paul
National General Secretary, AIASA
Mob: 8731073960
generalsecretary@aiasa.org.in

Organizing Secretary

Mr. Asish Kumar Padhy
Chief Coordinator, AIASA
Mob: 9464345684
chiefcoordinator@aiasa.org.in