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HARMFUL ALGAL BLOOM AND ITS MANAGEMENT

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Introduction

Over the last several decades, countries worldwide have experienced an escalating and worrisome trend in harmful algal blooms(HABs). The term harmful algal bloom is extensive and covers blooms of many types. Still, HABs all have one unique feature in common. They cause harm, either due to their production of toxins or how the cells' physical structure of accumulated biomass affects co-occurring organisms and alters food-web dynamics. HAB events are characterized by the growth and occasional supremacy of particular toxic or harmful algae species. These microscopic cells increase in quantity in a few cases until their pigments discolour the water-hence the everyday use of red tide. Many countries face difficulty understanding the array of toxic or harmful species and impacts, disturbing trends in bloom incidence upward, larger areas affected, more fisheries resources impacted, and higher economic losses.

HAB Impacts

When toxic phytoplankton is filtered from the water as food by shellfish, toxins levels can be lethal to humans or other consumers. The poisoning syndromes have been termed paralytic (PSP), diarrhetic (DSP), neurotoxic (NSP), amnesic (ASP), and azaspir acid (AZP) shellfish poisoning, respectively. Dinoflagellates are a marine algae class responsible for synthesizing biotoxins except for ASP. Domoic acid, an ASP toxin, is synthesized by diatoms previously thought to be toxin-free. Ciguatera fish poisoning (CFP) is caused by dinoflagellates toxins that inhibit their surfaces in many coral reef communities. Ciguatoxins are transferred from herbivorous reef fish to larger carnivorous, often commercially lucrative finfish through the food chain. Another type of HAB impact occurs when marine fauna is killed by algal species that release toxins and other compounds into the water. In recent years, the number of fish and shrimp mortalities at aquaculture sites increased considerably due to HABs. HABs also cause mortalities of wild fish, seabirds, whales, dolphins, and other marine animals, typically due to the transfer of toxins through the food web. Variety of harms caused by non-toxic blooms of algae. When the biomass decays as the bloom terminates, it leads to oxygen consumption and causes widespread mortalities of plants and animals in the affected area. Costs of conducting shellfish and other affected resource monitoring programs, short- and long-term closure of harvestable shellfish and fish stocks, reductions in seafood sales, mortalities of wild and farmed fish, shellfish, and coral reefs, impacts on tourism and tourism-related businesses, and medical treatment of exposed populations are just a few of the economic consequences of HABs.

Recent Trends to HAB

The nature of the HAB problem has changed throughout the world over the last three decades. The recorded distribution Shows the collective global increase and the confirmed appearance of PSP toxins in shellfish. A dramatic expansion in the areas affected by PSP toxins has occurred in

recent years. Few would debate that the number of toxic blooms, the economic losses, the types of resources involved, and the number of toxins and poisonous species has increased dramatically throughout the world. One of the factors underlying the global expansion in HABs is the dramatic increase in aquaculture activities in many countries. This leads to increased product quality and safety monitoring, revealing indigenous toxic algae that were probably always there. However, those boundaries are also expanding due to natural dispersal via storms or currents and enhanced growth due to pollution or other anthropogenic influences. Because of raising scientific awareness and detection capabilities, part of the expansion should not temper our concern.

Management Issues

A recent review highlights the strategies countries and commercial enterprises adopted worldwide to monitor and manage HABs in coastal waters. A few examples of strategies are briefly introduced below.

Mitigation

Many management steps taken in response to HABs can be termed mitigation, i.e., dealing with a subsist or ongoing bloom and taking whatever necessary steps to reduce negative impacts. Prominent examples are the routine monitoring programs for toxins in shellfish, currently conducted in more than 50 countries. The detection of critical limits of HAB toxins in shellfish will lead to imposed harvesting restrictions to keep contaminated products away from the market. The towing of fishnet pens away from the sites of intense HABs is one of the common mitigation strategies.

Prevention of HAB events

Actions implemented to prevent HABs from occurring or having a significant impact on a resource are prevention. In this regard, there seem to be several instantly apparent problems. We don't have all of the information we need to understand why HABs develop in so many places, so regulating or controlling the essential components is tough. The rapid increase of plant nutrients, especially nitrogen compounds, reaches coastal waterways worldwide due to increasing sewage disposal, greater use of chemical fertilizers, and increased fossil fuel combustion.

Control

Bloom control is the most controversial and challenging aspect of HAB management. The concept refers to actions to suppress or destroy HABs-directly intervening in the bloom process. Five general categories or strategies can combat or stop an invasive or harmful species. These include mechanical, biological, chemical, genetic, and environmental control applied to HAB species. For example, mechanical control removes HAB cells from the water by dispersing clay over the water surface. The clay particles aggregate with HAB cells to remove those cells through sedimentation. HABs threaten a fish-farming industry worth hundreds of dollars in countries like Korea. Biocontrol is widespread used in agriculture, such as releasing sterile males or pheromones to control insect pests. However, there is still considerable opposition to releasing one organism to control another in the ocean. Chemical control relies on toxic chemical release, including the potential development of species-specific chemical control agents. Chemical control was attempted in 1957 against the Florida red tide organism using copper sulfate delivered with crop-dusting aeroplanes. It will be hard to do and perhaps quite laborious to find an environmentally acceptable chemical that would target a particular HAB species but not cause widespread

mortality of other organisms. Another strategy for controlling introduced or exotic species is genetic control the genetic engineering of species that are purposely introduced to alter the undesirable species' environmental tolerances, reproduction, or other processes. The issues surrounding this control strategy are similar in the possible negative impacts of introducing a non-indigenous organism to an area. The last strategies are environmental manipulation-physical or chemical modifications of the environment so that the target species are affected or a natural or introduced bio-controlled species is enhanced. On shorter time scales, manipulating the environment becomes more challenging to conceive but might include altering water circulation through dredging or channels. Another method might be aeration or other methods to disrupt stratification, leading to changes in the phytoplankton community composition.

Emerging Technologies

Sophisticated analytical techniques combining chromatographic and mass spectrometry techniques (e.g., LC-MS) have been developed for all significant HAB toxins. They are now taking the place of many older methods, including the widely used but socially undesirable mouse bioassays. On the other extreme, simple test kits have been developed that allow inexpensive, rapid testing for toxins. They promise to use in screening samples, avoiding costly analysis for the many negative samples in monitoring programs. These kits also promise to allow offshore shellfish beds to be harvested, as fishers are more likely to gather at a site if they can gain knowledge that the harvested product will not contain toxins above regulatory limits. Another vital management need is for bloom detection and tracking. Again, there has been progress on both ends of the spatial spectrum. To detect HAB in the Gulf of Mexico, Satellite remote sensing is now used operationally on the largest scale. With the help of simple transport models, forecasts are now issued of impending landfall or exposure. For other HABs, remote sensing applications rely on detecting the water masses in which the cells reside using sea surface temperature. At the smallest scale, "molecular probes" have been designed for many HAB species that allow them to be detected and counted more efficiently and faster than has been possible with traditional microscopy. These probes are often either antibodies or short segments of DNA specific to the HAB species of interest. They are then used in various formats, some of which are amenable to remote, automated operation. Thus, they can be deployed in moored instruments that can become the sentinels for HABs.

References

Anderson D.M, (2009). Approaches to monitoring, control, and management of harmful algal blooms (HABs). Ocean & coastal management *52*(7): 342-347.

Naik R. K and Menon N. N (2017). *In* Project completion report harmful algal blooms in coastal ecosystems: implications for future aquaculture (HABAQUA) April 2016 - May 2017.

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APPLICATION OF TRANSGENICS IN IMPROVEMENT OF FRUIT CROPS

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Abstract

In this changing climate scenario explosion of human population, resulted for plant based energy sources and food. Fruits are called as a "Protective food" with rich vitamins and minerals and some fruits being rich in antioxidants which prevents free oxidation to reduce the chance of cancer. Fruit production is dependent upon several abiotic and biotic stresses. Enhancement of human population increases demand existing in global fruit production. Therefore, many economically important fruit crops are needed to be improved. During the past, some traditional breeding methods were used to solve these problems. Fruit breeding has had little success in improving fruit plants. There is an urgent need for the biotechnology based crop improvement especially of novel plant traits. Through genetic engineering methods introduction of transgenes and formation of transgenic plant has been successfully adopted to improve crops.

Keywords : fruits, stress, transgenic, traditional, genetic engineering

Introduction

Fruits are known as a relevant constituent of balanced diet which contain higher amount of vitamins, minerals, electrolytes, antioxidants and dietary fibre (**Slavin and Lioyd , 2012**) . Increasing population is creating demand in the global fruit production. This is improving the economically important fruit crops (**Tanuja and Kumar, 2017**). Since the twentieth-century, for increasing the fruit quality, traditional breeding techniques are being used. However, there are some constraints due to polyploidy, self- incompatibility, resources delimited to parental genome, long juvenile period, high heterozygosity and wide open to sexual combination (Litz and Padilla, 2012; Tanuja and Kumar, 2017). Some economically important properties including enhancement of biotic features like resistance to disease of virus, fungi, pest and bacteria or abiotic features like temperature, salinity, light, drought stress tolerance, nutrition, yield and quality and delayed fruit ripening and longer self life has been considered for breeding programmes. This has also been used to produce proteins in bioreactor and sometimes is used to produce edible vaccines (**Kuruganti and Ramanjaneyulu, 2011)**. A transgenic crop plant contains a gene which has been inserted from organism of different genus. Breeders are responsible for incorporation of beneficial genes in a crop which enhance quality and productivity. Transgenic research in fruit crops has very low difficulty in regeneration and transformation procedure being perennial and woody in nature.

Transgenes

Transgene is a foreign gene which contains transgenic plant. Foreign genes are incorporated from unrelated species, microbes and animals. Microbial genes are incorporated from fungi, bacteria

and viruses. In laboratory, genes from DNA are synthesized and are used for development of transgenic plants.

Advantages of transgenes

Transgenic plants are developed to overcome particular problems such as disease resistance, insects, drought, frost, salinity and metal toxicity, development of male sterility and enhancement of shelf life etc.

Applications of transgenic plant

Edible vaccines

One of the most recent examples is include transgenic banana, where genes of antigenic protein of many diseases causing pathogens have been expressed in banana fruits. Other some transgenic fruits are produced as edible vaccines which immunize human beings.

Biodegradable plastics

Ploy Hydroxy Butyrate (PHB) is one type of biodegradable plastics which is produced from transgenic plant. Through transfer of the gene, Poly Hydroxy Butyrate into the plant, large scale and cheaper production is possible. This might reduce the threat of polyethylene to the ecosystem.

Pest management

Fruit crops are infested by different types of insect pest. Through crop improvement methods insects pest can be managed eco-friendly, durable and rational manner. IPM plays important role in sustainable horticulture. Novel gene and insecticidal protein needed to be identified and conjunction with Bt to prevent development of resistance insects. Transgenic breeding have been used in diseases resistance, herbicides resistance and abiotic stress resistance. Example: In apple gene attack in (from *Hyalophorace cropia*) lysozome (farm chicken) and cecropin B (from H. *cecropia*) can promote disease resistance towards *Eriwinia amylovora*.

Some recently released fruit varieties:

- 'Nero' clementine (Spain,2006)- earliest fruit ripening
- 'Aldamla' cherry (turkey, 2014)- compact growth habits
- 'Burak' cherry (turkey, 2014)- high yield and large fruit
- 'Clemenverd' clementine (Spain,2010) -earliest fruit ripening

Papaya : These crops are severely affected by papaya ring spot virus which are carried by aphid vector resulting in yellowing of leaf and small fruit size and even can kill the papaya tree. This has devastated the papaya industry in the Pune area. Sunup and Rainbow are the two varieties developed by Dr. Dennis Gonsalves in 1998. "Pathogens derived resistance" is the coat protein gene of a mild mutant of a PRSV strain. 'Sunup' is a transgenic line of 'sun set' which on crossing with 'kapoho' produces 'Rainbow ' (yellow flesh).

Plum : Plum pox virus severely effects plum causing shark disease in stone fruit. This is spread by aphids and infected budwood. This virus causes deformed fruits, fruit drop, leaf chlorosis and tree decline. 'Honey sweet Plum' has been developed by USDA -ARS Appalachian Fruit Research station which is resistant to PPV - virus. This is developed through gene silencing and RNA interference (RNAi) techniques.

Apple : Arctic apple which was developed by Okanagan specialty fruits. The genes regulating the biosynthesis of polyphenol oxidase, responsible for fruit flesh browning are silenced or "switched off". Arctic Golden and Arctic Granny have been approved by US and Canadian regulatory agencies in early 2015. Arctic Gala and Fuji are other developed varieties.

Future prospects

To develop a stable transgenic plant it takes 4 to 5 years development of varieties through conventional breeding requires 12 to 15 years. Transgenic crop breeding is a rapid method of crop improvement. This method permits transfer of genes between unrelated species as well as among unrelated organisms. For example, a freezing resistant gene has transferred from fish to tomato. Even, ovalbumin gene of chicken has been transferred in alfalfa for improving protein quality. This is due to the natural evolution. It is used to improve genetic configuration both autogamous and allogamous crop plants. Transgenic breeding are more effective to implement of monogenic characters only.

Conclusion

Transgenic fruits crops are giving much more yield and having good quality than normal fruit crops which overcome the world hunger and malnutrition problems. It helps to protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides.

Reference

Gonsalves, D .(2004). Transgenic papaya in Hawaii and beyond. *Ag Bio Forum, 7,36 -40.*

Kumar, A. and Kumar, V.A., 2000. *Biotechnology for fruit crop improvement*. International Book Distributing.

Slavin, J.L. and Lloyd, B., 2012. Health benefits of fruits and vegetables. *Advances in nutrition*, *3*(4), pp.506-516.

Tanuja, P. and Kumar, A.L., 2017. Transgenic fruit crops—A review. *Int J Curr Microbiol App Sci*, *6*(8), pp.2030-2037.

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CRYOPRESERVATION OF EXPLOITED AND ENDANGERED SPECIES

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Introduction

Cryopreservation is branch of biology that deals with the principles and methods of preservation of living things (Cells, tissue, gametes) at ultra-cold temperature (-196^{o}C). At this temperature, the metabolic activities of the cells are arrested but they remain viable (Nannou *et al.,* 2016).

Their normal functions can be reactivated after proper thawing. The objectives of Cryopreservation of fish gametes are:

(a) Long term preservation of desired gametes for future use;
(b) For Conservation of species which are considered as endangered;
(c) For hybridization.

Why Cryopreservation?

Maintaining the viability of gametes for a prolonged period is advantageous in many ways:

- It can improve the induced breeding technology and would assist in the selective breeding programmer;
- The males & females artificial breeding can be alleviated;
- Different stock/species maturing at different time/seasons can be interbred;
- The gametes can be transported easily to different areas or countries;
- It will help in making sperm bank (gene bank) for conservation of genetic diversity (Anjali Pushp and Shyam Kumar, 2017).

Biology of Fish Gametes

- The gametes of oviparous fishes remain viable for a short time in the external medium.
- Fertilization occurs within 30-60 seconds after the gametes are released. In teleost an fish sperm penetrates in to an egg through the micropyle.
- An egg loses fertilizability in a short time due to the blockage of its micropyle.
- Similarly the duration of sperm motility (movement) is also very short and the fertilizing ability is lost with loss of motility.
- Therefore, for the proper handling of gametes during artificial insemination and for preserving their viability a sound knowledge on gamete biology is very important (Diwan *et al.,* 2010).

Cryopreservation of fish spermatozoa

The spermatozoa of several species of finfish and shellfish have been cryopreserved and `Sperm banks' established for some species.

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This is because of :

- Smaller size (4-6 um)
- Larger number per unit volume (several million spermatozoa/ml milt)
- Repeatability and ease of collection and handling
- Simple membrane (easy to dehydrate or cryoprotect spermatozoa)

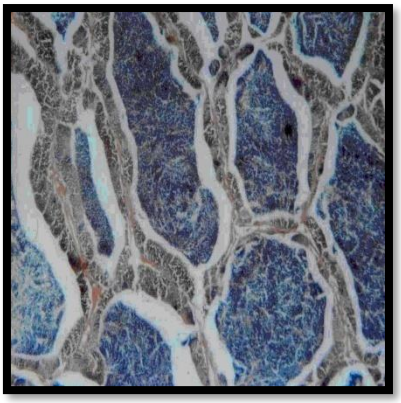


Figure : Minute spermatozoa found within

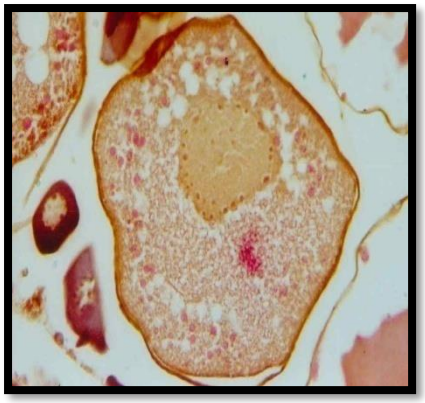


Figure: A mature egg (oocyte) seminiferous lobule

Fish sperm cryopreservation

- Since the first attempts to cryopreserve fish sperm, the potential application of this methodology to freshwater and marine species like zebra fish, common carp, salmonids and cyprinids, Atlantic salmon beluga sturgeon , Siberian sturgeon, perch, eel and shrimp. Because of their high commercial value, either as food or for recreation purposes such as fishing (NCBI 2015).
- The first time, Chow (1982) reported the successful preservation of spermatophores of the fresh water prawn *Macrobrachium rosenbergii*. Mud crab, lobster etc.

Family	Species	Common name	Collection method
Bagridae	*Mystus nemurus* (=*Hemibagrus nemurus*)	Asian redtail catfish	Crushed testis
	Pelteobagrus fulvidraco	yellow catfish	Crushed testis
Clariidae (airbreathing catfishes)	*Clarias gariepinus* (=*Clarias lazera*)	North African catfish	Crushed testis
Ictaluridae (North American freshwater catfishes)	*Ictalurus furcatus*	blue catfish	Crushed testis
	Ictalurus punctatus	channel catfish	Crushed testis

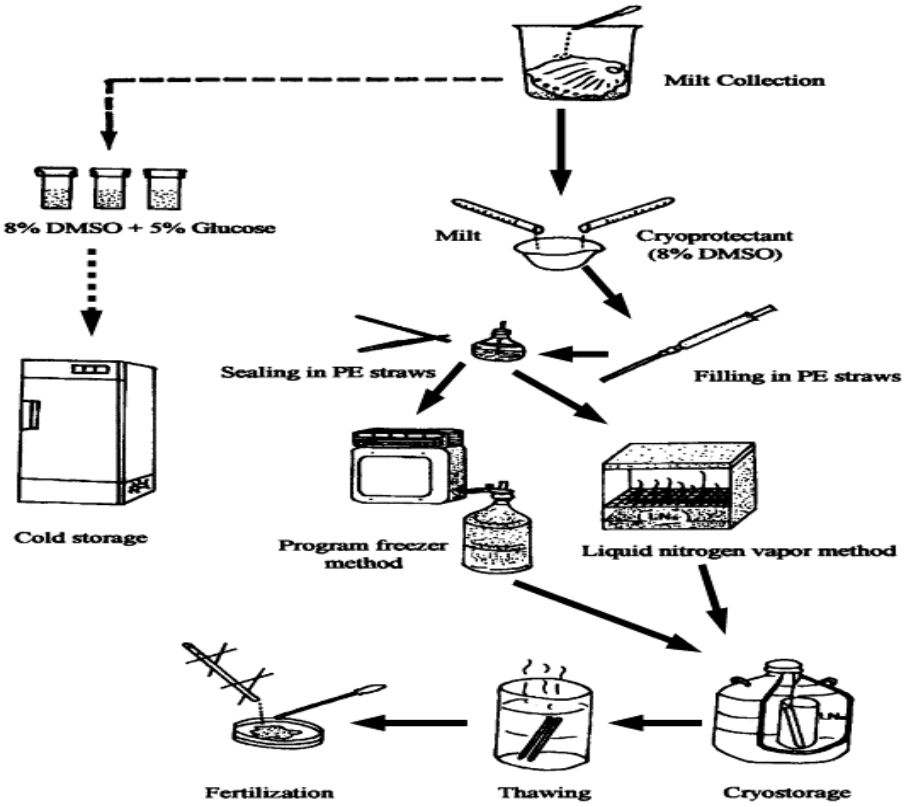
How does cryopreservation work?

There are several basic components to these protocols:

- Sperm collection
- Addition of extenders and refrigerated storage
- Labelling of straws, goblets and canes
- Addition of cryoprotectants
- Filling of straws

- Freezing
- Storage
- Thawing and fertilization (Pegg, 2009).

Cryopreservation of finfish and shellfish gametes and embryos



CRYOPRESERVATION METHOD

Sperm collection

Either by stripping or surgical removal of testis.

- However, stripping is often associated with urine contamination.
- The use of intratesticular spermatozoa obtained after slaughtering of fish can be considered when satisfactory milt quantities cannot be obtained by stripping.

Extenders and refrigerated storage

- Extenders are solutions of salts, which help maintain the viability of cells during refrigeration, prior to freezing; these have been developed for many species.

Types of extenders

- NaCl - 6.5 to 8 gm.
- KCl - 0.2 to 3 gm.
- CaCl2 - 0.16 to 3 gm.
- NaHCO3 - 0.2 to 0.35 gm.
- Sucrose - 1 gm.

Sperm samples should be stored at 4°C and not frozen; they should be stored in shallow containers with the lids loosely attached to allow oxygenation of the sperm cells during storage (Tsai and Lin, 2012).

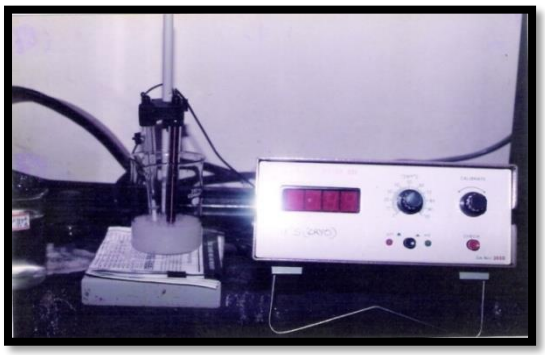


Figure: Determination of pH of extender

Figure: Checking motilityof spermatzoa

Labelling of straws, goblets and canes

- A simple method for labelling is to use straw colour for identification of cryoprotectant and a system of marks on the straws to identify fish number and cryoprotectant concentration.
- Straws can be stored in LN2 in plastic containers called goblets.
- Canes should be labelled, to avoid excessive searching for necessary straws, this helps protect the straws from warming during handling (Cabrita *et al.,* 2010).

Addition of cryoprotectants

- Cryoprotectants are chemicals that allow cells to survive freezing protocols. It helps to prevent or reduce the process of formation of crystal in intra-cellular fluid.
- They are grouped into 2 broad categories:
  1. Permeating cryoprotectants
  2. Non-permeating cryoprotectants
- Examples of permeating cryoprotectants include dimethyl sulfoxide (DMSO), methanol and glycerol.
- Examples of non-permeating cryoprotectants include sugars such as glucose or sucrose, polymers such as dextran, milk and egg proteins and antifreeze proteins (Kopeika *et al.,* 2017).

Examples of cryoprotectants used according to species:

- DMSO - salmonids and many other fresh and sea water species
- Glycerol - arctic charr and catfish.
- Methanol – tilapia, zebrafish
- Propanediol - halibut

Filling of straws

- Straws can be filled by automatic machines or by pipette.
- They are closed at the opposite end by a sealing powder and cotton plugs, or by thermo-sealing.
- There are 2 types of straws:
  - Bovine straws – these are inexpensive (but not airtight). They are the type currently used.

- CBC straws – these are more expensive (but are airtight). There is no risk of transmission /contamination by viruses or bacteria; they are sealed at both ends by soldering (Tiersch *et al.,* 2007).

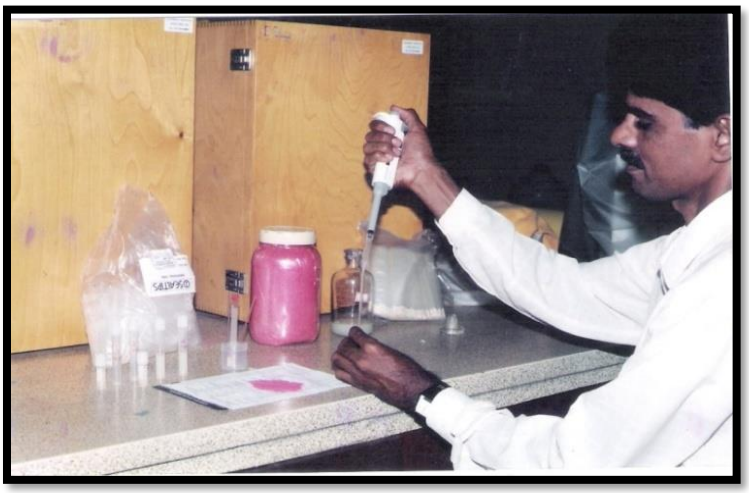


Figure: Filling plastic straw with diluted spermatozoa

Freezing procedures- 2 types

1. Programmable freezers
2. Non-programmable freezers

- Most computercontrolled freezers allow programming of the steps for insertion and removal of straws.
- Automatic freezing machines are only really used for embryos (large cells).
- For non-programmable freezers, samples should be held at the equilibrium temperature or at 4°C, until the beginning of the freezing procedure.
- The temperature should reach 80°C before the straws are plunged in liquid nitrogen and the samples should be held at this temperature before removal to ensure proper freezing and to allow sufficient time to transfer samples to LN2 (Agarwal, 2011).

Storage procedures

- Storage dewars are designed to store cryopreserved samples in LN2 for extended periods of time at -196°C.
- A vacuum chamber provides insulation. This type of storage does not have a time limit.

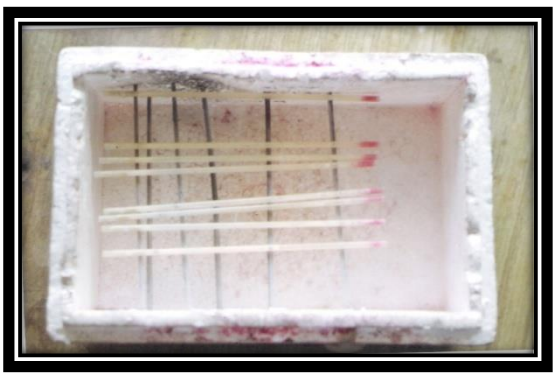


Figure: Straws being frozen over LN_2

Figure: Frozen straws being immersed in LN_2

Thawing and fertilisation

- Samples should be removed from the storage and transferred immediately to a Styrofoam ice chest containing LN2.
- The 0.5ml straws should be held in a water bath at a temperature of 37-40°C for around 7-10 seconds.
- The temperature inside the straws must not exceed 4°C, as above this temperature the cryoprotector becomes toxic.
- Thawed sperm samples should be added to the eggs and thoroughly mixed, and the gametes should be activated with an appropriate solution.
- After approximately 5 minutes, water should be added to water-harden the eggs (Songlin, 2002).

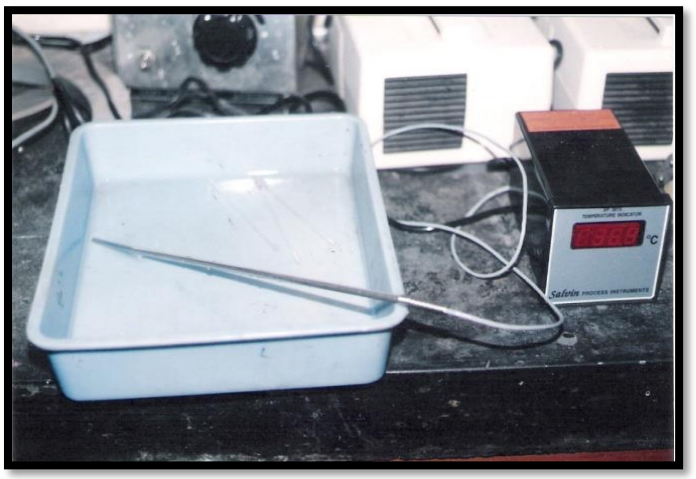


Figure: Straws being thawed at 37^0C

Cryoconservation use

The freezing of sperm is important for several fish species within genetic improvement programmes, in order to diffuse or conserve genetic potential or in order to evaluate genetic progress (Diwan *et al.,* 2010).

Successful cryopreservation of spermatozoa depends on a number of factors

i. Maturity stage of male;
ii. Handling of gamete during preservation
iii. Extender, Cryoprotectants composition
iv. Ratio of diluents' and semen
v. Cooling and thawing rates etc.

References

Agarwal, N.K., 2011. Cryopreservation of fish semen. *Himalayan Aquatic Biodiversity Conservation and New Tools in Biotechnology. 1st ed. Transmedia Publication, Uttarakhand*, pp.104-127.

Anjali Pushp and Shyam Kumar, A.P., 2017. Cryopreservation of fish gametes: A remarkable tool for breeding conservation.

Cabrita, E., Sarasquete, C., Martínez-Páramo, S., Robles, V., Beirão, J., Pérez-Cerezales, S. and Herráez, M.P., 2010. Cryopreservation of fish sperm: applications and perspectives. *Journal of Applied Ichthyology*, *26*(5), pp.623-635.

Diwan, A.D., Ayyappan, S., Lal, K.K. and Lakra, W.S., 2010. Cryopreservation of fish gametes and embryos. *The Indian Journal of Animal Sciences*, *80*(4), pp.109-124.

Diwan, A.D., Ayyappan, S., Lal, K.K. and Lakra, W.S., 2010. Cryopreservation of fish gametes and embryos. *The Indian Journal of Animal Sciences*, *80*(4), pp.109-124.

Kopeika, E., Kopeika, J. and Zhang, T., 2007. Cryopreservation of fish sperm. *Cryopreservation and freeze-drying protocols*, pp.203-217.

Nannou, T.K., Jouhara, H., Trembley, J. and Herrmann, J., 2016. Cryopreservation: Methods, equipment and critical concerns.

Pegg, D.E., 2009. -Principles of Cryopreservation. *PreservAtion of HumAn oocytes*, pp.34-46.

Songlin, C., 2002. Progress and prospect of cryopreservation of fish gametes and embryos. *Shuichan Xuebao*, *26*(2), pp.161-168.

Tiersch, T.R., Yang, H., Jenkins, J.A. and Dong, Q., 2007. Sperm cryopreservation in fish and shellfish. *Society of Reproduction and Fertility supplement*, *65*, p.493.

Tsai, S. and Lin, C., 2012. Advantages and applications of cryopreservation in fisheries science. *Brazilian archives of biology and technology*, *55*, pp.425-434.

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A RECENT ADVANCES IN USE OF PLANT GROWTH REGULATORS

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Abstract

Plant growth regulators, also known as phytohormones, are organic compounds made naturally in plants that affect growth or another physiological function at a location or from the plant's source and are only minutely active. Plant growth regulators (PGRs), which might enhance production, quality, and post-harvest life, were quickly discovered. Nowhere else has their impact been more strongly documented than in the production of tree fruits. After the discovery of auxins, it was discovered that NAA was effective in preventing preharvest drop and biennial bearing, two of the most major issues with apple production. As a result, the use of PGR results in some amazing successes in a variety of fruit crops, with notable superiority in growth, yield, and quality. These include promoting branching, enhancing rooting, suppressing the growth of winter sprouts, increasing or decreasing flower bud formation, thinning fruit or flowers, reducing biotic and abiotic stress, delaying pre-harvest drop, and improving stress tolerance.

Keyword : Plant growth regulators, growth and development, production.

Introduction

Plant growth regulators, also known as phytohormones, are organic compounds that are produced naturally in higher plants but are not nutrients. They control growth or other physiological functions at a location far from their source and are active in very small quantities, which alter plant physiological processes. A specific enzyme may be stimulated or inhibited by plant growth regulators, which also aid in controlling metabolism. The impact on plant physiology depends on both the quantity and sensitivity of the hormones in the tissues. The plant makes a limited amount of substances, which are then transported somewhere for utilisation.

Types of Plant Growth Regulators

1. Growth promoter

- Auxins
- Gibberellins
- Cytokinins & Kinetin

2. Growth Inhibiter

- Abscisic acid
- Ethylene

3.Growth Retardant

1. Cycocel or CCC or chlormequat
2. Phosphon D

3. AMO-1618
4. MH-40
5. B-995

Growth promoter

Auxins : Auxins are defined as – "An Organic compound characterised by its capacity in low concentration to induce elongation in shoot cells and inhibition of elongation in root cells. The term auxin was coined by F.W. went (1928). The existence of auxin was proposed by "Charles Darwin" while working on Canary grass (*Phalaris canariensis*).

Role of Auxin

(a) Apical dominance
(b) Cell division and cell enlargement
(c) Shoot and root growth
(d) Xylem differentiation
(e) Nucelic acid activity
(f) Plant growth movement

Gibberellins : Japanese scientist "E. Kurosava" made the discovery of gibberellic in 1926. It was initially taken from the fungus Fusarium moniliforme, Gibberella fujikuroi. The fungus is a common manifestation of "Foolish seedling of rice" or "Bakanae disease of rice." The rice plant develops unnaturally thin and tall due to this illness.

Role of Gibberellins

(a) Preservtion of genetical dwarflism
(b) Bolting and flowering
(c)Light inhibited stem growth
(e) Parthenocarpy
(f) Germination

Practical use of Gibberellins

(a) Germination
(b) Flowering
(c) Fruit setting
(d) Breaking of dormancy
(e) Fruit thinning

Cytokinins : Cytokinin is a substance that, in conjunction with auxins, induces cell division in plant cells. "Skoog" identified cytokinin in coconut milk (1945). Currently, it is evident that cytokinins are an element of RNA (Transfer- RNA).

Role of Cytokinins

(a) Cell division
(b) Cell and organ enlargement
(c) Seed germination
(d) Root initiation and growth
(e) Bud development and shoot growth
(f) Retention of chlorophyll and delayed senescence in leaves

Growth inhibiter

Abscisic acid : The inhibitory ingredient was isolated by Robinson and P.F. Weiring (1963–1964) and given the name "Dormin". comparable to the chemical Xanthoxine. ABA is a biproduct of xanthophyll breakdown.

(a) Abscission of leaves and flowers
(b) Dormancy of buds and seeds
(c) Inhibits germination

Ethylene : The only gaseous hormone that promotes growth is ethylene. In 1971, it was added to the harmones category. Stressful circumstances lead to ethylene production. Such pressures may include chemical exposure, mechanical injury, and radiation from disease.

Role of ethylene

(a) Fruit ripening
(b) Seedling growth and emergence
(b) Leaf abscission
(e) Other response

- Inhibition of elongation in root, stem and leaves
- Stimulation of adventitious root formation on stem
- Inhibition of geotropism in pea
- Inhibition of flowering and epinasty

Practical uses of ethylene
(a) Fruit ripening
(b) Flowering
(c) Growth

Growth retardants

These are artificial substances that stop the growth of the plants. Despite having their stems reduced, plants treated with growth retardants appear normal. They have no impact on how leaves, flowers, or fruits are formed. Among the most significant growth inhibitors are AMO-1618, Phosphon-D, Cycocel, MH, and B-995. B Nine, and C.

Uses of growth retardants

1. Improves stem stability and these prevent lodging.
2. Improves emergence and vigour.
3. Check excess vegetative growth.
4. Improves water and Nutrients supply.
5. Retardation of senescence.
6. Proper management of capacity (e..g. TIBA improves canopy of soybean).
7. Increase biotic and abiotic stress resistance.

Conclusion

Plant growth regulators, whether they are synthetic or natural, have many different and extensive uses in horticulture. These growth regulators, which are present in very little amounts, may negatively affect a physiological process in plants. These growth regulators have been shown to have more uses and are more economically significant for farmers and horticulturists based on

evidence of their harmful effects in modest quantities. Many farmers and gardeners throughout the world have benefited and benefited from knowing about these growth regulators.

References

Acquaah, George (2009). Horticulture-Principles and Practices. PHI Learning Private Limited, New Delhi, pp-178-180.

Prasad,S and Kumar, U (2008). Principles of Horticulture. Agrobios (India) Publishing Agency, Jodhpur, pp-367-401.

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CURRENT STATUS OF INDIAN MARINE FISHERIES PRODUCTION-2020 AND THEIR MANAGEMENT STRATEGIES

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Introduction

India being a tropical country is blessed with 8129 Km. of coastal line and 2.02 million km^{2}of Exclusive Economic Zone with an estimated annual potential production of 4.41 million metric tonnes. Marine fishery resources are naturally renewable and their management is necessary for sustained production from the ocean. In India, 3,288 marine fishing villages and 1,511 marine fish landing centres in 9 maritime states and 4 union territories. The Indian marine fisheries sector supports 4 million fishermen population for their livelihood by providing employment to nearly 9.9 lakh fishermen. Sustainable harvest of the marine fishery resources is necessary as over-exploitation of the resources is likely to harm the diversity and cause a reduction in the availability of some of the resources. Marine capture fisheries are undergoing tremendous changes due to increasing fishing efforts. Almost catch of all commercially important marine fin fishes and shell fishes is on a declining trend and resulting in resource depletion and unemployment as well as affecting the availability of cheap protein for the people and also affecting the Indian economy. India is one of the top marine fish producing countries in the world, which hold 7th rank in global marine capture fish production after China, Indonesia, USA, Russia, Japan and Peru with 4.3% contribution.

Current status of the Indian Marine sector : Marine fish landing for the year 2020 was estimated as 2.73 million tonnes with a decline of 23.45% compared to the year 2019 (Fig 1).

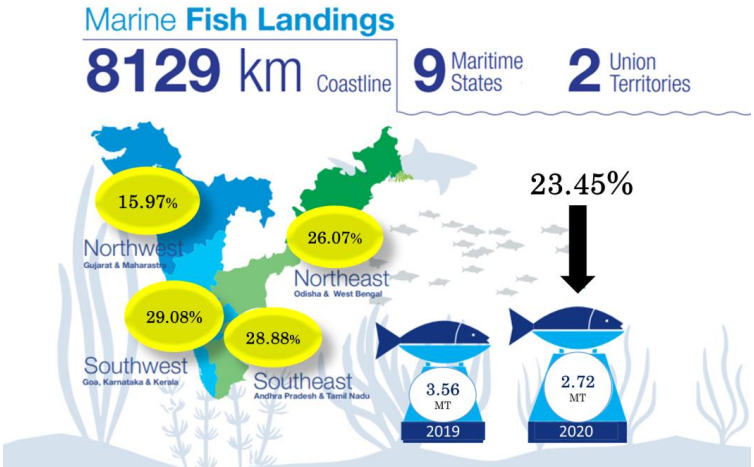

Figure 1. Marine Fish Landings overview- 2020

The national level decline in landings is caused by decline in landings by all the maritime states in northwest, southwest and southeast regions except Goa (Fig. 2).

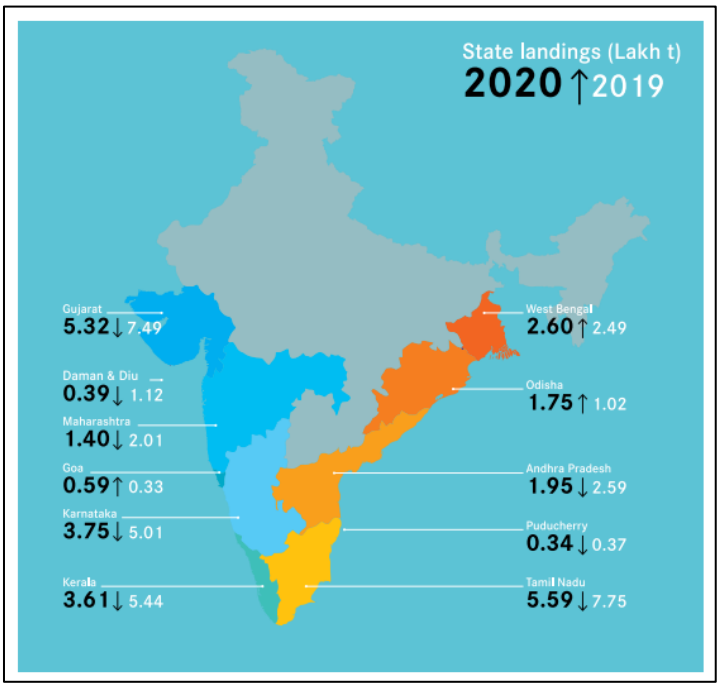

Figure 2. State-wise marine fish landings estimate for 2020 and 2019

Tamil Nadu topped the list followed by Gujarat and Karnataka contributing 20.51%, 19.51% and 13.75% respectively to the overall tally (Fig 3).

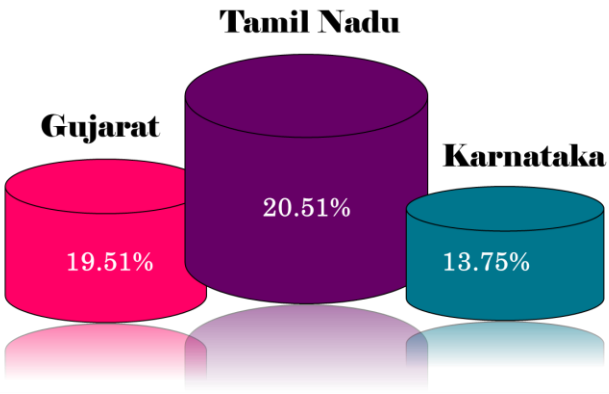

Figure 3. Top three state in Marine landing-2020

Lesser sardines are top in marine landing with 0.216 million tonnes contributing 7.19% followed by Indian mackerel 0.180 MT (6.61%), penaeid shrimp 0.157 MT (5.74%), Ribbonfishes 0.144 MT (5.27%) and Threadfin breams 0.123 MT (4.51%) (Fig. 4).

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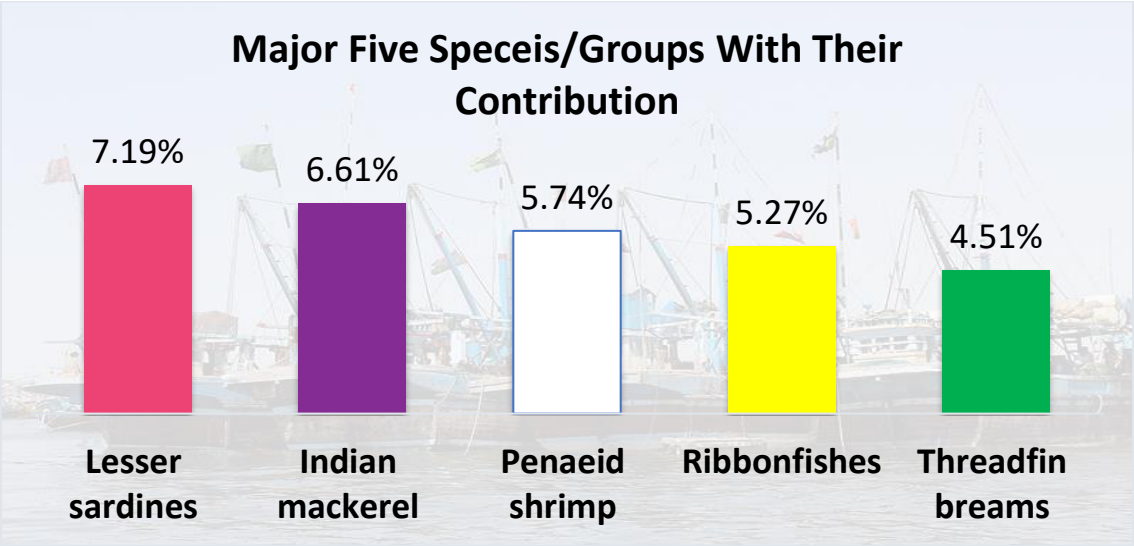

Figure 4. Major five species/groups with their contribution towards total marine fish landings in India 2020

The Oil sardine (*Sardinella longiceps*) which used to be at the first position few years ago moved to the 10th position with only 0.083 million tonnes as the landings in 2020 (3.05% of the national total). Assemblage-wise percentage contributions were Pelagic 54%, Demersal 29%, Crustaceans 11% and Molluscs 6% (Fig 5).

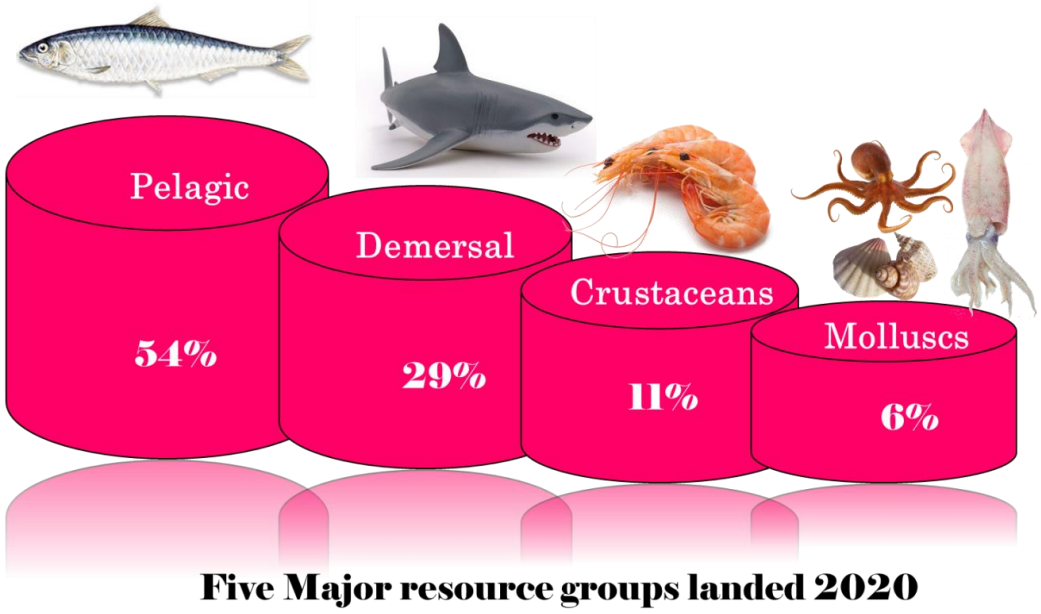

Figure 5. Assemblage-wise marine fish landings and major resources in each assemblage

Out of the total 2.726 million tonnes of marine fishery resources harvested in 2020 about 2.262 million tonnes (83.0%) is by mechanized fishing vessels, 0.438 million tonnes (16.1%) is by motorized fishing crafts and only 0.026 million tonnes (1.0%) is by non-mechanized fishing crafts (Fig 6).

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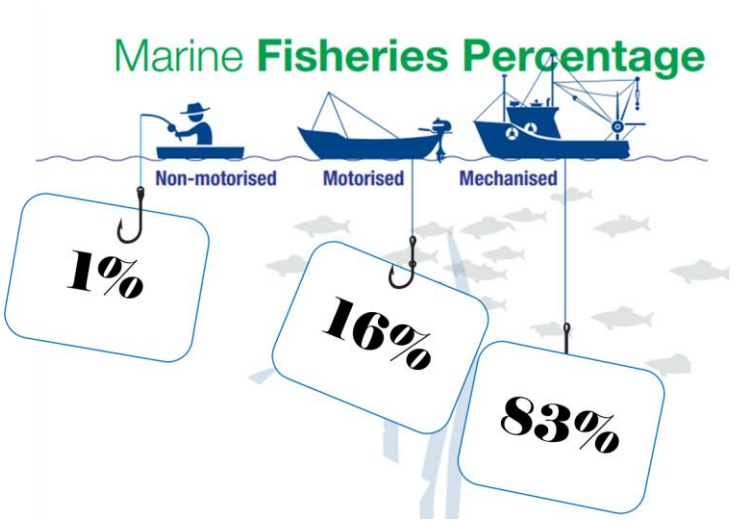


Figure 6. Sector-wise Contribution during 2020

The maritime state with maximum number of species in landings is Tamil Nadu (594) followed by Kerala (449) and Odisha (269). The national overall average per species landings in 2020 is 3349 t against 4146 tonnes in 2019. In 2020, the average landings per species was high in Gujarat (2674 t) followed by Karnataka (1893 t) and West Bengal (1136 t) (Fig 7).

Figure 7. State-wise Production: Overview

Gujarat : The annual marine fish landings of Gujarat was estimated at 5.32 lakh t, decreasing significantly (28.9%) in comparison to 2019 (7.49 lakh t). Pelagic resources formed 2.06 lakh t in 2020 contributing 37% to the total marine fish landings of Gujarat. The resources were dominated by ribbonfishes, followed by Bombay duck, clupeids, carangids, tunas, seer fishes and Indian mackerel. The dominant resources exploited were non-penaeid shrimps, ribbonfishes, Bombay duck, cuttlefish, croakers, squids, penaeid shrimps, catfishes, threadfin breams and rock cods etc.

Croakers were the most dominant resource, followed by catfishes, threadfin breams, and rock cod. A major decline was recorded in the elasmobranch fishery, which registered a fall of 66.5, 82.3 and 84.6% for sharks, rays, and guitar fishes, respectively. Non-penaeid shrimps continued to be the most dominant component of the fishery, followed by penaeid shrimps, crabs, and stomatopods.

Maharashtra : The estimated marine fish landings of Maharashtra was 1.39 lakh t, a decrease of 44% from the previous year (2.01 lakh t). Non-penaeid shrimps (19.6%) were the dominant resource during the year. The other major resources in terms of quantity were penaeid shrimps, Indian mackerel, croakers, bombay duck, threadfin breams, silver pomfret, squids, ribbonfish and golden anchovy. The highest contributor among pelagic resources was Indian mackerel (13862 t), followed by Bombay duck (8596 t), lesser sardines (8487 t) and horse mackerel (8259 t). Croakers (12108 t), pomfrets (5440 t) and catfishes (4985 t) were the major demersal resources in the fishery. Non-penaeid shrimps (17164t) followed by penaeid shrimps (12381t) contributed to the crustacean landings and molluscan landings were by squids (4538 t) and cuttlefish (2478t).

Karnataka & Goa : The estimated marine fish landings in Karnataka (374514 t) and Goa (58771 t) registered 25% decrease and 79% increase respectively during 2020 as compared to 2019. The major groups that constituted the pelagic resources included Indian mackerel, lesser sardines, ribbonfishes, carangids (scads, horse mackerel), tunas (*Euthynnus affinis, Auxis spp., Katsuwonus pelamis* and *Thunnus tonggol*), seer fishes (*Scomberomorus commerson* and *S. guttatus*), halfbeaks and full beaks. Major demersal resources landed in Karnataka were threadfin breams lizardfishes, bullseyes, rock cods, croakers, pomfrets, silverbellies, flatfishes, elasmobranchs and whitefish.

In Goa, the major pelagic fishes recorded were Indian mackerel, other carangids, lesser sardines, tunas, horse mackerel, seer fishes, ribbonfish, scads, lesser sardines and leather jackets.

Kerala & Lakshadweep : The total marine fish landings in Kerala during 2020 were 3, 60,742 t, which was 34% lower than that of the previous year's estimates (2019). About 68% of the catch was landed by mechanized gears and 31% by motorized units. The major resources in the catch were Indian mackerel (15.4%) followed by lesser sardines (9.1%), Stolephorus (8.4%), scads (8.3%), threadfin breams (7.9%) and penaeid shrimps (7.8%). Pelagic finfishes dominated in the landings with a share of 62.3%, and demersal finfishes constituted 21.7% of the total marine fish landings of Kerala. Catch of Indian mackerel increased significantly (37%) in 2020. Among the demersal finfishes, the dominant resource was threadfin breams with annual landings of 28,469 t which formed 36.3% of the total demersal landings of the state, which was followed by lizardfishes (17.5%), soles (9.6%), other perches (7.8%) and black pomfret (6.5%). There was a significant decline (-47.6%) in the landings of elasmobranchs in 2020 (1648 t), of which rays contributed 52.8%, followed by sharks (39.1%) and guitarfishes (8.1%).

Tamil Nadu : Total marine fish landings in Tamil Nadu was 5.59 lakh t, decreasing by 27.8% from 2019. Lesser sardines, carangids, oil sardine, mackerels, tuna and barracudas were the major contributors, forming >83% of the pelagic fish landings in the state. Silver bellies, lesser perches, pig-face breams, threadfin breams, goatfishes, croakers, lizardfishes, snappers and elasmobranchs were the major contributors, forming >86% of the demersal fish landings in the state. Silverbellies

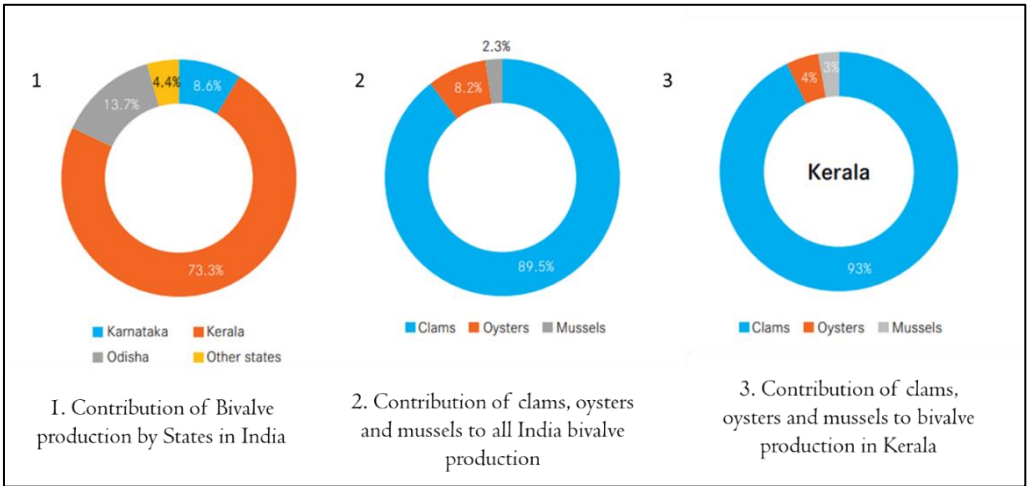
formed 30.7% of the demersal fish landings and lesser perches formed 12.8%. Penaeid shrimps formed 55.8% of the crustacean landings, crabs formed 41.9% and lobsters, 2.1%. The dominant species were *Metapenaeus monoceros* (22%) followed by *Trachysalambria aspera*, *M. dobsoni* and *Metapenaeopsis andamanensis*. The crab fishery of Chennai was mainly formed by 11 species. *Thenus unimaculatus* and *Panulirus homarus* were the dominant species of lobster. The total landings of molluscs was about 31,020 t. Cephalopods constituted 85.8%.

Total marine fish landings at Puducherry (including Karaikkal) was estimated at 33858.7 t, decreasing by about 8.2% from 2019.

Andhra Pradesh : Total marine fish production was estimated to be 1.95 lakh t, which was 24.67% less when compared to that of 2019. Oil sardine, Indian mackerel, lesser sardine, penaeid shrimp and ribbonfishes were the major resources in the landings. Within the pelagic resources, the highest contribution was by oil sardine (23.2%), followed by Indian mackerel (23.0%), lesser sardines (11.8%) and ribbonfish (6.8%). Croakers (19.7%) and silverbellies (12.4%) were the major demersal resources followed by other perches (11.6%) and catfish (7.9%). Penaeid shrimp contributed the highest (72.6%) to crustacean landings of the state, followed by crabs (22.7%) and non-penaeid shrimp (3.1%). The cuttlefishes contributed 65.9%, squids 33.9% (1338 t) and gastropods 0.2% to the molluscan landings of the state.

Sustainable Fisheries Management : Bivalves

Kerala State contributed maximum (73.3%) followed by Odisha (13.7%), Karnataka (8.6%) and other coastal States (4.4%). Among bivalves, the maximum contribution was by clams followed by oysters and mussels. In Maharashtra, the oysters' fishery is dominant. The Indian rock oyster (*Saccostrea cucullata)* contributed about 77% to the bivalve production. In Kerala, Clams dominated the bivalve fishery followed by edible oysters and mussels. Black clam, *Villorita cyprinoides* was the most important clam species exploited and Kerala was the major contributor (Fig 8).



1. Contribution of Bivalve production by States in India

2. Contribution of clams, oysters and mussels to all India bivalve production

3. Contribution of clams, oysters and mussels to bivalve production in Kerala

Figure8. Sustainable Fisheries Management: Bivalves

Sustainable Fisheries Management : Gastropod

South Tamil Nadu contributed nearly 95% and north Tamil Nadu contributes 5% of the total gastropod catch. The major portion of the catch is from Tuticorin District (56%) followed by

Ramanathapuram (38%), Chennai (3%) and Nagapattinam (2%). In gastropod fishery, *Turbinella pyrum, Chicoreus ramosus, Lambis lambis* are the most exploited and commercially important species. Gastropod is a targeted fishery by skin diving method. In Tamil Nadu, the gastropod exploitation by skin diving was monitored from two districts viz., Tuticorin (Kalavasal & Vembar) and Ramanathapuram (Olaikuda, Vedalai and Dhanuskodi). The targeted gastropod species in this fishery were *C. ramosus, T. pyrum* and *L. lambis* with the species composition of 67, 29 and 5%. Gastropods are landed as bycatch from gill net, mainly from bottom set gill nets.

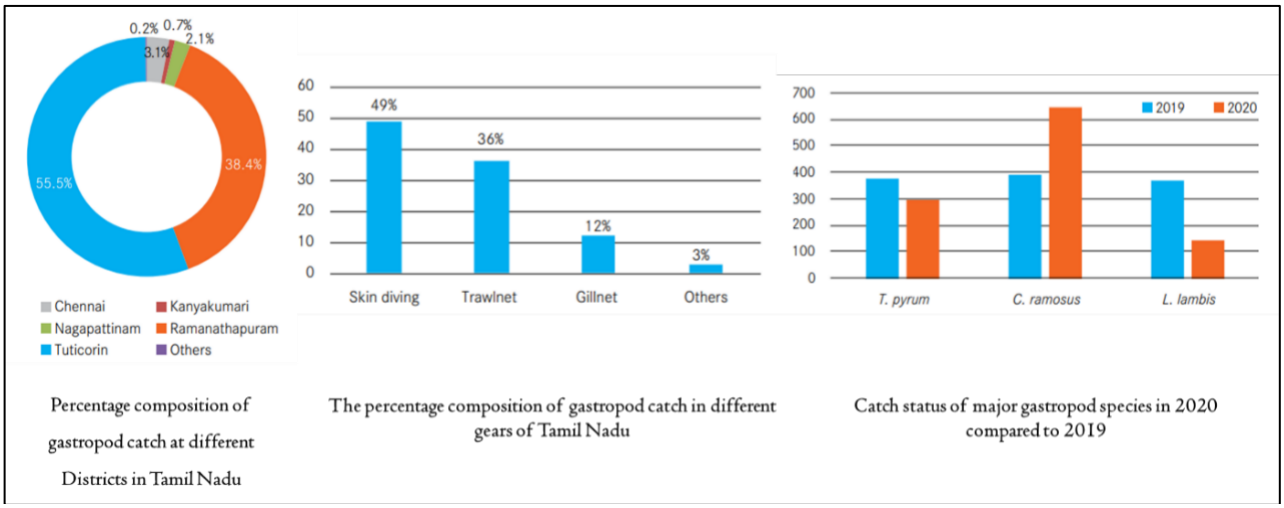


Figure 9. Gastropod Fishery

Sustainable Fisheries Management : Elasmobranchs

Elasmobranch landings in India during 2020 was 25,910 t, decreasing by 40% from the previous year. The east coast accounted for 70% of the landings and the west coast, 30%. West Bengal accounted for 31% of the total elasmobranch landings and Tamil Nadu &Puducherry, 25%. In 2020 except for West Bengal, Odisha and Gujarat (including Daman & Diu) there was a decrease in catch in all the other states when compared to 2019. Rays formed 48% of the total landed elasmobranchs, sharks, 40% and guitarfishes 11.5%.

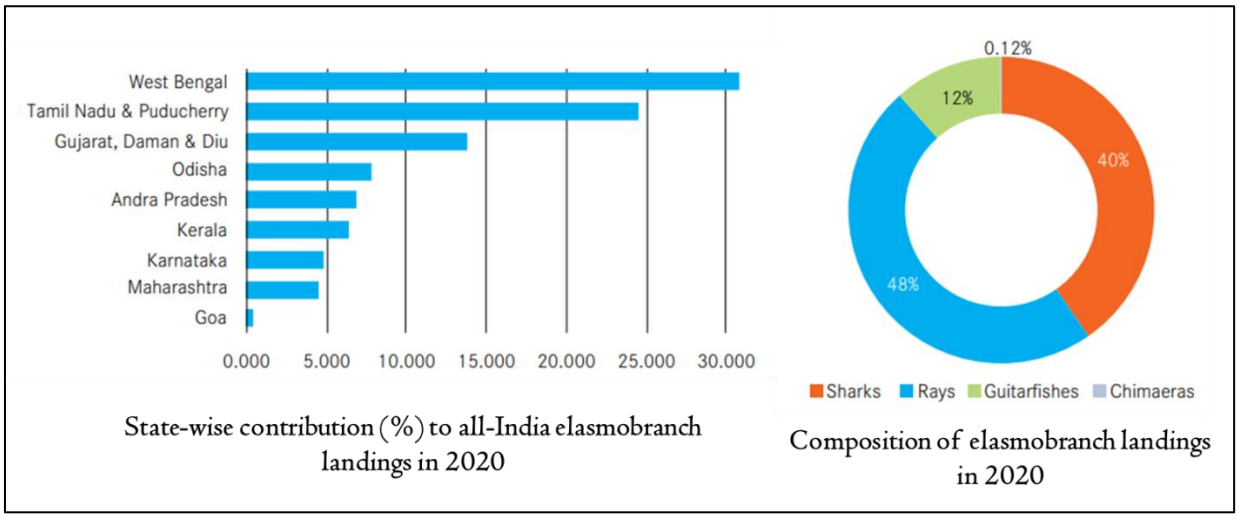


Figure 10. Elasmobranch landing state wise-2020

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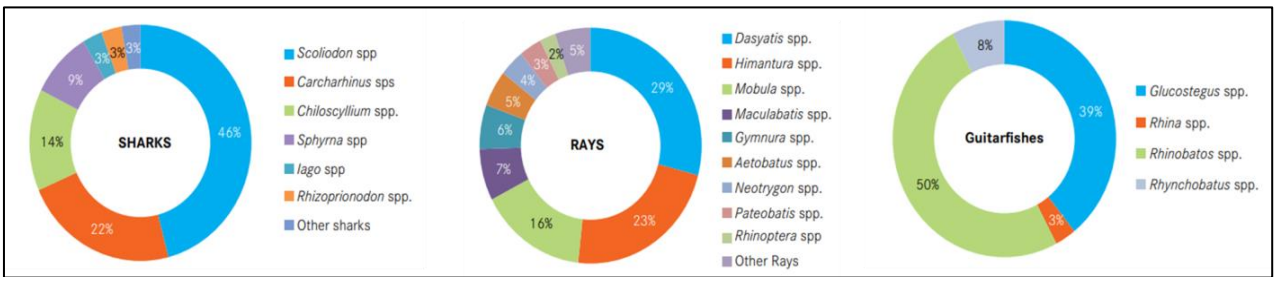

Figure 11. Composition of sharks, rays and guitarfishes landed in 2020 – major genera

Note : The decline in landings in 2020 was mainly due to the reduction in fishing effort in terms of number of operations and loss of fishing days due to COVID 19 lockdown. Some other factors are cyclonic weather days and steep increase in diesel price.

Conservation and management :

Fishes are an exhaustible and natural renewable resource with the capacity to rebuild. If not monitored and managed over exploitation will lead to stock depletion and some may become extinct. Harvest of this resource needs to be maintained at sustainable level through conservation and management.

Fisheries Management is the integrated process of information gathering, data analysis, planning, consultation, decision making, allocation of the resources and implementation of regulations or rules to govern fishing activities with enforcement as and when necessary to ensure steady and sustainable harvest of the resources. Fisheries Management is not about managing fish but about managing people and related businesses. Fish populations are managed by regulating the actions of people. These management regulations should also consider its implications on the stakeholders.

The basic goal of fisheries management is to find out the quantity of fish that can be harvested (optimum yield) in a sustainable manner, which may be subjected to changes based on political, economic, and social considerations. Highly conservative management can result in loss of fish production due to under-harvesting, while too liberal or no management can result in population depletion due to over-harvesting. Unlike mineral resources, if the fishery resources are well managed, their duration is unlimited. The fundamental basis for the conservation and management of fisheries resources is its biological characteristics.

Fisheries Management Mechanisms

- Prohibiting devices such as bows and arrows, spears, or firearms.
- Setting minimum mesh sizes.
- Limiting the average potential catch of each vessel in the fleet.
- Limiting the fishing season.
- Implementing Marine Protected Areas.
- Restricting the number of simultaneous fishing vessels.
- Limiting a vessel's average operational intensity per unit time at sea.
- Limiting average time at sea.

Reference

CMFRI, 2017. Annual report 2017. Central Marine Fisheries Research Institute, Kochi.
CMFRI, 2018. Annual report 2018. Central Marine Fisheries Research Institute, Kochi.
CMFRI, 2019. Annual report 2019. Central Marine Fisheries Research Institute, Kochi.
CMFRI, 2020. Annual report 2020. Central Marine Fisheries Research Institute, Kochi.

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IMPORTANCE OF STINGLESS HONEY BEE FARMING

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India is regarded as agricultural country. Most of the population in India depends on agriculture and agriculture allied sectors. 86% population in India is small and marginal farmers. Indian government encourages honey bee keeping to increase the revenue of the farmers. Bee keeping stood as a good source of income for rural farmers and women for their livelihood. Apart from honey, bee wax, pollen, royal jelly and bee venom can be gained by farmers through processing. The government aims to generate employment directly or indirectly to 2 lakhs people.

Most of the honey bees are stinged but there are 500 species of stingless bees. They are mainly found in Latin America, Australia Africa, east and west Asia. Melipona and Trigona are the two important genera of stingless honey bees. Unlike honey bees, stingless bees have the following advantages: They are generally less harmful to humans and domesticated animals; they are able to forage effectively in glasshouses. The genus Melipona has more number of bees compared to normal honey bees. These bees play an important role in ecology and economy. They also played a vital role in cross pollination of wild and cultivated crops. Products like honey cerumen and pollen can be obtained as income from stingless honey bees. The specialty of these bees is that they can collect nectar and pollen from even small flowers which also help in cross pollination. They can collect the pollen from flowers where normal honey bees can't collect.

These honey bees have less habit of constructing their own bee hives. So they can be easily reared with artificial hives and collect pollen, nectar and honey. Stingless honey bee keeping is very simple also. Honey collected from stingless honey bees is having distinctive sweetness with acidic nature. Having less knowledge about this honey, it is now efforts are being done to make it popular as industrial product. Plans are being laid to produce huge amounts of honey, propolis, geo-propolis and cerumen.

Cerumen is a mixture of tree resin (often in the form of propolis) that is mixed with beeswax and mandibular secretions. Compared to bee propolis, cerumen is quite different. In stingless honey bees cerumen is used for storing honey. It also helps in protecting the hive by mummifying the insects which enters into the hive. It also used in closing the hive and storing the honey due to which the honey gets its distinct taste as it is mixed with phytochemicals.

Nectar stored in cerumen converts into honey in three stages. The first stage is physical evaporation of water, second stage is biological transformation which means fermentation with bacteria and yeast and the last stage is chemical transformation done by worker bees. When they secreted enzymes glucose is formed from fructose and sucrose by hydrolyzation. Water in honey attracts microorganisms, high probiotics in these micro-organisms help preserve honey quality by secreting beneficial enzymes. Honey made from stingless honey bees have high medicinal values and also useful in healing the wounds. Healing of wounds is one of the wonderful biological

activities of honey. Rejuvenation of skin can be integrated in four steps after wounded. They are Hemostasis, swelling, extension and rejuvenation. Healing of broken wounds by using honey is following since ancient Egyptians to present surgeons. The qualities present in honey helps in healing the wounds. Antioxidants present in honey made by stingless bees helps in wound healing. This honey will also have anti-inflammatory, moisturizing and antimicrobial properties. Stingless bees have high capacity of making cross pollination of fruit and vegetables. The Ayurvedic medicinal properties present in the honey will help in studies for making medicines.

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REGISTERED PGR USES IN FIELD CROPS

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PGI, MPKV, Rahuri (MS).

Plant growth regulators are organic compounds other than nutrients that in small amounts promote, inhibit or otherwise modify a physiological process in plants. Plant hormones are signal molecules produced within the plant called as phytohormone, and occur in extremely low concentrations. Plant hormones and growth regulators are chemical compounds that affect flowering, ageing, root growth, distortion and senescence of leaves, stems, and other plant parts; prevention or promotion of stem elongation, etc. They are often produced and used on a local basis within the plant body. Plant hormones produce one part of plant cell that affect even different regions of the cell. The concentration of hormones required for plant responses are very low.

Due to climate change, conditions for the establishment, growth, reproduction, survival, and distribution of plant species are changing. In contrast to animals, plants are able to cease and resume growth. This flexibility in their growth and development pattern is partly achieved by the action of plant hormones. Still, the role of plant growth regulators in agriculture is modest compared to other agrochemicals, such as fungicides, herbicides, and insecticides. Applied concentrations of plant growth regulators usually are measured in parts per million (ppm) and in some cases parts per billion (ppb). These growth-regulating substances most often are applied as a spray to foliage or as a liquid drench to the soil around a plant's base. Generally, their effects are short-lived, and they may need to be reapplied in order to achieve the desired effect. Pesticides including plant growth regulators registered under section 9(3) of the Insecticides Act, 1968 for use in the Country.

Types of Plant Growth Regulators

There are five groups of plant-growth-regulating compounds: auxin, gibberellin (GA), cytokinin, ethylene, and abscisic acid (ABA). For the most part, each group contains both naturally occurring hormones and synthetic substances.

Auxin : Auxin causes several responses in plants:

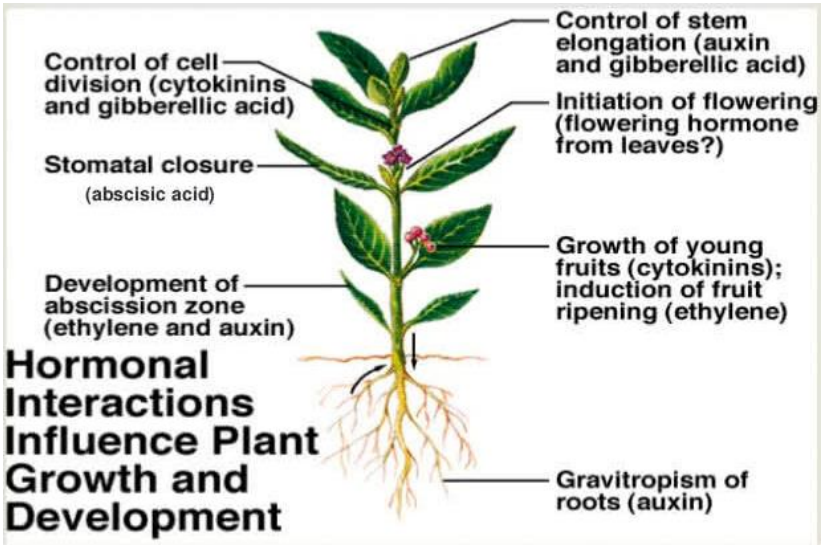
- Bending toward a light source (phototropism).
- Downward root growth in response to gravity (geotropism).
- Promotion of apical dominance (the tendency of an apical bud to produce hormones that suppress the growth of the buds below it on the stem).
- Flower formation.
- Fruit set and growth.
- Formation of adventitious roots.
- Auxin is the active ingredient in most rooting compounds in which cuttings are dipped during vegetative propagation.

Gibberellin : Gibberellins stimulate cell division and elongation, break seed dormancy, and speed germination. The seeds of some species are difficult to germinate; you can soak them in a GA solution to get them started.

Cytokinin : Unlike other hormones, cytokinin are found in both plants and animals. They stimulate cell division and often are included in the sterile media used for growing plants from tissue culture. If a medium's mix of growth-regulating compounds is high in cytokinin and low in auxin, the tissue culture explant (small plant part) will produce numerous shoots. On the other hand, if the mix has a high ratio of auxin to cytokinin, the explant will produce more roots. Cytokinin also are used to delay aging and death (senescence).

Ethylene : Ethylene is unique in that it is found only in the gaseous form. It induces ripening, causes leaves to droop **(**epinasty**)** and drop **(**abscission**)**, and promotes senescence. Plants often increase ethylene production in response to stress, and ethylene often is found in high concentrations within cells at the end of a plant's life. The increased ethylene in leaf tissue in the fall is part of the reason leaves fall off trees. Ethylene also is used to ripen fruit.

Abscisic acid : Abscisic acid (ABA) is a general plant-growth inhibitor. It induces dormancy and prevents seeds from germinating; causes abscission of leaves, fruits, and flowers; and causes stomata to close. High concentrations of ABA in guard cells during periods of drought stress probably play a role in stomatal closure.



Hormonal interactions influence plant growth and development

Uses of registered PGRs in field crops

Sr.no	Crop	Time of Application and Dose
1)	**Alpha Naphthyl Acetic Acid 4.5% SL (Na salt)**	
	Cotton	To prevent shedding of flower squares and bolls Three spray @ 10-20 ppm at 15 days interval from square formation stage
2)	**Chlormequat Chloride 50% SL**	
	Cotton (American)	20-40 ppm spraying at the time of flowering
	Cotton (Deshi)	Spray at square formation to early flowering @ 75 gm/a.i/ha.
	Potato	Dipping of cut pieces for 10 minutes in 100 ppm solution

3)	**Gibberellic Acid 0.001%L**	
	Paddy	Spray at 30-45 DAT @ 0.018 gm/a.i/ha.
	Sugarcane	First spray at 40-45 DAP and Second spray 70-80 DAP @ 0.018 gm/a.i/ha.
	Cotton	First spray at 40-45 DAP and second spray at the time of ball formation @ 0.018 gm/a.i/ha.
	Groundnut	First spray at flowering and second spray at the time of flowering @ 0.018 gm/a.i/ha.
	Potato, Cabbage and Cauliflower	First spray at 45 DAS and second spray at 65 DAS @ 0.018 gm/a.i/ha
	Tea	Five sprays at 30 days interval
4)	**Gibberellic Acid 0.186% SP**	
	Cotton	To improve fibre quality one spray at square formation or early flowering stage @ 142 ppm.
5)	**Mepiquat chloride 5% AS**	
	Cotton	Spray at flowering stage to Control of excessive vegetative growth and to increase crop yield in cotton @ 50-60 gm/a.i/ha.
	Potato	Spray at 45DAP to restrict excessive vegetative growth @ 60-75 gm/a.i/ha.
6)	**Triacontanol 0.05% EC**	
	Cotton	Three sprays at 45, 65 and 85 DAS @ 0.125 gm/a.i/ha.
	Rice and Groundnut	Three sprays at 25, 45 and 65 DAT @ 0.125 gm/a.i/ha.

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USAGE OF NANOPARTICLES AS A PRE-HARVEST PRECAUTION FOR POST-HARVEST PREVENTION OF DISEASES & INSECT PESTS IN VEGETABLE CROPS

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Abstract

Vegetables are the principal sources of vitamins and minerals that we essentially need. Despite India vegetable production sector being the second largest producer, next only to China, it suffers from 30-40% losses due to poor pre-harvest and postharvest practices. Application of insecticides at pre-harvest and fungicides at postharvest leaves the pesticide residues behind the produce. The consumer concern towards pesticide residue-free farm produces a quest for clean crop protection elements. The usage of nanostructures is reported to reduce the immoderate use of pesticides. Through this review, we recommend that the NPs, as pre-harvest application, can serve as an alternate candidate to pesticides towards lessening the post-harvest losses in vegetable crops.

Keywords : Vegetables, Nanoparticles, pre-harvest application, insect pests, disease management.

Introduction

Among the agricultural produces, the vegetables are the commodity of momentousness enhancing farm income, ensuring nutritional safety and maintaining the sustainability of global food security. The Indian vegetable production industry suffers, despite being the second largest producer next to China, from postharvest losses caused by insect pests and diseases to an extent of 30-40 per cent, due to poor postharvest practices (Tripathi, 2021). Unlike grains, the fresh vegetables are living entities even after harvest that continue to respire and senesce, thus highly perishable by nature. The postharvest deterioration causes qualitative and quantitative losses rendering the produce unfit for consumption and accompanied by potential health risks.

Application of insecticides at pre-harvest and fungicides at postharvest leaves the pesticide residues behind the produce. For the reason that the Good Agriculture Practices (GAPs) are less enforced in a country like India, the farmers are naturally tended to condemn the fair usage of pesticide chemicals. The same is the case with post-harvest treatments of vegetables aimed at shelf-life extension. The degree of residue level left behind in the produce and the vulnerability of consumers pose acute to chronic impacts on human health (Neff *et al*., 2012). The use of pesticides post-harvest has been claimed to increase pesticide residue concentration (James and

Zikankuba, 2017). The consumer concern towards pesticide residue-free farm produces a quest for clean crop protection elements.

In recent times, agriculture is stepping on nanotechnology geared towards almost all of its domains ranging from crop biotechnology, crop improvement, crop production and crop protection. Nanoparticles (NPs) are emerging alternatives against microbial pathogens and insect pests due to their higher surface area : volume ratio that enables better contact with the target pathogen/pest, therefore leading to improved antimicrobial/insecticidal activity (Elmer and White, 2018; Worral *et al*., 2018). The usage of nanostructures is reported to reduce the immoderate use of pesticides (Khot *et al*., 2012). Taking cognizance of the above specifics, we canvass the way how pre-harvest application of nanoparticles reduces the losses during post-harvest of vegetables, caused by diseases and insect pests.

Management of postharvest diseases with pre-harvest application of NPs

Below discussed are the studies that used NPs to manage various post-harvest diseases in vegetable crops (Table 1).

***Botrytis* cinerea**

Sadek*et al*., 2022made a comparative study between S-NPs and CuNPs for their antifungal activity against *B. cinerea* of cucumber. They found that the S-NPs showed the highest antifungal activity followed by CuNPs. They also found that the antifungal activity of the NPs increased with NPs concentration.

Colletotrichum capsici

Anthracnose caused by *C. capsici* is a serious post-harvest disease of chilli. CuNPs of 1-3nm size were found to control *C. capsici* at a higher concentration than the lower concentrations. The maximum antifungal activity was exhibited at 200 ppm (Divte *et al*., 2019). Iliger and others (2020) found that CuNPs at 500 ppm was superior to carbendazim (500 ppm) and copper oxychloride (2500 ppm) against *C. capsica* of chilli. Their results showed that a lower concentration of CuNPs was more effective than conventional fungicides.

Fusarium solani

Soft rot disease of ginger causes significant postharvest deterioration of the rhizomes, which is caused by *F. solani*. Pang and others (2022) investigated the usefulness of SiNPs against the soft rot pathogen. SiNPs at 100 ppm showed superior effects against the pathogen through prevention of hyphae penetration into the host cells. In addition to the antifungal effect, SiNPs were studied to produce other benefits namely an increase in SOD and CAT enzyme activities, phenol and flavonoid contents which in turn reduced ROS accumulation; reduction in POD and PPO activities thereby lowering color difference; decrease in water loss from the cells that was mediated by alteration in aquaporin genes expression.

Phomopsis vexans

Phomopsis blight is a post-harvest deteriorating disease of eggplant, which makes the produce unfit for consumption. Khan and others (2022) tested the efficiency of TiO_2NPs and SiO_2NPs against this pathogenic fungus. Their study realized that among the two NPs SiO_2NPs were more efficient in controlling the pathogen under test. They also added that the foliar application of SiO_2NPs increased shoot dry weight and chlorophyll content.

***Phytophthora* spp.**

Across the world, the losses due to the *Phytophthora* diseases are estimated to be in billions. *P. infestans* causes late blight in potatoes and tomatoes, whereas *P. capsici* results in blights in many vegetable crops. Kim and others (2015) revealed that the AgNPs synthesized from *Artemisia absinthium* were proved efficient in inhibiting the mycelial growth, germination of zoospore, elongation of germ tube and production of the zoospore. In addition, they also recorded the encystment of zoospores by the AgNPs treatments. Le and others (2019) ascertained the efficiency of silver-incorporated chitosan nanocomposites against the *P. capsici* that causes *Phytophthora* blight in pepper. The nanoblend showed better and stronger antifungal capacity than the individual ingredient. Giannousi and team (2013) studied that the CuNPs were more effective than the commercial fungicides in controlling *P. infestans* of tomato, even at lower concentrations. Manna and other (2017) revealed that the bimetallic Cu-Zn NPs were effective in controlling *P. infestans* of potato, additionally offering an advantage of plant growth promotion.

***Sclerotinia* spp.**

S. sclerotiarum causes devastating soft rot and white mold diseases in vegetable crops. White mold of common bean leads to severe post-harvest loss. Abdel-Halim and El-Ghanam (2019) studied the antifungal potency of a few metallic NPs against the same pathogen. Their examination reported that the following order of NPs efficiency against the pathogen under study: MgONPs > SiO_2NPs > ZnONPs > CuONPs. They also stated that the NPs treated bean pods recorded higher chlorophyll content, total phenols and ascorbic acid content. This pathogen also causes white mold in cucumbers. Sadek *et al*., 2022made a comparative study between S-NPs and CuNPs for their antifungal activity against *S. sclerotiarum* of cucumber. They found that the S-NPs showed the highest antifungal activity followed by CuNPs. They also found that the antifungal activity of the NPs increased with NPs concentration. Al-Tememe and others (2019) proved the effectiveness of ZnO NPs in controlling the white rot disease in eggplant.

Erwinia sp

Erwinia carotavora causes bacterial soft rot in the field and storage in potato and tomato. Abbas and co-workers (2015) compared the effectiveness of AgNPs with antibiotic Nystain. Their study concluded that AgNPs at 250 ppm exhibited a maximum inhibitory effect against *Erwinia carotavora*pv. *carotovora*, than the antibiotic standard.

Management of postharvest losses caused by insect pests with pre-harvest application of NPs

Various reports on controlling insect pests with NPs were reviewed hereunder (Table 2).

Plutella xylostella

Diamondback moth (DBM) is an important pest of cole vegetables and is cosmopolitan in distribution. The pests' major hosts are cabbage and cauliflower. The damage symptoms include mining, scraping and biting of leaves. The excreta present in the leaves reduce the post-harvest quality. Besides, the pupae and pupal cases inside the cabbage head and cauliflower curd interior also reduced the produce quality. Ali and others (2019) evaluated the toxic effect of green synthesized AgNPs applied against 3rd larval instars of *P. xylostella*. Their investigation indicated that the AgNPs had good toxicity against the 3rd larval instars of *P. xylostella.*

Shoaib and team (2018) assessed the entomotoxic effects of SiO_2NPs on the larvae of *P. xylostella.* They employed four NPs application methods *viz.,* dust spray, larvae dipping, leaf dipping and solution spray, among which the dust spray method of application was more effective than the

others. They stated that the mortality rate increased as the exposure time and concentration of NPs increased. The SEM observation made it apparent that the larvae's death was due to desiccation, body wall abrasion and spiracle blockage.

Spodoptera litura

It is a polyphagous pest whose main damage includes feeding on leaves and fresh growth. The young caterpillars make holes on leaves, while the older larvae defoliate the foliage. It is a big menace in cabbage, cauliflower and other vegetables wherein the economic part is foliage. Suresh and others (2020) proved the toxicity of SiO_2NPs against *S. litura*. Arunthirumeni and co-workers (2021) evaluated the effects of SeNPs for its larvicidal activity against *S. litura*. They observed the highest antifeedant effect when the larvae were treated with 100 μg ml^{-1} at 48 h of exposure. SeNPs were verified as very effective larvicidal and antifeedant agent against *S. litura.*

Chakravarthy and team (2012) checked the efficiency of DNA-tagged AuNPs against the *S. litura*. They subjected the second instar larvae to DNA-tagged AuNPs for 30 seconds as surface treatment. The AuNPs exhibited effective larval mortality and the semi-lethal dose was found at 500 ppm. They also reported that as the NPs concentration and treatment duration increased, the larval mortality also increased. Hosamani and others (2019) reported the insecticidal property of AgNPs against *S. litura.* The larvae administered with AgNPs appeared to be sluggish, inactive, and refusing to feed which all led to larval mortality. Xu and coworkers (2020) used conidia of *Beauveria brongniartii* coated with FeNPs against *S. litura* larvae. Their study signified a higher mortality rate of the larvae on treatment with FeNPs. They concluded that the median lethal dose and median survival time were to be 59 ppm; and 200 and 500 ppm, respectively. They also noticed a significant decline in feeding and larval growth.

Phthorimaea operculella

This cosmopolitan pest thrives in warm temperate and tropical zones, having potato as its principal host it also affects tomato, chilli, eggplants and beet. Ibrahim and others (2021) established that the garlic essential oil loaded onto solid lipid NPs (GO-SLNPs) was more efficient in affecting than free oil on larval, pupal development and adult longevity. They also marked that the GO-SLNPs were stable even under field conditions and pronounced a high rate of larval mortality.

Myzus persicae

The green peach aphid is one of the several species of aphids that infest potato. The virus transmission is the principal menace caused, where the potato tubers are used as plant propagules. They build up in mass and vector potato virus A and potato leaf roll viruses to the potato plants. The α-Fe_2O_3NPs were demonstrated to possess aphicidal effect on the green peach aphids (Asoufi *et al.,* 2018).

Helicoverpa armigera

This cosmopolitan polyphagous pest enjoys wide distribution across tropics, subtropics and warmer temperate regimes. It is a major pest of tomato, but candidly feeds on economic parts of okra, chilli, cabbage, cauliflower and many. The young larvae feed on the foliage while the advanced instars bore inside fruits and leave the fruits not preferred by the human consumers. Devi and others (2014) demonstrated larval mortality of *H. armigera*, following the administration

of AgNPs. The NPs treatment showed toxicity against all larval instars, besides many biological parameters. The treated larvae and pupae prolonged their durations. They observed a decline in longevity in the fecundity period of male and female adults. They also exhibited a lesser consumption index during the growth stages. Their study also indicated that the NPs interrupted the gut physiology through decreased food utilization efficiency measures and digestive enzyme profiles.

Kamaraj and other (2018) evaluated TiO_2NPs for their larvicidal, antifeedant and pupicidal properties against *H. armigera.* Their study revealed that the NPs showed the highest mortality rate on I, II and III larval instars at 100 ppm. They noted a reduction in β-glucosidase and carboxylesterase at 100 ppm.

Conclusion

Vegetables are the principal sources of vitamins and minerals that we essentially need. Despite India vegetable production sector being the second largest producer, next only to China, it suffers from 30-40% losses due to poor pre-harvest and postharvest practices. The growing population demands a hike in production as well as a reduction in these losses to satisfy their requirements. The unjust use of pesticides leaves the residue behind the produce to which it is applied, which had gained the concern of the consumers. The high time for an alternative against pesticides has arisen. We articulate the efficiency of nanoparticles as a pre-harvest precaution to address the losses occurring in postharvest of the vegetable crops.

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References

Abbas, A., Naz, S. S., & Syed, S. A. (2019). Antimicrobial activity of silver nanoparticles (AgNPs) against Erwinia carotovora subsp. atroseptica& Alternaria alternata. Pakistan Journal of Agricultural Sciences, 56(1), 113–117. https://doi.org/10.21162/PAKJAS/19.3886

Abdel-Halim, K. Y., & El-Ghanam, A. A. (2019). Antifungal Potent of Some Metallic Nanoparticles against Sclerotinia Sclerotiorum on Common Bean Plants: An Emphasis for Biochemical Alterations and Metal Accumulation. Academic Journal of Life Sciences, 511, 93–106. https://doi.org/10.32861/ajls.511.93.106

Ali, F., Tariq, M., Shaheen, F. A., Mashwani, Z.-R., Zainab, T., &Gulzar, A. (2019). Toxicity of Different Plant Extracts and Green Silver Nanoparticles AgainstPlutellaxylostella (Lepidoptera: Plutellida). Plant Protection, 3(3), 151–159. https://doi.org/10.33804/pp.003.03.3112

Al-Tememe, Z. A. M., Abdalmoohsin, R. G., Mohammadali, M. T., Al-Mosawy, M. M., & Al-Masoudi, Z. M. (2019). Molecular diagnosis of the fungus Sclerotinia sclerotiorum: A causal agent of white rot disease in Solanum melongena L. and its control using zinc oxide nanoparticles. Biopesticides International, 15(1), 51–56.

Amini, A., Jones, B., Ghosh, D., Schefter, T., & Goodman, K. (2017). Inhibition of Phytophthora parasitica and P. capsici by silver nanoparticles synthesized using aqueous extract of Artemisia absinthium. Biochemistry and Cell Biology, 95(4), 1–32. https://cdnsciencepub.com/doi/abs/10.1139/bcb-2016-0256

Arunthirumeni, M., Veerammal, V., &Shivakumar, M. S. (2021). Biocontrol Efficacy of Mycosynthesized Selenium Nanoparticle Using Trichoderma sp. on Insect Pest Spodoptera litura. Journal of Cluster Science, 4. https://doi.org/10.1007/s10876-021-02095-4

Asoufi, H. M., Al-Antary, T. M., &Awwad, A. M. (2018). Green route for synthesis hematite (α-Fe2O3) nanoparticles: Toxicity effect on the green peach aphid, Myzus persicae (Sulzer). Environmental Nanotechnology, Monitoring and Management, 9(January), 107–111. https://doi.org/10.1016/j.enmm.2018.01.004

Chakravarthy, A.K. (2012). DNA-tagged nano gold: A new tool for the control of the armyworm, Spodopteralitura Fab. (Lepidoptera: Noctuidae). African Journal of Biotechnology, 11(38), 9295–9301. https://doi.org/10.5897/ajb11.883

Elmer,W.;White, J.C. 2018. The Future ofNanotechnologyinPlantPathology.Annu. Rev. Phytopathol. 56, 111–133. https://doi.org/10.1146/annurev-phyto-080417-050108

Giannousi, K., Avramidis, I., &Dendrinou-Samara, C. (2013). Synthesis, characterization and evaluation of copper based nanoparticles as agrochemicals against Phytophthorainfestans. RSC Advances, 3(44), 21743–21752. https://doi.org/10.1039/c3ra42118j

Hosamani, B., G., Patil, R. R., Benagi, V. I., Chandrashekhar, S. S., &Nandihali, B. S. (2019). Synthesis of Green Silver Nanoparticles from Soybean Seed and its Bioefficacyon Spodopteralitura (F.). International Journal of Current Microbiology and Applied Sciences, 8(09), 610–618. https://doi.org/10.20546/ijcmas.2019.809.073

Ibrahim, S. S., Salem, N. Y., AbdElNaby, S. S., & Adel, M. M. (2021). Characterization of Nanoparticles Loaded with Garlic Essential Oil and Their Insecticidal Activity AgainstPhthorimaeaOperculella (Zeller) (PTM) (Lepidoptera: Gelechiidae). International Journal of Nanoscience and Nanotechnology, 17(3), 147–160.

Iliger, K. S., Sofi, T. A., Bhat, N. A., Ahanger, F. A., Sekhar, J. C., Elhendi, A. Z., Al-Huqail, A. A., & Khan, F. (2021). Copper nanoparticles: Green synthesis and managing fruit rot disease of chilli caused by Colletotrichum capsici. Saudi Journal of Biological Sciences, 28(2), 1477–1486. https://doi.org/10.1016/j.sjbs.2020.12.003

James, A.; Zikankuba, V. (2017). Postharvest management of fruits and vegetable: A potential for reducing poverty, hidden hunger and malnutrition in sub-Sahara Africa. Cogent Food Agric. 3, 1312052. https://doi.org/10.1080/23311932.2017.1312052

Khan, M., Siddiqui, Z. A., Parveen, A., Khan, A. A., Moon, I. S., &Alam, M. (2022). Elucidating the role of silicon dioxide and titanium dioxide nanoparticles in mitigating the disease of the eggplant caused by Phomopsisvexans ,Ralstoniasolanacearum , and root - knot nematode Meloidogyne incognita. Nanotechnology Reviews, 11, 1606–1619.

Khot, L.R., Sankaran, S., Maja, J.M., Ehsani, R., Schuster, E.W. (2012). Applications of nanomaterials in agricultural production and crop protection: A review https://doi.org/10.1016/j.cropro.2012.01.007

Le, V. T., Bach, L. G., Pham, T. T., Le, N. T. T., Ngoc, U. T. P., Tran, D. H. N., & Nguyen, D. H. (2019). Synthesis and antifungal activity of chitosan-silver nanocomposite synergize fungicide against Phytophthoracapsici. Journal of Macromolecular Science, Part A: Pure and Applied Chemistry, 56(6), 522–528. https://doi.org/10.1080/10601325.2019.1586439

Neff, R.A.; Hartle, J.C.; Laestadius, L.; Dolan, K.; Rosenthal, A.C.; Nachman, K.E. 2012. A comparative study of allowable pesticide residue levels on produce in the United States. Glob. Health, 8, 2.

Peng, H., Hu, H., Xi, K., Zhu, X., Zhou, J., Yin, J., Guo, F., Liu, Y., & Zhu, Y. (2022). Silicon Nanoparticles Enhance Ginger Rhizomes Tolerance to Postharvest Deterioration and Resistance to Fusarium solani. Frontiers in Plant Science, 13(March). https://doi.org/10.3389/fpls.2022.816143

Sadek, M. E., Shabana, Y. M., Sayed-ahmed, K., &Tabl, A. H. A. (2022). Antifungal Activities of Sulfur and Copper Nanoparticles against Cucumber Postharvest Diseases Caused by Botrytis cinerea and Sclerotinia sclerotiorum. Journal of Fungi, 8(412). https://doi.org/https://doi.org/10.3390/jof8040412

Shoaib, A., Elabasy, A., Waqas, M., Lin, L., Cheng, X., Zhang, Q., & Shi, Z. H. (2018). Entomotoxic effect of silicon dioxide nanoparticles on Plutellaxylostella (L.) (Lepidoptera: Plutellidae) under laboratory conditions. Toxicological and Environmental Chemistry, 100(1), 80–91. https://doi.org/10.1080/02772248.2017.1387786

Suresh, U., Murugan, K., Panneerselvam, C., Aziz, A. T., Cianfaglione, K., Wang, L., & Maggi, F. (2020). Encapsulation of sea fennel (Crithmummaritimum) essential oil in nanoemulsion and SiO2 nanoparticles for treatment of the crop pest Spodopteralitura and the dengue vector Aedesaegypti. Industrial Crops and Products, 158, 113033. https://doi.org/10.1016/j.indcrop.2020.113033

Tripathi AN, Singh D, Pandey KK, Singh J. (2021). Postharvest diseases of leguminous vegetable crops and their management. In: Singh D, Sharma RR, Devappa V, Kamil D, editors. Post-Harvest Handling and Diseases of Horticulture Produce. 1st ed. pp. 387-396. London: CRC Press.
https://doi.org/10.1201/9781003045502-33

Worrall, E.A., Hamid, A., Mody, K.T., Mitter, N. &Pappu, H.R. (2018). Nanotechnology for Plant Disease Management. Agronomy, 8, 285. https://doi.org/10.3390/agronomy8120285

Xu, J., Zhang, K., Cuthbertson, A. G. S., Du, C., & Ali, S. (2020). Toxicity and biological effects of beauveriabrongniartii fe0 nanoparticles against spodopteralitura (Fabricius). Insects, 11(12), 1–15. https://doi.org/10.3390/insects11120895

Table 1. NPs in management of post-harvest pathogens

Sl. No.	Nanoparticle	Pathogen	Reference
1	Sulfur NPs	*Botrytis cinerea*	Sadek *et al.*(2022)
	Copper NPs		
2	Copper NPs	*Colletotrichum capsici*	Divte *et al*. (2019)
3	Copper NPs	*Colletotrichum capsici*	Iliger *et al.* (2020)
4	Silica NPs	*Fusarium solani*	Pang *et al.* (2022)
5	Titanium dioxide NPs	*Phomopsis vexans*	Khan *et al.* (2022)
	Silicon dioxide NPs		
6	Silver NPs	*Phytophthora capsici*	Kim *et al*. (2015)
7	Chitosan-silver NPs		Le *et al.* (2019)
8	Copper NPs	*P. infestans*	Giannousi *et al*. (2013)
9			Manna *et al.* (2017)
10	Copper-zinc NPs	*Sclerotinia sclerotiarum*	Abdel-Halim and El-Ghanam (2019)
	Magnesium oxide NPs		
	Silicon dioxide NPs		
	Zinc oxide NPs		
	Copper oxide NPs		
11	Sulfur NPs		Sadek *et al.* (2022)
	Copper NPs		
12	Zinc oxide NPs		Al-Tememe *et al.* (2019)
13	Silver NPs	*Erwinia carotavora*pv. *carotovora*	Abbas *et al.* (2015)

Table 2. NPs in management of insect pests inducing post-harvest losses

Sl. No.	Nanoparticles	Insect pests	Reference
1	Silver NPs	*Plutella xylostella*	Ali *et al*.(2019)
2	Silicon dioxide NPs		Shoaib*et al.* (2018)
3	Silicon dioxide NPs	*Spodoptera litura*	Suresh *et al*.(2020)
4	Selenium NPs		Arunthirumeni *et al.*(2021)
5	Gold NPs		Chakravarthy *et al.*(2012)
6	Silver NPs		Hosamani *et al*.(2019)
7	Iron NPs		Xu *et al*. (2020)
8	GO-SLNPs	*Phthorimaea operculella*	Ibrahim *et al.*(2021)
9	Hematite NPs	*Myzus persicae*	Asoufi *et al.*(2018)
10	Silver NPs	*Helicoverpa armigera*	Devi *et al*. (2014)
11	Titanium dioxide NPs		Kamaraj *et al*.(2018)

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GENETIC IMPROVEMENT OF CATTLE THROUGH A FIELD PROGENY TESTING PROGRAM

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Introduction

Progeny testing refers to evaluation of bulls on the basis of their daughter's performance. Progeny testing is of two types, field based and farm based (Rosa, 2013). The method used by the breeder to make long-term change in animals is called selection. Selection based on a number of criteria has been the tool for achieving improvement in livestock throughout the world (Kumar *et al*., 2020). In India, selection of sires based on the breed characteristics and pedigree information whenever available was followed during the pre-independence period (Kumar *et al*.,2015). The most powerful tools in dairy breed improvement are an efficient bull progeny testing of a fairly large number of bulls and an intensive selection among the tested bulls(Johansson, 1952).Recent investigations have however, revealed that young bulls must be tested based on their daughters performance, before extensive use in artificial insemination program(Gaur, 2007).Progeny testing is a method for accurately evaluating and selecting top bulls and using them to produce future bulls. The parents of progeny with higher performance for desired traits are selected for future breeding. Another application of progeny testing refers to the detection of heterozygous individuals for an undesirable recessive trait. There is a great demand of crossbred bulls with high genetic merit in cattle genetic improvement programs. Population size further needs to be increased by including many organized/farmers' herds to make the progeny testing program successful. Breeders always tend to go for selection of several traits at a particular time. Since the facilities available with the institutional farms are limited, it is necessary that the progeny testing programmes are extended to the farmers' herds where large number of daughters per bull can be produced and recorded (Das *et al*., 2017).

Need / Importance of progeny testing (DHAD. 2009)

- Usually sires rather than dams are progeny tested because generally sires produce more progeny in a given season or year and presumed to be more than half of the herd.
- More rigorous selection is possible in males, easy multiplication of elite germplasm and early selection of the males based on genetic markers.
- Genetic improvement depends on the accuracy of sire selection, selection intensity, generation interval and genetic variability of the traits considered.
- It is the best way of determining the genetic makeup of an individual.
- Chance at segregations & environmental factors cause greater deviation from true BV of parent.

Superiority of progeny testing over other selection criteria

- Useful for low h2 traits like production traits.

- High efficiency for sex limited traits and traits expressed after death.
- Accuracy of this more ideal due to evaluation of male parent.
- Performance of many progenies gives the best and most reliable information about the genetic merit of parent (individual) so it over the mendelian error of gene segregation.
- used to the detection of heterozygous individuals for an undesirable recessive trait.

Prerequisites in Progeny testing program

a. Identified an area having a sizeable breedable female bovine population of the proposed breed in a compact area.
b. Either a network of mobile AI technicians or tie up arrangement with an established AI service provider to carry out test AIs in the identified area.
c. Village level infrastructure and exclusive manpower to implement and supervise the project.
d. Semen Station.

Points to be considered:

1. Test as many as sires possible (5 to 10 would be minimal).
2. Make sure that dams are mated to sires at random, within age group is possible.
3. Produce as many progenies per sire as possible (10 to 15 progenies of either sex for growth traits but up to 300 to 400 progenies is required for traits like calving difficulty and fertility).
4. No progeny should be culled until the end of the test.
5. Offspring that are being tested are not a select group.
6. Performance of an adequate sample of an animal's progeny under normal environmental conditions will give a true indication of its genotype than any knowledge of individuality or pedigree.

Steps to be adopted in the field progeny testing program
(Annual Report, CIRC. 2015-16)

- Selection of Districts/Sub-Divisions/Blocks
- Selection of bulls for testing
- Orientation programme
- Identification of clusters in each block
- Farmers' awareness programmes
- Registration / Identification of dams (cows)
- Maintenance of records
- Follow up of inseminated cows
- Detection and follow up of the progenies
- Organization of calf rallies or shows
- Organization of infertility treatment/HI camps
- Breeding the female progenies attaining maturity
- Recording of milk
- Estimation of probable breeding value of sires

All the sires will be ranked on the basis of their sire index of which 20-30 % top ranking bulls shall be selected for future use as proven bulls for production of superior germplasm.

FIELD PROGENY TESTING PROGRAMMES CENTRES (Annual Report, CIRC. 2019)

Sr. No.	Program regulating agencies	Program (Animal include)
1	Kerala Livestock Development Board	HFCB
2	BAIF Development Research Foundation	HFCB jointly with Project Directorate, Meerut
3	Andhra Pradesh Livestock Development Board	Jersey CB
4	Sabarmati Ashram Gaushala, Bidaj	HF crossbred, Murrah under the technical guidance of NDDB, Gir
5	Banaskantha Milk Union	Mehsana, Kankrej
6	Mehsana District Coop. Milk Producers' Union	Mehsana
7	Haryana Livestock Development Boar	Murrah
8	Himachal Pradesh Livestock Development Board	Jersey
9	Punjab Livestock Development Board	Murrah, Sahiwal
10	Shri Ganganagar Milk Union	Sahiwal
11	Tamil Nadu Coop. Milk Producer's Federation	Jersey CB
12	Uttar Pradesh Animal Breeding Research Organization	Murrah

Limitations Progeny Testing

1) It prolongs the generation interval.
2) It is time consuming and expensive.
3) Use of superior animals extensively once they have been located and errors due to environment that are not standard for the progeny are more serious limitations.
4) Sires can be selected only when the progenies come for production and by the time the sire may become old and useless.
5) The annual rate of genetic gain is lowered**.**

Conclusion

A large number of cows are being inseminated in the program so that records of sufficient daughters are achieved for sire evaluation despite significant data loss (Kumar *et al*. 2015).The top ranked bulls are used in nominating mating for production of male calves for induction in the new sets. The association between Field Progeny Testing staff and farmers is being improved by frequent visits, motivation to farmers and some provision of incentives. Manpower engaged in artificial insemination and data recording has been trained to maintainaccuracy of the program. Excellent germplasm unit with modern facilities has been developed at ICAR-CIRC and its Bull Rearing Units.The project also helped to upgrade the nondescript or diluted Kankrej cattle into defined breed so as to increase the population size for conservation of this elite cattle germplasm.

References

Annual Report (2015-16). ICAR-Central Institute for Research on Cattle, Meerut Cantt.

Annual Report (2019). ICAR-Central Institute for Research on Cattle, Meerut Cantt.

Das, A.K., Kumar, R., Rathee, S.K., Prakash, B., Anil, K., Dubey, P.P., Bhagat, R.L., Singh, C.B., Singh, U., Kumar, A., Tyagi, S. and Vineeth, B (2017). Genetic improvement of cattle through field

progeny testing programme: An evaluation of achievement. *Indian Journal of Animal Science,* 87(12):1445-1451.

DHAD (2009). Minimum Standards for Progeny Testing.

Gaur, G.K. (2007). Environmental factors affecting various performance traits of Holstein Friesian × Sahiwal Cattle. *Indian Journal of Dairy Science,*54: 209-13.

Johansson, I(1952). Progeny testing in the breeding of farm animals. *In Proceedings of the British Society of Animal Production*1: 79-105.

Kumar, A., Radhika, G., Simon, S.E. and Aravindakshan, T.V (2020). Evaluation of contributions of ICAR- field progeny testing scheme towards genetic improvement of crossbred cattle of Kerala. *Ruminant Science,*9(2*):*291-296.

Kumar, S., Alex, R., Singh, U., Kumar, A. and Das, A.K (2015). Comparative performance evaluation of Frieswal bulls in organized farms and farmers herd. *Indian Journal of Animal Sciences,*85(3): 316–19.

Rosa, G.J.M (2013). Brenner's Encyclopedia of Genetics (Second Edition).

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