Open Access Multidisciplinary Online Magazine

Agri-India TODAY

Monthly e-Newsletter

ISSN : 2583-0910

Volume 02 | Issue 03 | March 2022

www.agriindiatoday.in

Editorial Board

INDEX

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed
monthly newsletter

Article ID : 02/III/01/0322

PARENTAL COMPONENTS OF RNA- DIRECTED DNA METHYLATION AND ITS ROLE ON SEED DEVELOPMENT

Akash A, Karthik Kumar M, Abhishek E, and Prathap V*
ICAR – Indian Agricultural Research Institute
New Delhi-12
*Corresponding Author: prathuv1994@gmail.com

Abstract
Small RNAs are <200 nucleotide in length and are usually non-coding RNA molecules. Small RNAs are a common mechanism to protect a genome with most eukaryotes deploying at least one variety of small RNA to transcriptionally or post transcriptionally silence transposons. Suppression of transposons is particularly important in the germ line to prevent the inheritance of reactivated elements or transposon-based mutations. Small RNA trigger repressive DNA methylation at thousands of transposable elements in a process called RNA directed DNA methylation (RdDM). It is known that 24- nucleotide pol IV dependent siRNA a hallmark of RdDM are abundant in flowers and developing seeds indicating RdDM may be important during the reproduction. High rates of abortion occur when seeds have RdDM mutant mothers but, not when they have mutant fathers indicating the maternal role. In this way small RNAs from the both the parents have their effect on the seed development or on their next generation.

Introduction
In the late 1980s and early 1990s, numerous studies demonstrated that the expression of pieces of a viral genome in plants protected these plants from infection by the virus and even related viruses. It was also found that transgenes led to the silencing of endogenous genes in a homology-dependent manner. A breakthrough study by Fire and colleagues in *Caenorhabditis elegans* revealed that long double-stranded RNAs (dsRNAs) confer effective sequence-specific silencing of endogenous genes in a process named RNA interference or RNA silencing. Another breakthrough study, by Hamilton & Baulcombe, uncovered small RNAs derived from plant transgenes undergoing RNA silencing. Small RNAs are 20-30 nt in length and are usually non-coding RNA molecules. Many, although not all, small RNAs are processed from double-stranded RNAs or single-stranded RNAs with local hairpin structures by RNAse III enzymes and are loaded into argonaute-protein-containing effector complexes. Some small RNAs cause transcriptional gene silencing by guiding heterochromatin formation at homologous loci, whereas others lead to posttranscriptional gene silencing through mrna degradation or translational inhibition. There are a variety of types of small RNAs that are not only made from but target foreign nucleic acids, such as viruses and transgenes. They are also derived from endogenous loci and regulate a multitude of developmental and physiological processes. Small RNAs can inhibit the expression of target genes through PTGS, CDGS in both the cytoplasm and nucleus. Small RNAs can regulate >30% of the cell functions. So, small RNAs are involved in the regulation of all major cellular functions.

Importance of small RNA
Small RNAs play a major role in the post-transcriptional regulation of gene expression. Though RNAi was initially discovered in nematodes and plants, RNA-mediated regulation is widely found in eukaryotic organisms, and similar small RNA-guided regulatory pathways appear to be operative in prokaryotes. Eukaryotic small RNAs play critical roles in regulating gene expression in development,

cancer biology, anti-viral defense, and chromatin modification. Researchers have capitalized on regulatory pathways mediated by small RNAs to enable analyses of gene function not previously possible.

- Small RNA in cell metabolism and cell defense
- Small RNA in cell differentiation
- Small RNA in diagnosis
- Small RNA in therapy
- Small RNA in diseases
- Small RNA in apoptosis

Epigenetics

The stable heritable phenotype results from changes in a chromosome without alterations in the DNA sequence. Gene expression regulation is through the remodeling of chromatin primarily through histone modification and DNA methylation. Post-translational modifications of amino acids make up histone proteins. The addition of methyl groups to DNA is known as DNA methylation.

DNA methylation

DNA methylation is one of the most commonly found epigenetic events taking place in the genome. This change is heritable and reversible. DNA methylation is a covalent modification of DNA that does not change the DNA sequence but influences gene activity. Methylation can occur to two of four DNA bases that are cytosine and adenine. It is found in cells of fungi, plants, vertebrates, and non-vertebrates but the range of cytosine and adenine methylation is different in different species (in plants 30% of DNA cytosine is methylated). Occurs almost exclusively at cytosines that are followed by a guanine.

Mechanism of DNA methylation

Methyl groups are transferred from S-adenosyl methionine in a reaction catalyzed by a DNA methyltransferase or methylases.

Roles

- Silencing of genes
- Plays role in X- chromosome inactivation
- Suppress the expression of viral genes and other deleterious elements that have been incorporated into the genome

RNA directed DNA Methylation

RNA-directed DNA Methylation is a small RNA-mediated epigenetic pathway in plants, fungi(siRNA), and metazoans (piRNA). In the nucleus, small RNAs elicit transcriptional gene silencing by directing repressive epigenetic modifications such as cytosine methylation and histone methylation to homologous regions of the genome.

Mechanism

- RNA triggers for DNA methylation come from different sources, including invasive viral, transgene, or transposon sequences, and in some cases derived from the single-stranded RNA precursors by RNA-dependent RNA polymerases.
- The mechanisms by which RNA signals are translated into DNA methylation are not clear but certain models have been proposed.
- The models are based on studies done on Arabidopsis and are particularly common in plants.

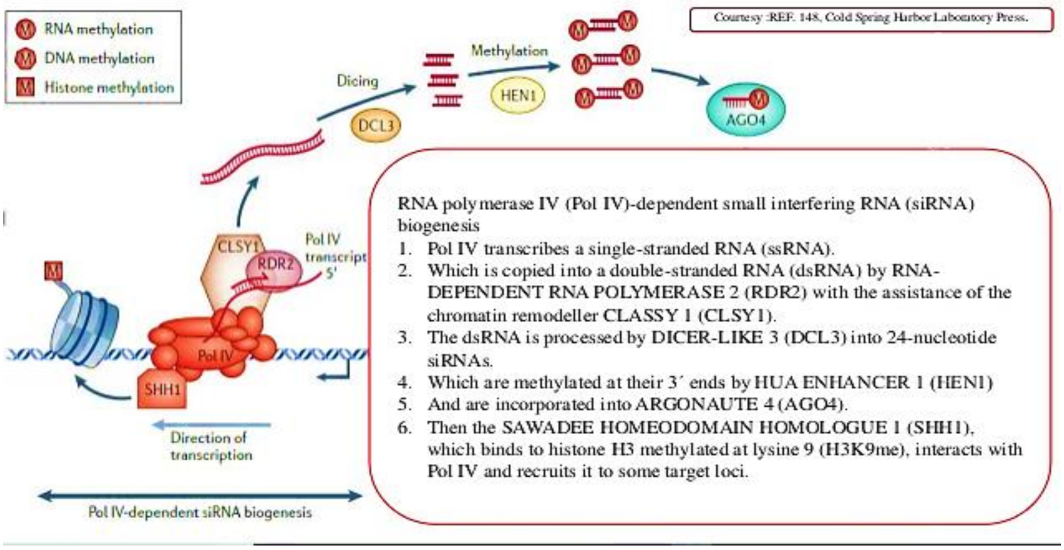


Fig 1. Mechanism of RNA dicrected DNA methylation

Small RNAs are a common mechanism to protect the genome

Small RNAs are a common mechanism to protect the genome, with most eukaryotes deploying at least one variety of small RNA to transcriptionally or post-transcriptionally silence the transposons. All the cell in our body have the same genomic DNA, but all cell does not need all genes to be expressed as they constitute different tissue that differs in structure and function. Silencing of tissue-specific genes is important to prevent them from being expressed in the wrong tissues. For these, the cell needs to deactivate some genes.

Maternal components of RNA directed DNA methylation

- Suppression of transposons is particularly important in the germline to prevent the inheritance of reactivated elements or transposon-based mutations (Iwasaki *et al.*,2015).
- Piwi-interacting RNAs in Drosophila (Brennecke *et al.*, 2008)
- easiRNAs in Arabidopsis (Martinez *et al.*, 2016)

Piwi-interacting RNAs in Drosophila

In Drosophila, Piwi-interacting RNAs (piRNAs) are produced in pre-meiotic nurse cells that surround and support the egg cell and are loaded into the egg before fertilization. These piRNAs trigger additional piRNAs production after fertilization to suppress transposons in the zygotic germline. The maternal initiation of piRNAs mediated silencing i.e, transposons inherited solely from the paternal genome can evade silencing and retrotranspose in the zygote. Hence maternal genotype influences the successful development of the seed.

easiRNAs in Arabidopsis

Plants do not encode piRNAs, and instead, use small interfering RNAs (siRNAs) to silence transposons. In the Arabidopsis male gametophyte, 21 nucleotides (nt) epigenetically activated RNAs (easiRNAs) are produced from transposon sequences in the pollen vegetative nucleus, a haploid cell that supports the sperm cells but does not contribute to the zygote (Slotkin et al., 2009). These easiRNAs are transferred to the sperm cells, where they can silence homologous transcripts post-transcriptionally. This demonstrates the role of paternal genotype in the development of the seed.

References

Brennecke, J., Malone, C. D., Aravin, A. A., Sachidanandam, R., Stark, A., & Hannon, G. J. (2008). An epigenetic role for maternally inherited piRNAs in transposon silencing. *Science*, *322*(5906), 1387-1392.

Iwasaki, Y. W., Siomi, M. C., & Siomi, H. (2015). PIWI-interacting RNA: its biogenesis and functions. *Annual review of biochemistry*, *84*.

Klattenhoff, C., & Theurkauf, W. (2008). Biogenesis and germline functions of piRNAs. *Development*, *135*(1), 3-9.

Malone, C. D., & Hannon, G. J. (2009). Small RNAs as guardians of the genome. *Cell*, *136*(4), 656-668.

Martínez, G., Panda, K., Köhler, C., & Slotkin, R. K. (2016). Silencing in sperm cells is directed by RNA movement from the surrounding nurse cell. *Nature plants*, *2*(4), 1-8.

Matzke, M. A., & Mosher, R. A. (2014). RNA-directed DNA methylation: an epigenetic pathway of increasing complexity. *Nature Reviews Genetics*, *15*(6), 394-408.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed
monthly newsletter

Article ID : 02/III/02/0322

SOIL AGGREGATES- A SOIL HEALTH INDICATOR

Megha Vishwakarma and G.S. Tagore
[1] Assistant professor, Shri Vaishnav Institute of Agriculture,
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore (M.P.)
[2] Scientist, Jawaharlal Nehru Krishi Vishwa vidyalaya, Jabalpur (M.P)

Introduction

A group of primary soil particles (sand, silt and clay) that cohere to each other by moist clay, organic matter (like roots), gums (from bacteria and fungi) and by fungal hyphae is called soil aggregates."

Soil aggregates are important in the formation of soil structure and for soil health. Aggregate stability is important in agriculture since it determines how well an agro ecosystem will work. Well-aggregated soils have a lot of aggregates, and this condition is regarded to be particularly desirable for a variety of reasons. Aggregates are necessary for a variety of basic soil processes, including retaining nutrients and preventing erosion, as well as maintaining root systems and minimizing water stress, provide a home for soil microorganisms, enable for the growth and penetration of plant roots, help in nutrition transportation and cycling. The spaces between soil particles and soil aggregates are known as soil pores. Air and water storage, as well as gaseous exchange, are influenced by the pore spaces in soil. Erosion is less likely in soils with a high aggregate stability. When stable aggregate subjected to disruptive forces such as water, they maintain their shape and do not easily disintegrate.

These aggregates are clumps of soil that range in size from micro (less than 0.25 mm in diameter) to macro (more than 0.25 mm in diameter) (greater than 0.25 mm in diameter) each class having specific benefits for soil health. Organic components bind silt and clay particles together form micro aggregates. This results in the formation of a long-term organic matter pool. Macro aggregates are made up of silt/clay particles, micro aggregates, and organic components. Plant roots, mycorrhizae, and earthworms all play a part in the creation of macro aggregates. These larger aggregates decompose more quickly, supplying organic materials to roots, bacteria, and fungi. Because of the wide soil pores, water can easily permeate the soil.

Practices that lead to poor aggregate stability include:

- Tillage methods and soil disturbance activities that breakdown plant organic matter, prevent accumulation of soil organic matter, and disrupt existing aggregates,
- Cropping, grazing, or other production systems that leave soil bare and expose it to the physical impact of raindrops or wind-blown soil particles,
- Removing sources of organic matter and surface roughness by burning, harvesting or otherwise removing crop residues,
- Using pesticides harmful to beneficial soil microorganisms.

Managing Soil Aggregates

1. **Reduced or no-till systems-** The level of soil aggregation is directly influenced by management approaches. Reduced or no-till systems enhance aggregation, whereas high-intensity tillage practices inhibit aggregation. Tilling breaks up macro aggregates, which limits their production and leaves microscopic soil particles behind. This closes pore spaces

and makes it difficult for water to penetrate the soil. Minimal tillage, for example, minimizes soil disturbance and promotes the establishment of micro aggregates within macro aggregates, resulting in long-term carbon and organic matter storage."

2. **Cover Crops-** It's critical to keep soil covered in order to keep it intact. The impact of erosive forces on the soil is reduced by vegetative cover. By limiting evaporation and increasing water infiltration, a cover crop mulch can improve moisture availability. Cover crop residue aids in weed control, which is especially crucial in organic no-till farming.
3. **Cropping diversification**- Promoting a cropping diversification. Perennial plants and meadows have extensive root systems and do not require tillage. The dense, fibrous, rooting system of perennial grasses and shallow-rooted legumes creates a very active biological zone near the surface.
4. **Grazing management**- Grasses have strong root systems, but over grazing by animals can disturb the forage chain. There are numerous techniques to graze animals while maintaining or improving soil stability.
5. **Crop rotation**- Crop rotation means changing the type of crop grown on a particular piece of land from year to year. Legumes (and their rhizobial partners) promote aggregation by producing binding agents. On the other hand, legumes have a less fibrous root architecture than grasses, which are linked to more macro aggregation in the topsoil. A higher root length density (length of roots per volume of soil) than, resulting in stronger, denser, and more stable soil macro aggregates loaded in SOC. When exposed to erosive forces, poorly aggregated soils disintegrate quickly.
6. **Increase soil organic matter content-** Organic matter is broken down by soil organisms. When these organisms break down, they emit organic substances which act as the "glue" that binds soil aggregates. A polysaccharide is an organic substance released into the soil by microbes and roots that are made up of several simple carbon compounds linked together in a long chain that can make contact with many soil particles and is linked to the formation of aggregates.
7. **Soil microorganism**- Soil microorganism plays an important role in maintaining structure and health. Fungi form nets rather than glues. These networks of fungal is called mycelia (the organism's vegetative portions) binds small aggregates together and forms large aggregates. Macro aggregates are kept together by fungal hyphae, which drive vital biological activity in the root zone, much like micro aggregates are held together by microbial glue. Fungal hyphae and fine roots are essential for minimizing erosion, physically protecting aggregates, and keeping soil in your field where it belongs. Bacteria produce EPS, which is a slimy polymer secreted by bacteria (extracellular polymeric substances). These can operate as stronger soil glues, create aggregate and keeping soil moisture levels stable. Plant roots continuously release organic substance into the soil in the rhizosphere which is called root exudates. Exudates provide food for the microorganisms, in addition to assisting plants in obtaining nutrients. Exudates act on the micro level, whereas roots and fungi in the soil hold bigger clumps of soil together. They bind soil particles together in critical mechanical networks, much like glue. Exudates' influence on the soil can be transitory, whereas the binding actions of roots and fungal networks are usually long-term. Microbes

consume and convert root exudates, thus they don't persist long in the soil in their natural state." The addition of organic materials improves the aggregate's strength and stability.

Conclusion- Soil aggregation can be influenced by soil disturbance methods or indirectly by biotic and abiotic variable that regulate soil stability. Soil aggregates play a crucial role in the establishment of soil structure and the health of the soil. As a result, we should implement techniques that promote soil aggregation.

References

- Nets and Glues: How Microbes Build Soil Structure | EcoFarming Daily, https://www.ecofarmingdaily.com/nets-and-glues-how-microbes-build-soil-structure-sponsored.
- Soil Health - Formation of soil aggregates. www.soilhealth.com/soil-health/biology/formation.htm
- Soil Quality for Environmental Health, soilquality.org/indicators/aggregate_stability.html.
- Kemper, W. D. & Rosenau, K. [Size distribution of aggregates] Methods of Soil. Analysis, Part 1 [Klute, A. (ed.)] [425–442] (ASA, Madison, 1986).
- What are soil aggregates? – Soils Matter, Get the Scoop!

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed monthly newsletter

Article ID : 02/III/03/0322

AQUA-MEDICINCE USED IN AQUACULTURE SYSYETEM

[1]Devati*, [1]Niranjan Sarang and [2]Tameshwar
Fisheries Polytechnic, Dau Shri Chandrakar Kamdhenu
Vishwavidyalaya, Durg, Chhattisgarh, India
Email: devatijaiswal@gmail.com

Abstract
The majority of farmers lack knowledge and information about the quality and usability of aqua-drugs and chemicals, and they rely on local consultants or representatives to apply them to aquaculture. Some medicines and chemicals that are commonly used in animal medicine and agricultural procedures have found their way into aquaculture. Apart from this, anthropogenic activities have resulted in the release of vast amounts of pharmaceuticals, chemicals, pesticides, and antibiotics into aquatic systems, primarily through human waste and agricultural runoff. Uncontrolled use of antibiotics and pesticides may result in the growth and spread of antimicrobial resistant bacteria, posing a risk to humans, seafood, and the environment.

Keyword : Pesticides, Antibiotics, Oxytetracycline, Oxolinic acid, Flumequine

Introduction

In India, aquaculture has been a long-standing tradition that has evolved into a major commercial activity. With the increase in aquaculture practices leading to increase fish production, aquatic animals have come across a series of health threat due to environmental stress, invasion of infectious pathogens and increased incidence of fish disease outbreaks. This has lead to enhancement in application of a wide range of aqua–medicines, drugs and chemicals in aquaculture to control production loss. Aqua-medicine are not only important for fish health management, but also for increasing fish production and growth, fecundity, and reducing disease occurrence, as well as reducing loss due to mortality by increasing total production of fish and other commercial aquatic organisms, manipulation and enhancement of reproduction, growth promotion, processing, and value addition of the final product.

Table 1: Chemicals use for pond preparation and water quality management

Trade Name	Active ingredients	Dose	Source
Zeofresh	SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, TiO_2	24kg/acre	Square Pharmaceuticals Ltd
Zeocare	SiO_2, A12O_3, Fe_2O_3, CaO, MgO, Na_2O	200g/acre	Nature care
Zeolite Gold	SiO_3, MgO, CaO_2 etc.	25kg/acre	Fishtech BD Ltd.
Mega Zeo Plus	SiO_2, $A1_2O_3$, Fe_2O_3, CaO, MgO, Na_2O, K_2O and Mn	20kg/acre	ACI Animal Health Ltd.
JV Zeolite	SiO_2, $A1_2O_3$, Fe_2O_3, CaO, MgO, Na_2O, K_2O and Mn	22kg/acre	Eon Animal Health Ltd.

Table 2: List of disinfectant used in aquaculture system

Trade Name	Active ingredients	Dose	Source
Aquakleen	Tetradecyl Trimethyl Ammonium Bromide: 6.6 g, BKC-83g, Amino Nitrogen-10000ppm	1L/acre	Square Pharmaceuticals Ltd
Timsen	n-Alkyl dimethyl benzyl ammonium chloride 40%, stabilized urea60%	20-80g/33 decimal	Eon Animal Health Products Ltd
Virex	Potassium Peroxymono sulphate 50%	100-200 /33 dec	ACI Animal Health
Polgard plus	3-Methyl and 4-Methyl two chain brominated compound	500 ml/acre	Fish tech (BD) Limited
Pathonil	Alkyl dimethylbenzyl ammonium chloride 80%, BKC 80%	200ml/33 decimal	ACI Animal Health

Table 3: Chemical used for Oxygen enhancer in aquaculture system

Trade Name	Active ingredients	Dose	Source
Oxylife	Sodium percarbonate	500gm-1kg/acre	Square pharmaceuticals Ltd.
Bio ox	Sodium carbonate, H_2O_2	500gm-1kg/acre	ACI animal health
ACI-OX	Sodium carbonate, H_2O_2	500gm-1kg/acre	ACI animal health
Oxy flow	Sodium carbonate, H_2O_2	500gm-1kg/acre	Elanco Ltd.
Oxy-Ren	Sodium carbonate	500gm-1kg/acre	Renata Ltd.

Table 4: List of chemicals used for disease treatment in aquaculture system.

Trade Name	Active ingredients	Dose	Source
Potash	$KMnO_4$	5-15 gm/decima	Chemical seller
Salt	NaCl	250gm/decimal	Chemical seller
Timsen	n-Alkayl di-methyl benzyl ammonium chloride + stabilize urea	80 g/33 decimal.	Eon animal health products ltd.
Aquakleen	Each 1L contains: Tetradecyl Trimethyl Ammonium Bromide: 6.6 g, BKC-83g, Amino Nitrogen-10000ppm	1L/acre	Square Pharmaceuticals Ltd
Virex	Potassium Peroxymono sulphate 50%	100-200/ 33 decimal	ACI Animal Health

Table 5: List of antibiotics used for disease treatment in aquaculture system.

Trade Name	Active ingredients	Dose	Source
Renamycin	Oxytetracycline	5gm/kg feed for 5 days	Renata pharmaceuticals ltd.
Otetra-vet 20%	Oxytetracycline	5gm/kg feed for 5 days	Square pharmaceuticals ltd.
Biomycin	Oxytetracycline	5gm/kg feed for 5 days	Biopharma Ltd

Trade Name	Active ingredients	Dose	Source
Aquamycine	Oxytetracycline	5gm/kg feed for 5-7 days	ACI Animal Health Ltd.
Oxy-D Vet	Oxytetracycline 20% Doxycycline 10%	5-10 g/Kg body wt. for 5-7 days	Eon Animal Health Ltd

Table 6: List of chemicals used as growth promoter in aquaculture system.

Trade Name	Active ingredients	Dose	Source
Aqua Savor	Amino acid premix	2-3 kg /Ton feed	Eon Animal health Products Ltd.
Eon Fish Grower	Multivitamin and Minerals	1.5-3 g/Kg	Eon Animal health Products Ltd.
Aqua Gel	Amino Acid, Fatty Acid, Macro and macro minerals and natural antioxidants	5-10 g/ Kg feed for prevention 10-15 g/Kg Feed	Square Pharmaceuticals Ltd.
Panvit Aqua	Vit- A, D_3, B_1, B_2,	In hatchery 05-1 ml/ ton water and for nursery 5-10 ml/kg feed	Square Pharmaceuticals Ltd.
Square Aquamix	Vitamin, Minerals, Amino Acid, Probiotic, Yeast and Antioxidant	1g/ kg feed	Square Pharmaceuticals Ltd.

Table 7: List of chemicals used for toxic gas removal in aquaculture system.

Trade Name	Active ingredients	Dose	Source
Gastrap	Lactic acid Bacillus, Bacillus subtilis and Enzymes	200 mg/acre	Square pharmaceuticals Ltd.
Bio-Aqua-50	Yucca plant extract, Saponin Components Glyco components	60-70 ml /33 dec	Eon animal health Co. Ltd.
Gasonex plus	Na-lorile ether sulphate	200-400 mg/Kg Zeolite	Fish tech. (BD) Co. Ltd.
Aqua Magic	Azotabactor chorococcum, Bacillus subtilis, candida utilis	400g/acre	Fish tech. (BD) Co. Ltd.
Ammonil	Yucca plant extract, Bacillus subtilis, candida utilis	100-200 g/acre	Fish tech. (BD) Co. Ltd.

Table 8. List of available immunity increaser in aquaculture system.

Trade Name	Active ingredients	Dose	Source
Ossi-C	Oxolinic Acid, Beta glucan, Vitamin C	4-5g/ Kg feed	Fish tech (BD) Limited
Vitex C	Vitamin C BP	1-5g/ kg feed, 2-5 g/1000 Litre for hatchery	Eon Animal health Products Ltd.
Cevit- Aqua	Ascorbic Acid	For prevention 1 g/ kg feed and for treatment 2-3 g/kg feed	Square Pharmaceuticals Ltd.
Aqua C	Ascorbic Acid	0.1-0.3g/kg feed	ACI Animal Health

Trade Name	Active ingredients	Dose	Source
Osmosaline	Betain	5-10g/100 Litre(Fry transportation), 10- 20g/1000 Litre (Hatchery tank)	Eon Animal health Products Ltd.

Conclusion

Aquaculture has become the world's fastest-growing food producing sector. Aquaculture medications are important components in aquatic animal health management, pond construction, soil and water management, feed composition, reproduction modification, growth stimulation, processing, and value addition of the final product. Indiscriminate use of such antibiotics and chemicals may lead to development and spread of antimicrobial resistant bacteria and resistance genes and occurrence of antimicrobial residues. All that may induce a negative impact on human, fish and the environment.

References

Mishra, S.S., Das, R., Das, B.K., Choudhary, P., Rathod, R., Giri, B.S., Debbarma, J., Sahoo, S.N., Barua, A., Sahu, A. and Patil, P.K (2017). Status of Aqua-medicines, drugs and chemicals use in India: A Survey Re-port. J Aquac Fisheries, 1: (004).

Kawsar, M.A., Alam, M.T., Ahamed, S. and Mou, M.H (2019). Aqua drugs and antibiotics used in freshwater aquaculture of North Chittagong, Bangladesh. Int. J. Fish. Aquat. Stud, 7, pp.28-34.

Singh, M. and Singh, P (2018). Drugs and chemicals applied in aquaculture industry: A review of commercial availability, recommended dosage and mode of application. J Entomol Zool Stud, 6(6), pp.903-7.

Subasinghe RP, Barg U, Tacon A (1996). Chemicals in Asian aquaculture: need, usage, issues and challenges. In: Use of Chemicals in Aquaculture in Asia. Arthur, J. R., Lavilla-Pitogo, C. R. and Subasinghe, R. P. (eds). Southeast Asian Fisheries Development Center, Aquaculture Department Tigbauan, Iloilo, Philippines, 1-6.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed monthly newsletter

Article ID : 02/III/04/0322

IMPACT OF COVID-19 PANDEMIC ON FISH PROCESSING INDUSTRY IN INDIA

[1]Tameshwar*, [1]Niranjan Sarang, [2]Devati, and Omkar Sahu[3]

Fisheries Polytechnic, Dau Shri Chandrakar Kamdhenu
Vishwavidyalaya, Durg, Chhattisgarh, India
Email: tameshwar400@gmail.com

Abstract

Around the end of December 2019, the COVID-19 pandemic broke out, causing a worldwide public health emergency. The epidemic has had an impact on the global economy. The fisheries industry and fish farming sectors are among the hardest hit. Due to lack of transportation facility, scarcity of labors fish feeds and fish seeds. Various import and export activities were also hampered as a result of the limitations. Due to stringent road traffic management, demand and supply lines were interrupted, resulting in material dumping.

Introduction

COVID-19 (Corona Virus Disease 2019) began as a locally circulating illness. The WHO declared the COVID-19 outbreak a pandemic on March 11, 2020, citing an increasing number of cases recorded outside of China, from Eastern Asia to Europe and North America (WHO, 2020a). In India first case of COVID-19 infection in Kerala, India is presented here. A 20-year-old woman presented to the Emergency Department of the General Hospital in Thrissur, Kerala, on January 27, 2020, with a one-day history of dry cough and sore throat (Andrews *et al*., 2020). A shortage of labour, a significant reduction in consumer purchasing power, and an increase in health-care missions are all issues that have badly impacted the fish processing industries. India is the world's third-largest producer of fish and the second-largest producer of aquaculture. According to a recent estimate by the National Fisheries Development Board, the fishing industry alone employed 145 million people, contributed 1.07 % to GDP, and earned export earnings of Rs 334.41 billion. According to the National Institute of Agricultural Economics and Policy Research, demand is expected to increase to 11.80 million metric tonnes by financial year 2021(NFDB, 2021).

Impacts of COVID-19 on Seafood Sector

In terms of value and quantity, India exports 50 different varieties of fish and fish products worth INR 451.06 billion and 1.377 million tonnes, respectively (Ngasotter *et al*., 2020). In recent years, India's seafood industry has been recognized as a key source of nutritional benefits and employment, as well as a significant economic boost. India is the world's fourth largest seafood exporter, with a 4.41 % total share of the global seafood market with plans to grow to 6.7 percent by 2030 (Bureau ET., 2020). But the current situation has slowed down the growth of this industry. The pandemic has awfully impacted the backbone of this sector that includes integration of the production of seafood, supply chain, export and marketing, employment, and consumption.

Employment crisis due to COVID-19

The Indian fisheries sector employs about 15 million people, with women accounting for 65 percent of total workers in processing industries. Workers faced a new sort of immobility during the epidemic, when fishing activities were abruptly halted or processing industries were shut down. In both cases, people are losing jobs or receiving lower pay because the majority of processing and fishing businesses are self-funded, and the owners are unable to maintain daily wages for workers; the situation is similar around the world. Hatcheries, feed mills, and other related businesses in the fisheries industry have closed as a result of the prolonged lockdown, interruption in internal and international trade, and reduced demand from importing countries. The unemployment problem has led to severe predictions about COVID-19's extremely detrimental impact. The administration is currently dealing with a severe issue: jobless and homeless migratory laborers finding interstate borders closed (Mukherjee *et al*., 2020).

Impact of COVID-19 on trade and distribution

50% reduction in export has been predicted due to stringent lockdowns during this pandemic, losses incurred is estimated to be Rs 4883.24 crores. Many retailers have devised strategies for delivering things to customers' homes. However, due to government-imposed supply constraints, demand is not satisfied with enough supplies. Many processing plants have been forced to close due to an abundance of products that cannot be transported and require more frozen storage. Following the shutdown, the trade has gradually reopened, but it is currently experiencing challenges like as lower demand for certain species or products, as well as a drop in prices. A global food catastrophe might be triggered if the supply network is disrupted (Stoll., 2020).

Decrease fish consumption due to COVID-19

Seafood is a nutritious option that is becoming increasingly popular around the world. Consumers are worrying about eating fresh seafood because of a false belief that the new coronavirus originated in a seafood store in Wuhan, China. Although it has been stated that fish and shellfish do not host the virus, the risk of infection from afflicted food workers and merchants must be overlooked. The commerce of fresh and frozen seafood is harmed to some extent in this scenario. Consumers may see these items as less scary, non-perishable, and a little cheaper, which may be the reason for the growth in consumption of processed, packaged, and canned foods. It's encouraging to see more attention being paid to processing sectors, but the dwindling demand for fresh and live seafood must also be addressed.

Recovery of the sea food sector

It was impossible to recover and reestablish the industry overnight. Newer policies, as well as changed attitudes and behaviors in both government and community, must be implemented gradually to solve the issues. The government enforced lockdowns and border restrictions as an early response to the looming pandemic, ensuring public safety across the country. All large-scale fishing activity were halted as a result of the lockdown. Fortunately, the government has exempted fishing activities, including culture, capture, processing, and sale, from the limitations designating the industry as an essential one after only a few days of the lockdown.

Catching of marine fishes after lockdown

All minor efforts and activities combined will undoubtedly be able to mobilise the system and make it more functional than before, allowing the system to meet its 7 billion export goals and gain a greater portion of the global market. Many measures are being done, and the prime minister's "Atma-Nirbhar Bharat" (Self-Reliant India) plan, which includes INR 20 lakh crores, will undoubtedly boost the fisheries sector. Additionally, by bolstering India's fisheries industry, the Pradhan Mantri Matsya Sampada Yojana (PMMSY) is projected to facilitate a "Blue Revolution". This scheme (with a budget of INR 20,050 crores) will be implemented over a five-year period. It will undoubtedly enhance the fishing community's socioeconomic well-being by increasing income, employment, and the sector's future prospects. With the passage of time, the epidemic will inevitably cease, and worldwide markets and trades will resume as before, and the Indian seafood sector is expected to achieve new heights in no time (Anonymous; 2020 and Kumaran *et al*., 2021).

Conclusion

The COVID-19 outbreak has been declared a worldwide health emergency, with growing concern about its impact on poor countries like India. With 1.3 billion people and a terrible economic state prior to COVID, a lengthy shutdown would be disastrous for the economy. Agriculture and related industries, in particular, will be particularly susceptible. With its effective government, India has taken the crisis as a challenge and is doing everything possible to combat the pandemic. Simultaneously, the government and policymakers must be prepared to mitigate the shock and the economy's V-shaped recovery in the post-COVID period.

References

Andrews, M.A., Areekal, B., Rajesh, K.R., Krishnan, J., Suryakala, R., Krishnan, B., Muraly, C.P. and Santhosh, P.V (2020). First confirmed case of COVID-19 infection in India: A case report. The Indian journal of medical research, 151(5), p.490.

Anonymous.12 May 2020. Press information bureau, government of India. Accessed. Available:https://pib.gov.in/PressReleseDet ail.aspx?PRID=1623418

Kumaran M, Geetha R, Antony J, Vasagam Kk, Anand Pr, Ravisankar T (2021). Prospective impact of Corona virus disease (COVID-19) related lockdown on shrimp aquaculture sector in India–a sectoral assessment. Aquaculture. 531:735922.

Mukherjee, S., Ikbal, A., Ngasotter, S., Bharti, D., Jana, S., Mondal, A. and Pahari, T (2020). Impact of COVID-19 on Indian seafood industry and potential measures for recovery: a mini-review. Curr. J. Appl. Sci. Technol, 39(48), pp.519-527.

Ngasotter S, Panda Sp, Mohanty U, Akter S, Mukherjee S, Waikhom D (2020). Current scenario of fisheries and aquaculture in india with special reference to Odisha: A review on its status, issues and prospects for sustainable development. Int J Bio-Resource Stress Manag 11(4):370-380.

Stoll Js, Harrison Hl, De Sousa E,Callaway D (2020). Collier M, Harrell K et al. Alternative seafood networks during COVID-19: Implications for resilience and sustainability.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed
monthly newsletter

Article ID : 02/III/05/0322

TYPES OF FISH PONDS AND THEIR IMPORTANCE IN AQUACULTURE

Jham Lal[1], Tameshwar[2], Shivbhajan[1], Narsingh Kashyap[3] and Shatrupa[4]
[1]College of Fisheries, Lembucherra, Central Agricultural University, Imphal
[2]College of Fisheries, Mangalore, Karnataka Veterinary,
Animal and Fisheries Sciences University, Bidar
[3]Institute of Fisheries Post Graduate Studies
TNJFUVaniyanchavadi, Chennai
[4]College of Fisheries, Dholi,
Dr. Rajendra Prasad Central Agricultural University, Samastipur
Corresponding Author: jhamlalj@gmail.com

Abstract
Creating a nice fishing pond is more than just piling up some dirt to impound water and stocking fish. A well-designed pond can produce an ecosystem that will sustain a variety of creatures, both plant and animal, that are beneficial to fish. A pond, with correct stocking and care, may generate high-quality fisheries, benefit terrestrial animals, and be relatively low-maintenance. Different types of ponds are used for different purposes in a fish farm.

Keywords : Pond, Overwintering, Isolation, Quarantine

Introduction
Ponds are one of the most dependable and cost-effective sources of water. Ponds are presently used for a multitude of functions, including cattle and irrigation water, fish production, field and orchard spraying, fire protection, energy conservation, wildlife habitat, recreation, and landscape development. The effectiveness of fish farming is heavily dependent on the design and construction of fish ponds. Local knowledge is crucial, and landowners are encouraged to consult with pond-building specialists. The basic concepts for fish farms include numerous ponds for various tasks in fish production (Ch *et al.*, 2019).

Types of fish ponds
Following farms differ in their requirements concerning cultural practices and has a different type of ponds.

1. Fish seed farm-maintains fish broodstock and has facilities for breeding & seed production (larval rearing).
2. Fish production farm- maintains fish seed stock & produces table-size fish.
3. Fish seed cum production farms- maintains broodstock and produces both fish seed and table size fish.
4. Research farms maintain a variety of ponds for rearing fish seed, broodstock, and table size fish along with overwintering, isolation, and quarantine ponds to store fish stocks for selection, protection, or screening purposes.

Site for fish pond
The pond site is the location where fish ponds are constructed. When selecting a location for fish ponds these characteristics must be considered: Water supply, Soil, rocks, and trees, supporting services. The fish ponds can be made almost anywhere, but some sites are better than others and

maybe developed more economically. Fish ponds could be constructed where the soil is suitable as well as beneficial for fish culture (Ezenwa, 1974).

Shape, size, and depth of the pond

The shape of contour and paddy-type fish ponds should be rectangular or square, preferably the former. The shape of barrage ponds should be as regular as feasible. Ponds irregular in shape are complicated for crop production as well as the harvesting of fish. The size of a fish pond in the area of the water surface is usually given in acres. The length and width of yards can be used to calculate the area of rectangular ponds (Mutter, 1972).

Nursery pond

In the nursery pond, the culture period requires 15-30 days to produce fry size fish. These ponds are required for rearing 2-3 days old spawn to early fry (1.5-2.5 cm), fry (2.6-4.0 cm), or late fry (4.1-6.0 cm) stage, in an environment free from all types of enemies or factors which affects spawn survival & growth, e.g. aquatic weeds, aquatic insects, predatory weed/predatory fishes, etc. The size of these ponds generally varies from 0.05-0.10 acres (200 m²-400m²)

Rearing pond

In the rearing pond, the culture period requires 30-60 days to produce fingerling size fish. Rearing ponds are used for rearing fry/advanced fry too early fingerling (6.1 8.0cm), fingerling (8.1-10.0 cm or advanced fingerlings (10.0-12.5 cm) for stocking of production ponds. Survival of fish seed in the production ponds increases with an increase in size from fry to fingerling. The size of these ponds generally varies from 0.1-0.5 acres (400 m²-2000m²).

Production Pond

In rearing ponds rearing of fish fingerlings size to table size or marketable size. It ponds are referred to as stocking ponds as well as production ponds. In the production pond, the culture period requires 6-12 months to produce marketable size fish. Production ponds are used for rearing table-size fish either by stocking late fry or fingerling stages (depending upon the availability of size). However, it is recommended to stock the production ponds with fingerlings for higher growth and survival of fish. The size of these ponds generally varies from 1-5 acres (4000 m²-20000 m²).

Conditioning pond

Conditioning of fish before transportation or manual handling (e.g. for hormone injection of broodstock for induced breeding). A conditioning period is required for 4-48 hrs depending on the fish size. Fish needs to be conditioned before transportation for its acclimatization to crowded conditions while transportation and reducing its oxygen requirement through defecation (by keeping the fish unfed during conditioning), is generally done in small cemented flow-through tanks or ponds (50-100m).

1. Fish are kept in crowded conditions and the period of conditioning depends on the size of fish to be transported. Conditioning requires 5-12 hrs for fry, 12-14 hrs for fingerlings, up to 48 hrs for broodstock.
2. Broodstock of fish also requires conditioning before being handled for being injected during induced breeding of fish. It is also done in small cemented flow-through tanks or ponds (25-50 m²). Fish is not fed during this period and kept in well-aerated flow-through conditions.

Overwintering pond

Overwintering ponds are providing warmer comfortable conditions to cold-sensitive species (e.g. catfishes, murrels, freshwater prawns, etc.) during the winter season to prevent the mortality of fish during winters. Many warm-water species are unable to survive if the water temperature falls below 15°C. Hence, to protect them from low temperatures they are kept in a protected environment for overwintering.

e.g.

- Keeping fish under poly house conditions
- Addition of fresh underground water in the evening hrs and using thermostats
- Keeping fish in deep ponds with the comfortable warmer bottom zone.

Isolation Pond

To keep fish stocks in isolated conditions e.g. diseased stock, different generations, different strains, male or female stocks, etc. Some fish stocks are required to be kept under isolated conditions at the farm. e.g. Diseased stock- during treatment, so that it does not affect the other stock at the farm Different generations & different strains of fish-different generations produced from crossing of selective parents and wild strains of a species collected from different water resources (in different geographical areas) for genetic up-gradation of broodstock- are also required to be kept in different ponds for development of genetically improved broodstock for quality seed production. Male or female stocks- some species are prolific breeders (they breed naturally even under captive conditions). For such species, males and females are required to be kept in isolated ponds to prevent inbreeding and take up selective breeding programs for stock improvement.

Quarantine ponds

To keep stocks under observation for the presence of pathogens/parasites e.g. stocks imported from other countries or procured from a different geographical area within the country. Stocks of fish (especially in the case of ornamental fishes) which are procured from far off places within or outside the country for stock enhancement, is required to be screened w.r.t. presence of any pathogen or parasite to protect the indigenous or already existing stocks at the farm from any kind of serious disease outbreak and subsequent stock loss. Screening of fish is done by keeping them in a quarantine pond for at least 3-4 weeks under observation for the appearance of any kind of symptoms of infection or disease. Similarly, the fish seed of food fishes procured from other states shall also be kept in separate nursery ponds for at least 3-4 weeks for screening before being released into the production ponds.

Conclusion

Both isolation & quarantine ponds need to be constructed at a safe distance of at least 50 m from the farm area, with a separate drainage system, so that there is no chance of accidental entry of water or fish stock from these ponds into other ponds of the farm.Different types of ponds are used for rearing different age groups of fishes such as fry, fingerling as well as table size fish on a farm. Nursery ponds are usedforthe spawn to fry, rearing pond for fry to fingerling, and stocking pond for the table as well as the marketable size of fish rearing.

Reference

Ch, B., Singh, R. K., Sureshchandra, N., Soranganba, N., Sobita, N., Singh, T. B. &Prakash, N. (2019). Fish farm design and pond construction for small-scale fish farming in Manipur. Technical

Bulletin No. RCM (TB)-12. ICAR Research Complex for NEH Region, Manipur Centre, Lamphelpat, Imphal, 27page.
Ezenwa, B.I.O. (1974). Acclimatization experiments with mullet fry/fingerlings in freshwater ponds. Annual Report of the Federal Department of Fisheries, Lagos.
Mutter, N.E.S., (1972). Niger Valley Survey Appraisal Mission September-December, 1971: Final report. Overseas Development Administration, U.K., PROP/6/72.

Article ID : 02/III/06/0322

MICROBIALS: AN ENVIRONMENTAL FRIENDLY APPROACH FOR INSECT PEST MANAGEMENT IN RICE ECOSYSTEM

[1] Golive Prasanthi, [1] Rath PC, [2]Debjani Dey and [1] Anjan Kumar Nayak

[1]Division of Entomology, ICAR- National Rice Research Institute, Cuttack753006
[2]Division of Entomology, ICAR- Indian Agricultural Research Institute, New Delhi 110 012
*****Email: prasanthi.golivi@gmail.com (corresponding author)

Rice is the staple food for almost half of the world population. From seedling to storage several Biotic and abiotic factors influence the field population of insect pests. Damage due to pests can be minimized if appropriate control measures are taken in time. Casual and indiscriminate application of insecticides for insect control has not only incited resistance and resurgence of pests, but also threatened human health and environment. Most insects have several associated natural enemies and diseases. Intelligent use of these natural biological organisms would suppress the pests as well as maintain ecological balance. As biopesticides are relatively safe for human beings and are highly effective for many pests and they can be used to control green leaf hopper (GLH), brown plant hopper (BPH) and white backed plant hopper (WBPH) *etc* in the rice ecosystem. Microbial insecticides include microscopic living organisms viz., bacteria, fungi, nematodes, protozoa and viruses and the toxins produced by these organisms. Epizootic of leaf folder (LF) by *Pseudomonas* spp (Dangar TK., 2008)., suppression of LF by *Zoophthora radicans*, BPH by *Metarhizium* spp. and infection are evidences of successes of entomopathogenic microbes.

Commercial bacterial and fungal formulations available in the Indian market

The share of microbial pesticide is less than 5 % of the Indian pesticide market (CIB&RC), and most of it is Bt-based. Although, biopesticides are effective against rice pests but they are not used due to ignorance and non-availability of the products. Popularization of these formulations would benefit the farmers and also the environment. In India at present only about three Bt and six fungal formulations are registered in CIB&RC for paddy pest control (Tables 1).

Table 1. List of entomopathogens registered for rice pests in India

Insect pest	Microbial bioagent	Accession No/ Strain	Dose/ha Formulation (g/ml) /%	Dilution in water (l /ha)
Stem borer (*Scirpophaga incertulas*) and Leaf folder (*Cnaphalocrocis medinalis*)	*Bacillus thuringiensis* var. krustaki,	serotype H-39, 3B, Strain Z-52	500-750	-
Stem borer (*Scirpophagaincertulas*) and Leaf folder (*Cnaphalocrocis medinalis*)	*Bacillus thuringiensis var. krustaki* 2.5% AS	(Spicbio-BTK AS)	1.50 kg.	500-750
Leaf folder (*Cnaphalocrocis medinalis*)	*Bacillus thuringiensis var. galleriae* 1593 M sero type H 59 5b,	1.3% flowable concentrate Potency 1500 IU/mg	1.0-3.0	1000

Insect pest	Microbial bioagent	Accession No/ Strain	Dose/ha Formulation (g/ml) /%	Dilution in water (l /ha)
Rice leaf folder (*Cnaphalocrosis medinalis)*	*Beauveria bassiana* 1.15% WP. (1x10^8 /gm min)	Accession No – MCC 1022, Strain BB-ICAR-RJP	2.5 kg.	750-850
Rice leaf folder (*Cnaphalocrosis medinalis*)	*Beauveria bassiana* 1.15% WP	(Strain: BB – 5372, own R & D Isolate)	2.5 kg.	600-750
Rice leaf folder (*Cnaphalocrosis medinalis*)	*Beauveria bassiana* 1.15% WP (1x10^8 /gm min)	Accession No – NAIMCC-F-03045 Strain ICAR, Research Complex, Umiam, Meghalaya,	2.5 kg.	750-850
Rice leaf folder (*Cnaphalocrosis medinalis*)	*Beauveria bassiana* 1.15% WP (1x10^8 /gm min)	Strain No. NBAIM, MAU. Accession No – NAIMCC-F-03045	2.5 kg/ha	750
Brown plant hopper (*Nilapavata lugens*)	*Metarhizium anisopliae* 1.15% WP (1x108 CFU/gm min)	Accession No. MTCC – 5173	2.5 kg.	500
White backed plant hopper (*Sogotella furcifera*)	*Verticillium lecanii* 5.0% SC, (1x10^8 CFU/gm Min.)	Strain No. VI-17874, MTCC No.5716, Strain – Own Red Isolate	3.125 kg.	600

Aqueous suspension of both *Bt* and fungal formulations could be sprayed at recommended doses. As most of these products are safe to human beings, they can be used relatively with lesser precautions. Toxic genes of Bt and the fungal bioagents can be used alternatively to develop transgenic rice. All over the world, several organizations have produced transgenic rice using the toxin genes which would reduce the pesticide utilization and pollution related hazards.

Mode of action

Entomopathogenic bacteria like *Bt* is a stomach poison and highly specific in nature showing its effect on the digestive system after feeding the treated surface. The spores proliferate in the gut and eventually the insect dies. Visible symptoms like cessation of feeding, watery excrement, body turning brownish black as they decompose. Entomopathogenic fungi like *Metarhizium anisopliae*, *Beauveria bassiana* infect the insects when sufficient moisture is available. The spores of fungus germinate through the softer portions of the cuticle and cover the insect with a layer of mold, *viz*., white or green fungal growth enveloping the body or emerging through the joints. The fungus proliferates throughout the insect body producing toxins, draining nutrients and eventually killing it.

Advantages of Microbial Insecticides

1. The safety provided by microbials is their greatest strength. Microbial insecticides are non-pathogenic and nontoxic to humans, wildlife, and other insect biocontrol agents not close to the target pest.
2. The mode of action of microbial insecticides is specific to a single group or species of insects, so they may not affect beneficial insects like parasites and predators of pests. their residues cause no hazards to animals.
3. Most of the cases microbial products not deactivated by chemical insecticides. Hence, they can be used in combination with chemical insecticides. (label directions should be followed regarding any limitations.

Limitations

Although biopesticides are effective but there are some inherent limitations

1. Biopesticides are not popular and therefore, unavailable in the local market
2. Due to their specificity towards the pest potential market will be limited. Consequently, some products are relatively expensive and not widely available
3. Action of the biopesticides is relatively slower than chemical insecticides
4. At present biopesticides are costlier than some of the popular insecticides
5. Microbial insecticides are toxic to only a specific group of insects, each application controls only a particular pest population occurring in the field. Therefore, other pests will survive and cause damage
6. Exposure to ultraviolet radiation, heat, desiccation *etc*. reduces the efficacy of several kinds of microbial insecticides
7. Special formulation and storage conditions are needed for some microbial pesticides

Conclusions

The general conclusions regarding biopesticides are

1. Biopesticides affect specific group of pests hence do not pollute the environment
2. Initiative for popularization is crucial for the biopesticides
3. Pesticide application should be need based to preserve the natural entomopathogens
4. Biopesticides are self-perpetuating and therefore have long-term effect

References

Dangar, T K. (2008). "Infectivity and ecology of *Pseudomonas spp*. from natural epizootics in the rice leaf folder*, Cnaphalocrocis medinalis* (Lepidoptera: Pyralidae) in India." *Biocontrol Science and Technology*, **18.3**: 241-253.

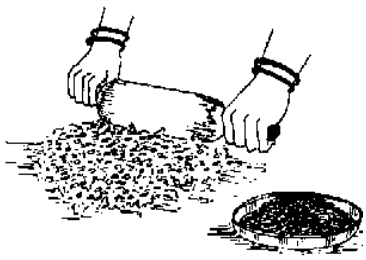
Article ID : 02/III/07/0322

PREPARATION OF NEEM SEED KERNEL EXTRACT AT HOME

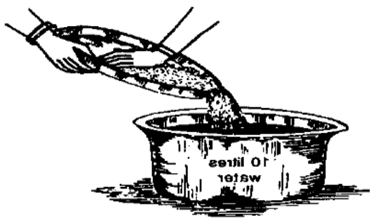
Akkabathula Nithish

Assistant professor (Department of entomology)
SKLTSHU, Telangana state
Author's mail- nitishakkabattula@gmail.com

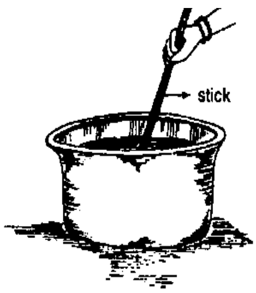
1. For preparation of 100 liters of 5% NSKE solution, 5 kg of three to eight months old fresh fruits are collected from the tree during day time, as they are best suited for the preparation of neem kernel extract containing high quantity of azadirachtin which can be efficiently used in pest control. The collected fruits are stored in bamboo baskets or jute bags.
2. The seed coats are removed and take required quantity of neem seed kernel.
3. Crush the seeds gently to make powder. They should be pounded gently in such a way that no oil comes out from the seeds.



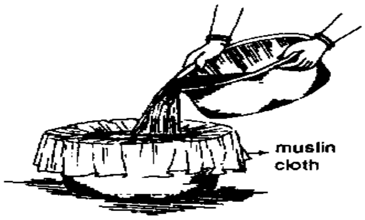
4. Add about 10 litres of water to the powder and let the mixture to stand overnight.



5. Take a wooden stick and stir the mixture for 20 minutes in the morning till solution becomes milky white and then add 1% detergents to the solution by mixing a teaspoon of soap powder in the spray solution.



6. Filter the solution using fine gauze or through a muslin cloth or with a fine meshed sieve or tissue to remove the bigger particles and any other impurities. Make the solution volume to 100 liters by adding water.



neem seed kernel extract

7. The extract can now be applied with a knapsack sprayer or a hand pump sprayer with mixing of proper quantity of water without any emulsion or wetting supporting substance. Spray the solution on crop in the evening hours to get good result and repeat the spray in 5-6 days interval. About 500 to 750 litres of to spray solution is required for spraying in 1 acre of field.

Advantages of neem

- Neem is non-poisonous and safe for humans, animals and also for the spraying persons.
- Crushed neem seed extraction is less costly than synthetic insecticides.
- Neem does not pollute the air, water, or soil.
- NSKE can be made easily at home and is very cheap in making.
- Neem shows no adverse effect on beneficial insects.
- There are no handling risks and no minimum re-entry time interval is allowable in spraying.
- Neem solution can be mixed with liquid fertilizers and used in drip system.
- Neem is ideal for both conventional and IPM Programmes and can be used throughout the entire crop period.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed
monthly newsletter

Article ID : 02/III/08/0322

BIOLOGICAL CONTROL OF IMPORTANT INSECT PEST OF CEREAL CROPS

Biwash Gurung
Assistant Professor in Entomology,
SOAG, ITM University, Gwalior,
Madhya Pradesh- 474001.

In the simplest terms, biological control is the reduction in pest populations from the actions of other living organisms, often called natural enemies or beneficial species. Virtually all insect and mite pests have some natural enemies. Learning to recognize and manage these natural enemies can help reduce pest populations and, thus, reduce crop losses and the need for costly chemical and/or other control measures.

Biological control is most effective when used with other compatible pest control practices in an integrated pest management (IPM) program. Practices that are often compatible with biological control include cultural control; planting pest resistant varieties and using selective insecticides when other practices fail to keep pest numbers below the economic threshold.

To be used effectively, biological control requires a good understanding of the biology of the pest and its natural enemies, as well as the ability to identify the pest's life stages in the field. Frequent field scouting also is necessary to monitor natural enemies and evaluate their impact on pest populations.

Biological control programs are categorized in three basic ways: conservation, importation and augmentation.

1. **Conservation and encouragement of indigenous Natural Enemies**
   Defined as actions that preserve and increase natural enemies by environmental manipulation. e.g. Use of selective insecticides, provide alternate host and refugia for Natural enemies.
2. **Importation or Introduction**
   Importing or introducing natural enemies into a new locality (mainly to control introduced pests).
3. **Augmentation**
   Propagation (mass culturing) and release of natural enemies to increase its population. Two types,
   i. **Inoculative release**: Control expected from the progeny and subsequent generations only.
   ii. **Inundative release**: Natural enemies mass cultured and released to suppress pest directly e.g. Trichogramma sp. egg parasitoid, *Chrysoperla carnea* predator

Recognition of Common Biological Control Agents

Predators

Predatory insects and mites live by hunting or trapping other insects (prey), and killing them for food. Over 100 families of insects, spiders and mites contain species that are predaceous, either as adults, immatures or both. About 12 of these families play major roles in the biological control of field pests. Following, are summaries of some of the most important families.

Lady beetles : Lady beetles or "ladybugs" probably are the most universally known group of beneficial insects. They are found almost anywhere and feed on aphids and a variety of soft-bodied insects

Lacewings : Lacewings are common predators of aphids and other soft-bodied insects on a wide variety of crops grown in the field and greenhouse. One of the most common species is the green lacewing, *Chrysoperla carnea.*

Ground beetles : Ground beetles are commonly found in all cultivated crops. Both the larvae and adults are predaceous. Ground beetles likely help to regulate pest populations. Much of the predation occurs near the soil surface. Likely targets include caterpillars, root maggots, snails and other soft-bodied insects.

Spiders : While spiders are not insects, they play an important role in the natural regulation of insect populations. As a group, spiders are exclusively predaceous, many specializing on insects. Spiders will feed on a wide variety of insects including moths, beetles, caterpillars and grasshoppers. There are many groups of spiders commonly found in cultivated fields, some are active searchers; others trap their prey. This is a diverse and important group of beneficial insects.

Parasitoids

Parasitoids are insects that, in the immature stages of their life cycle, parasitize other insects but have free living (no parasitic) adults. Adult parasitoids serve mainly to transport their offspring to new hosts. Two major groups of parasitoids are discussed in this article: parasitic wasps and tachinid flies

Parasitic wasps : Parasitic wasps are the largest group of insects that serve as biological control agents. They also are the most diverse in terms of size, shape and lifestyle. Worldwide, it is estimated that there are more than 1 million species of parasitic wasps. Almost all insect pests are attacked by at least one species of parasitic wasp, and many are parasitized by more than one species. Many of these wasps specialize on one target pest. For these reasons, parasitic wasps are an extremely important source of naturally occurring or human managed biological control.

Tachinid flies : The family Tachinidae represents the second largest group of parasitoids and the second largest family of true flies. Adult females typically glue one or more eggs onto the body of an insect. The resulting larva then bores its way inside the body of the host insect where it feeds. Some tachinids enter the host's body by being swallowed as the insect eats. Larval feeding almost always causes host death. Therefore, tachinids are very useful biological control agents.

Biological control for rice pest

Trichogramma japonicum and *T chilonis* may be released @ 1 lakh/ha on appearance of egg masses / moth of yellow stem borer and leaf folder in the field.

Natural biocontrol agents such as spiders, drynids, water bugs, mirid bugs, damsel flies, dragonflies, meadow grasshoppers, staphylinid beetles, carabids, coccinellids, *Apanteles*, *Tetrastichus, Telenomus*, *Trichogramma*, *Bracon, Platygaster* etc. should be conserved.

Natural enemy category	Natural enemy	Pest attacked and feeding potential
I. Parasitoids		
1. Egg parasitoids	*Trichogramma japonicum*	Egg parasitoid of yellow stem borer (YSB)
	Trichogramma chilonis	Egg parasitoid of leaf folder, y Case worm, YSB etc
2. Larval parasitoids	*Cotesia flavipes*	Larval parasitoid of stem borer and semi-looper
	Stenobracon nicevillei	Larval parasitoid of leaf folder
3. Larval and pupal parasitoids	*Haplogonatopus spp* *Pseudogonatopus spp.*	Haplogonatopus attack leaf hoppers and Pseudogonatopus attack plant hoppers and act as parasites and predators.
	Opius sp	Larval pupal parasitoid of whorl maggot larvae. Wasp emerges from whorl maggot pupa

Biological control for important cereal pest

Insect	Natural enemies
Shootfly	Parasitoids: *Trichogramma chilonis* (egg), *Trichogrammatoidea simmondsi* (egg), *Neotrichoporoides nyemitawus* (larva) Predators: *Chrysoperla carnea*, coccinellids, king crow, common mynah, wasp, dragonfly, spider, robber fly, reduviid bug, preying mantids
White grub	Parasitoids: *Tiphia rufo- femorata* (grub) etc. Predators: Spider, robber fly, preying mantids
Pyrilla	Parasitoids: *Epiricania melanoleuca* Predators: Anthocorid bugs/pirate bugs (Orius spp.), mirid bugs, syrphid/hover flies, green lacewings (*Mallada basalis* and *Chrysoperla carnea*), predatory coccinellids (*Stethorus punctillum*), staphylinid beetle (*Oligota spp.*)
Aphid	Parasitoids: *Aphidius colemani* (adults and nymphs), *Diaeretiella spp.* (adults and nymphs), *Aphelinus spp.* (adults and nymphs) etc. Predators: Anthocorid bugs/pirate bugs (Orius spp.), mirid bugs, syrphid/hover flies, green lacewings (*Mallada basalis* and *Chrysoperla carnea*), predatory coccinellids (*Stethorus punctillum*), staphylinid beetle

Insect	Natural enemies
	(*Oligota spp.*), predatory cecidomyiid fly (*Aphidoletes aphidimyza*) and predatory gall midge, (*Feltiella minuta*), earwigs, ground beetles, rove beetles, spiders, wasps etc
Thrips	Predatory mite (*Amblyseius swirskii*), predatory thrips (*Aeolothirps spp.*), insidious flower bugs (*Orius insidiosus*) et

Conclusions

As a natural process, biological control plays an important role in the suppression of field crop pests. It also shows considerable promise as a management approach for field crop pests. However, to reach its potential, either as a single tactic, or as a component in integrated pest management programs, research is needed to increase the effectiveness and predictability of natural enemies and to make biological control more economical. Efforts should be continued to establish new natural enemies for the many important pests. Much work also is needed to find ways to better conserve natural enemies. This protection extends both to native and imported species, and to those released into the environment as well as populations that are already established. Finally, improved methods for handling and rearing natural enemies are needed to increase efficacy and reduce costs of argumentatively released biological control agents. One step in the right direction would be for farmers who are interested in using biological control to become more active in working together, and with public officials, to promote the research and development of biological control.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in

Peer reviewed
monthly newsletter

Article ID : 02/III/09/0322

HYBRID WHEAT: METHODS OF CONTROL OVER POLLINATION PROCESS

Karthik Kumar M, Akash A, Abhishek E, and Prathap V*
ICAR – Indian Agricultural Research Institute, New Delhi-12
*Corresponding Author: prathuv1994@gmail.com

Abstract

To enhance wheat grain production, innovative technologies must be developed and delivered to ensure global food security. Wheat yield needs to be increased; hybrid breeding has the potential to increase yield significantly. An efficient pollination control system is necessary to avoid the unwanted self-pollination of the dominant parental line. The male-sterile female parent prevents pollen shedding and self-fertilization, maintaining the purity of hybrid seeds and crossing between desirable parents for hybrid seed production. Several methods have been proposed to limit selfing in female parental lines of wheat, such as emasculation, chemically and genetically induced male sterility, cytoplasmic male sterility, photo/thermo/thermo-photosensitive male sterility, and biotechnological approaches for pollen abortion. There are many restorer genes identified for CMS and markers linked to it also made available. The biotechnological approaches enable the rapid generation of male-sterile hexaploid wheat lines for use in hybrid seed production.

Introduction

Wheat is a staple food crop that provides nearly 20% of the calories and protein consumed by humans. Wheat is cultivated on 221.82 million hectares across the globe. The world wheat production was 775.8 million tons, which is 16.6 million tons less than expected (FAS; USDA, 2021). In India, 107.86 million tons of wheat was produced in 31.6 million hectares. By the year 2030, global wheat production will need to rise 50% to meet the demand of a growing population with increasing per capita income and consumption. It is essential to meet this target despite reduced land area, reduced irrigation water, and predicted climate change. Global food security demands the development and deployment of cutting-edge technologies to increase and secure cereal production on finite arable land. There are several options for boosting wheat yield. Among these, hybrids hold the potential to deliver a major lift in yield. As a result, they will open a wide range of new breeding opportunities. For hybrid breeding, an efficient pollination control system is necessary to avoid the unwanted self-pollination of the female parental line. The male-sterile female parent prevents pollen shedding and self-fertilization, maintaining the purity of hybrid seeds.

Methods of control over the pollination process in wheat

Genetic male sterility : Genetic male sterility is controlled by genes present in the nucleus. GMS has never been exploited for commercial hybrid wheat production, although five nuclear genes for male sterility are known. Three of these are dominant, namely Ms2 (4DS), Ms3 (5AS), and Ms4 (4DS). The remaining two genes ms1 (4BS) and ms5 (3AL) are recessive. Among the above five genes, Ms2 is a spontaneous mutation found in wheat variety 233. The wheat lines carrying the Ms2 gene are 100% male sterile and are called ‘Taigu genic male-sterile wheat’. The Ms2 gene encodes for an orphan protein that confers male sterility in grass species. Male-sterile mutants should be non-conditional, monogenic, and recessive.

CMS and Fertility Restoration : CMS in plants is caused by mutations in mitochondrial DNA. The mitochondrial gene encoding protein ORF279 causes male sterility in wheat plants carrying T-CMS, by disrupting the tapetal cell or microspore function by invoking oxidative stress. Restorer proteins induce cleavage of the orf279 transcript in wheat to counteract male sterility-inducing cytoplasm. Currently, there are more than 70 different cytoplasms that induce cytoplasmic male sterility (CMS) in wheat. In recent studies, four novel alien male-sterile cytoplasms (*Ae. kotschyi, Ae. uniaristata, Ae. mutica*, and *H. chilense*) were found to cause male sterility in wheat. Based on the source of cytoplasm that contributes to male sterility, these CMS systems have been divided into eight categories (Table 1). The *T. timopheevii* (T-type) and *Hordeum chilense* (msH) CMS systems are now receiving the most interest. YA-type CMS systems are recently discovered systems whose potential is not yet discovered. Therefore, these three systems may be used in the future for cost-effective hybrid seed production.

Types of CMS systems based on the source of cytoplasm contributing to male

***Triticum aestivum* CMS Type; YA- Type :** YA-type CMS is based on a cytoplasmic mutant derived from the common Chinese wheat variety ‘CA805’ that initially served as the restorer. It carries two major restorer genes (YARf1, YARf2) as well as some minor genes. The development of commercial hybrid wheat using CGMS from *T. aestivum* was not possible due to reduced vigor, abnormal plant morphology, zygote elimination, and delayed maturity.

***T. timopheevii* CMS system; T-type** : It is considered the most effective hybrid wheat seed production method among available hybrid seed systems to use *T. timopheevii* CMS. It has therefore been used most widely for the production of hybrid wheat seeds. But fertility restoration in lines carrying timopheevii cytoplasm has often been partial, so pyramiding of two or more Rf genes in the same male parent was considered a necessity. This became possible through the use of molecular markers linked to restorer genes.

***Rf^{multi}* :** In addition to the above nine Rf genes, another gene for fertility restoration was discovered called Rf^{multi} (Restoration of fertility in multiple CMS systems). Male sterility due to cytoplasm from *Ae. kotschyi, Ae. mutica and Ae. uniaristata* was manifested in only those kinds of wheat, which lacked the arm 1BS, as is the case of wheat cultivars carrying 1BL.1RS translocation. This suggested that perhaps 1BS carries a fertility restorer gene, which is effective against multiple cytoplasms, hence the name Rf^{multi}. This gene was assigned to a 2.9-cM segment on 1BS.

***Hordeum chilense* CMS system; msH1-type :** A novel CMS system (msH1) derived from *Hordeum chilense*, utilized in wheat by developing alloplasmic lines. The corresponding restorer gene is identified in genotype H1 which is located on the short arm of chromosome 6.

CHA-induced male sterility : The first generation of chemical compounds consisted of Ethaphon, gibberellin, and RH531. The second generation of CHA compounds included RH-0007 (Hybrex) as the most effective drug, causing 95–100% male sterility. However, it is associated with a reduction in hybrid seed quality that discouraged its use on a long-term basis. New CHAs include 'GenesisTM', registered as Clofencet, and 'Croiser® 100', currently used in Europe. 100'. Croiser ® 100’ is currently the most widely utilized CHA. Using CHAs, in 1994 the first hybrid ‘Hpo-Precia’ was released in France by Hybrinova, and ‘Domino’ was released in the USA by HybriTech-Monsanto.

Environmental sensitive Male Sterility

Photoperiod-sensitive male sterility : The cytoplasm of *A. crassa* is sensitive to a long photoperiod (≥ 15 h), which causes male sterility. In this system, the genotype to be used as a female parent will be fertile under short-day conditions, i.e., < 14.5 h or less, but male sterile under LD conditions.

Thermo-sensitive male sterility : Wheat varieties are known to carry genes that render them male-sterile at reduced temperatures. A spontaneous TGMS mutant BS20-T was recovered in a commercially grown wheat variety BS20 in China. Under temperatures of * 10°C, the TGMS line (B20-T) is completely male sterile, while under temperatures of >13°C, it is completely fertile. The TGMS is controlled by a recessive gene tmsBS20T located on chromosome 2BL flanked by SSR loci Xgwm403 and Xgwm374 at genetic distances of 2.2 and 4.5 cM, respectively. Apart from the above, the recessive TGMS gene wtms1 on 2BL from line 337S is also known. This gene is located within an interval of 11.3 cM from the SSR marker Xgwm374.

Photoperiod and temperature-sensitive genic male sterility : PTGMS in wheat was also reported from China. The PTGMS is controlled by two major genes, both of which interact with the genetic background.

Candidate genes for hybrid wheat

Gene	Strategy	Source of gene	Plant	Reference
Barnase	Early degradation of the tapetum layer which provides nutrition and a structural component to pollen	*Bacillus Amyloliquefaciens*	*T. aestivum*	Block et al., 1997
Cell-cycle regulator gene, cdc25	Expression of cell-cycle regulator cdc25 gene, under regulation of ADP-glucose pyrophosphorylase large subunit (AGP) promoter	*Schizosaccharom pombe*	*T. aestivum*	Chrimes et al., 2005
Silencing of MYB80 transcription	MYB80 transcription factor involved in the regulation of tapetum and pollen development	*T. aestivum*	*T. aestivum*	Phan et al., 2012
GPC gene	Silencing of NAC transcription factor GPC gene	*T. aestivum*	*T. aestivum*	Distelfeld et al., 2012

Conclusion

Hybrid wheat with increased grain yields is undoubtedly being considered as a potential solution to future wheat scarcity, which cannot be ruled out totally. However, only limited progress has been made in this area. Investments and efforts towards the development of novel technologies for the successful production of hybrid wheat seed at a cheaper rate should help in making hybrid wheat varieties a commercial success. As a result, newer and more economical hybrid varieties of wheat may become a reality in the next few years, boosting wheat production and providing higher returns to farmers.

References

Gupta, P. K., Balyan, H. S., Gahlaut, V., Saripalli, G., Pal, B., Basnet, B. R., and Joshi, A. K. (2019). Hybrid wheat: past, present, and future. *Theoretical and Applied Genetics*, 132(9), 2463-2483.

Singh, S. P., Srivastava, R., and Kumar, J. (2015). Male sterility systems in wheat and opportunities for hybrid wheat development. *Acta Physiologiae Plantarum*, *37*(1), 1713.

Whitford, R., Fleury, D., Reif, J. C., Garcia, M., Okada, T., Korzun, V., and Langridge, P. (2013). Hybrid breeding in wheat: technologies to improve hybrid wheat seed production. *Journal of experimental botany*, *64*(18), 5411-5428.

ISSN : 2583-0910
Agri-India TODAY
visit us at www.agriindiatoday.in
Peer reviewed
monthly newsletter

Article ID : 02/III/10/0322

AGRI-DRONES – A BOON TO AGRICULTURE

Sharad S. Jadhav*[1], Aniruddha S. Jadhav[2] and Pratiksha J. Karpe[3]
[1]Ph.D. Research Scholar, PGI, MPKV, Rahuri MH.
[2]Assistant System Engineer, TCS, Pune.
[3]MSc. Scholar, College of Agriculture, Latur.
*Corresponding author: sharadsssjadhav882@gmail.com

Agriculture is the backbone of the Indian economy. Agriculture not only helps to feed the large population, but also supports manufacturing industries with various raw materials and agricultural products form a major part of the country's exports. However, despite the growing importance of agriculture, it still lags far behind other countries when it comes to adapting the latest technologies to agriculture. Due to labor shortages and high labor costs, climate change, pests and diseases, low availability of funds and agricultural inputs, waste of inputs, these are all problems that limit access to good quality food. Global food hunger affects 815 million people each year. The Food and Agriculture Organization of the United Nations predicts that the current level of agricultural production must increase by 60% by 2050 to feed the growing world population. The Intergovernmental Panel on Climate Change (IPCC) warns that crop yields could actually decline by 10-25% by 2050. As a result, there is widespread concern about the sustainability of food production. In such an effort to tackle this task, farmers all over the world have to adapt to the advanced and computerized solution to meet the needs of daily life. Therefore, drones, being a modern technology, can be a solution for agriculture to reduce drudgery and with less time, a lot of data can be brought back for research to facilitate sustainability in futuristic agriculture.

Agricultural drones relieve the modern farmer as they help increase the level of productivity and reduce expenses by reducing the need for human labor and other inputs. Now, the Ministry of Agriculture, Forestry and Fisheries is vigorously focusing on the use of drones in agriculture. For the sustainable development of agriculture and to stimulate mechanization in the agricultural sector, the Ministry of Agriculture and Farmers' Welfare has recently issued revised guidelines of the program "Submission on Agricultural Mechanization" (SMAM) in an effort to make drones more accessible. to farmers through the purchase, rental and demonstration of agricultural drones.

Drones

A Drone (Dynamic Remotely Operated Navigation Equipment), commonly known as Unmanned Aerial Vehicle (UAV) is essentially flying ROBOT. The aircraft may be remotely controlled or can fly autonomously through software-controlled flight plans in their embedded system working in conjunction with onboard SENSORS and Global Positioning System (GPS). Drone is defined as the remotely piloted air craft controlled directly by a human operator or via a radio link or with various levels of autonomy achieved by using auto pilot technology.

Agricultural drones are drones applied to farming in order to help increase crop production and monitor crop growth. Through the use of advanced sensors and digital imaging capabilities, farmers are able to use these drones to help them gather a richer picture of their fields. Information gathered from such equipment may prove useful in improving crop yields and farm efficiency.

History of drones in Agriculture

In 1983, the Japan Agricultural Aviation Association established a commission to develop a remote-controlled aircraft capable of spraying agrochemicals in areas which was known as the Remote-Controlled Aerial Spraying System (RCASS). Japan's first government deployed drones to pinpoint the cause of the decline of rice farmers in 1986. Around 35% of pest control of Japan's rice fields is being achieved with UAVs.

Applications of drones in agriculture

1) Soil and field analysis : Drones can be used for soil and field analysis. They can be used to produce accurate three-dimensional maps that can be used for early soil analysis on soil properties, moisture content, and soil erosion. This is very important in planning seed planting patterns. Even after planting, drone soil analysis provides data for irrigation and soil nitrogen level management.

2) Plantation : Although still not very common, some manufacturers have devised systems capable of shooting seed pods and plant nutrients into prepared soil. These drone planting systems will reduce planting costs by 85 percent.

3) Crop spraying : Distance measuring equipment such as ultrasonic echoes and lasers can adjust altitude with a change in topography and geography. Their ability to scan and modulate their distance from the ground allows them to spray the right amount of the desired liquid evenly in real time. This results in increased efficiency with a reduction in the amount of chemicals that enter the groundwater. In fact, experts estimate that drone spraying will be tested 5 times faster than traditional methods.

4) Crop monitoring : One of the biggest obstacles in agriculture is inefficient crop monitoring of vast fields. Monitoring challenges are made worse by the increase in unpredictable weather patterns leading to increased risk and maintenance cost. Previously, satellite imagery offered the most advanced form of monitoring. But there were drawbacks. Today, drones equipped with surveillance technology create time-series animations that can show the precise development of a crop and reveal inefficiencies in production, allowing for better crop management.

5) Irrigation : Drones with hyperspectral, multispectral or thermal sensors can identify which parts of a field are dry so that water resources can be allocated much more cheaply, i.e., more water for dry areas and less for once wetter areas. In addition, once the crop is growing, the drones allow the calculation of the vegetation index, which describes the relative density and health of the crop, and shows the heat signature, the amount of energy or heat that the crop emits.

6) Biotic and abiotic stress assessment : Assessing crop health and detecting bacterial or fungal infections in trees is essential. By scanning a crop in visible and near-infrared light, drone-borne devices can identify which plants reflect different amounts of green light and NIR light. This information can produce multispectral images that track changes in plants and indicate their health. A quick response can save an entire orchard. Also, as soon as a disease is discovered, farmers can apply and control remedies more precisely.

7) Mid-field weed identification : Using NDVI sensor data and post-flight image data, we can create weed maps that will help farmers easily differentiate areas of high weed intensity from areas of healthy crops growing next to them.

8) Livestock management : Drones with thermal sensors are the solid option to monitor herds from above, see if animals are missing, injured or calving. Therefore, drones provide ranchers with a new way to keep an eye on their cattle at all times, resulting in higher profits.

9) Geofences : Thermal cameras installed on drones can easily detect animals or humans. So, drones can protect fields from external damage caused by animals.

10) Crop Insurance : Aerial imagery can be used to quickly classify surveyed areas into cultivated and non-cultivated land, and to assess how much damage natural disasters have caused. Crop insurers and insurance policy holders also benefit from readily available and repeatable drone imagery. In India, insurers plan to use unmanned aerial vehicles to assess crop losses after natural disasters, allowing them to calculate payments more accurately and quickly. They can use the same data to build statistical models for risk management, based on historical yield, pest, and weather data. Drone data could also be useful for early detection and prediction of pest infestations, data that insurance companies could share with farmers. Finally, drone data can be used to detect insurance fraud, preventing fraudsters from ensuring the same piece of land multiple times or claiming damages where none exist.

Drone Based Government Project and Schemes:

- The Drone Federation of India (DFI) supports and tries to build a safer and more scalable unmanned aviation industry to build a sustainable UAV industry in India.
- Information, rules and regulations on drones provided on the Digital Sky platform of the Directorate of Civil Aviation.
- The Sub-Mission on Agricultural Mechanization (SMAM) scheme was launched in 2014-15 with the aim of increasing the reach of agricultural mechanization for small and marginal farmers.
- On November 16, 2020, the central government granted the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) the use of drones for agricultural research.
- On January 23, 2022, the Ministry of Agriculture and Farmers Welfare issued revised SMAM scheme guidelines consisting of the following points:

1) Subsidy to Institutes

A grant of up to 100% of the cost of the drone or Rs.10 lakh for the purchase of drones will be given to the testing and training institutes of agricultural machinery, ICAR, KVK and SAU institutes.

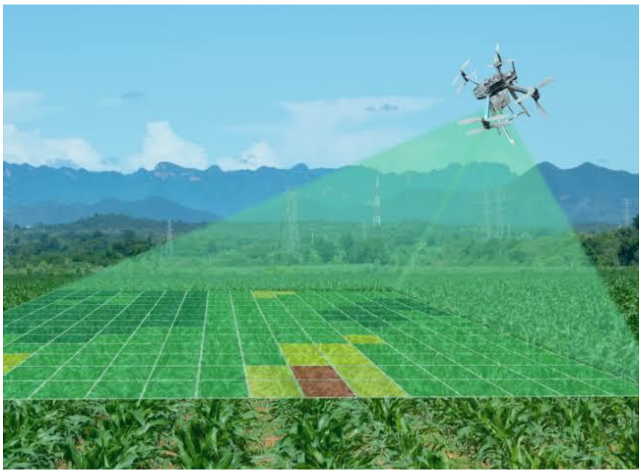
2) Subsidy to Graduates in Agriculture

50% of the basic cost of a drone grant for the purchase of drones for agriculture graduates who establish Custom Hiring Centers (CHC) will be eligible to receive up to Rs. 5 lakhs.

3) Subsidy to the Farmers Producers Organization (FPO) or Farmers' Cooperative Society (CSF)

FPOs, CSFs and rural entrepreneurs are eligible to receive 4% up to Rs.4 lakh as a subsidy on the basic cost of the drone.

FPOs would be eligible to receive a subsidy of 75% of the cost of the drones if they are used for demonstration purposes only.



Official Address :
Peshok Tea Estate
P.O.- Peshok, Dist.- Darjeeling
West Bengal, India
PIN-734312

Contact No : +91 7501389678
email : agriindiatoday@gmail.com