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WHEAT BREEDING USING TISSUE CULTURE TECHNOLOGY

Article Id: AL2021163

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Plant tissue culture, as a method of growing explants extracted from the mother plant, is a good way to prepare a significant quantity of plant materials in a short period of time and boost natural levels of in vitro processing of useful compounds (Pandeb *et al.*, 2013). It has also encouraged researchers to advance their expertise in a variety of fields, including biology and molecular plant breeding. Plant cells and tissues' ability to respond optimally in tissue culture medium and later developmental stages may be beneficial in agriculture, horticulture, plant breeding, genetic engineering, and the chemical industry (Evans *et al.*, 2003).

Importance of Tissue Culture in Wheat

During the formation of callus in cereal tissue culture, the chemical 2,4-Dichlorophenoxy acetic acid is used to regulate growth (naturally synthetic auxin). Naqvi *et al.*, (2002) used a combination of 2,4-D and cytokinins to induce callus in wheat plants. When various doses of 2,4-D were used, different effects were observed on all genotypes (Elwafa and Ismail, 1999). The genotypes, forms of ex-plants, physiological state, geographical origin, culture mediums, and their interactions all influence the callogenesis and organogenesis responses of tissue culture techniques in wheat plants (Chen *et al.*, 2006).

Mature Embryo Culture in Wheat

Mature embryo cultures revealed significant variations in wheat cultivars in terms of plant regeneration and callus effectiveness (Zale *et al.*, 2004). In wheat, mature embryos with or without endosperm were used to form calluses and regenerate plants. Embryogenic callus proportion was shown to be higher in endosperm-free embryos (Turhan and Baser, 2004). At a rate of 1.28% to 1.77 %, mature embryos cultured in *Triticum aestivum* and *Triticum durum* result in the growth of transgenic plants (Patnaik *et al.*, 2006).

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Immature Embryo Culture in Wheat

Wheat callus reaction to ABA was demonstrated using immature embryo culture (Morris *et al.,* 1989). Immature embryo culture can be used to study the floral developmental mechanisms in wheat. Immature embryos are the best ex-plant sites for callus induction and somatic embryogenesis in cereals. Immature embryos cultured in wheat can quickly produce callogenesis and organogenesis (Redway*et al.,* 1990).

Somaclonal Variations in Wheat

Plant regeneration from embryogenic tissues of somatic cells revealed that morphological and chromosomal modifications occurred during culturing as well. Variations in Mt DNA plantlets were observed in immature embryo culturing, and these distinctions were easily stabilised during Callogenesis (Hartmann *et al.,* 1987). Variations in Mt DNA were also observed in green plant regeneration arising from somatic tissue culture (Aubry *et al.,* 1989). Plants that have undergone in-vitro culturing have phenotypic modifications that are real representations of genetic variants (Liu and Chen, 1978 a and b; Orton, 1980). Some plants retained their original morphology, demonstrating that changes in field conditions are caused by physiological factors rather than genetics (Callebaut *et al.,* 1978)

Conclusion

Plant Tissue Culture has a major impact on both agricultural and ornamental plants. In-vitro embryo culture can help with a variety of realistic plant breeding issues. Embryo culture may aid in the research of plant feeding, metabolism, and developmental stages. Somatic embryogenesis, cell biological techniques, and molecular approaches, in addition to traditional breeding programs, have been shown to be useful instruments for improving the genetics of various crop plants. Callus induction and plantlet regeneration is greatly influenced by media structure, genotype, and their interactions. The regeneration capability of media can be increased by using various growth regulators.

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SEED PRIMING – A SUSTAINABLE APPROACH FOR FARMING

Article Id: AL2021164

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Seed enhancement technique is a range of techniques performed post harvesting and conditioning before sowing like priming, pelleting, pre-germination, resulting in improved germination and physiological performance.

Objectives

- Improved germination/seedling growth.
- Facilitate seed planting.
- Deliver specific materials needed at the time of sowing (e.g., Nutrients and inoculants).
- Remove weak or dead seeds.
- Tagging of seeds with visible pigments or other materials/markers.

History of Seed Priming

Evenari (1984) reported that the efforts for improving seed germination and growth are dated back to ancient Greeks. Theophrastus (371–287 B.C.), during an investigation, observed that cucumber seeds, when soaked in water, end in faster and uniform germination as compared to un-primed seeds (Theophrastus, Enquiry into Plants, Book VII, I.6). Likewise, the Roman naturalist Gaius Plinius Secundus (23–79 A.D.) reported the positive effects of pre-soaking of cucumber seeds in honey and water for seed germination (Gaius 1949–1954). Afterward, in 1539–1619, the French botanist Oliver de Serres reported the seed soaked in manure water for two days then dried before sowing as an efficient way of seed treatment for better crop growth. Darwin tested osmo-priming on lettuce and cress seeds in seawater and observed high germination within the treated seeds as compared to non-primed seeds (Darwin 1855). And this fashionable concept of seed priming was presented by Ells (1963), who highlighted the critical parameters associated with a seed treatment. He observed high germination rates when seeds were treated with a selected nutrient solution. Koehler

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(1967) reported that treatment with salt solution promotes RNA accumulation that, in turn, enhances other physiological processes and leads to high seed emergence. May *et al*. (1962) stated that seed drying surely time at a specific level after priming exerts beneficial effect and results in fast germination under normal also as stressful conditions (Berrie and Drennan 1971). Heydecker*et al.* (1973) used organic chemical polyethylene glycol (PEG) H–(O–CH_2–CH_2)n–OH, a high molecular weight compound, for seed pre-treatment to spice up germination and avoid several problems related to salts treatment like hardening. Hence, various seed treatment techniques were introduced and examined for uniform germination under different environmental conditions.

Seed Priming

Seed priming is a method in which seeds are hydrated (control hydration or uncontrolled hydration) and dried to original moisture content, but the actual emergence of the radicle is prevented.

Phenomenon of Seed Priming

After sowing, seeds remain within the soil for a particular duration to soak up water and a few essential nutrients for his or her growth. Seed priming reduces this point and makes the germination quick and uniform. Additionally to hydration, priming also reduces the sensitivity of seeds to external environmental factors (Afzal *et al.*, 2016). Priming promotes seed germination under three stages like imbibition, germination, and growth. During the imbibition stage, the water uptake promotes protein synthesis and respiratory activities through messenger RNA (mRNA). The second stage is said to the initiation of various physiological activities associated with germination like protein synthesis, mitochondria synthesis, and alteration in soluble sugars (Varier*et al*. 2010). The critical factor during seed priming is that the controlled water uptake during the second stage, before the emergence and growth of radical from the testa during the last stage. The second stage (germination) is far sensitive to environmental factors than the third stage (Côme and Thévenot 1982). Therefore, during priming, the seeds that have skilled the second stage could germinate under variant environmental conditions as compared to un-primed seeds (Corbineau and Côme2006).

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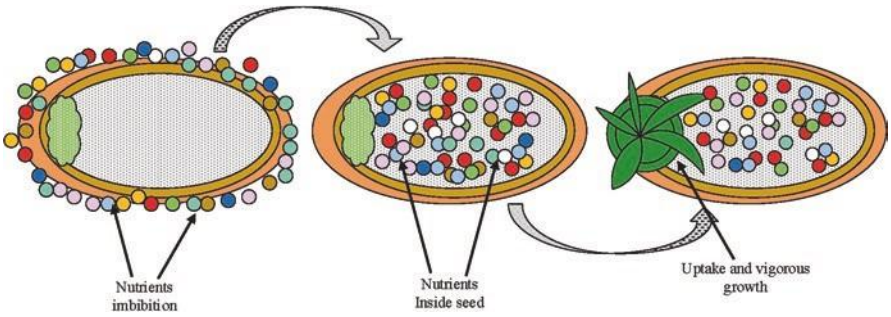

Fig. 1: General phenomenon of seed priming. (M. Waqas *et al.*, 2019)

Methods of Seed Priming

A. Conventional methods of seed priming.

- ***Hydro-priming***: It is a seed priming method that involves priming of seed in pure water to initiate pre-germinative physiological activity of seed, but without radicle emergence, seeds are dried to original moisture content before sowing.
- ***Osmo-priming***: Osmo-priming is one among the sort of seed priming during which seeds are mixed with osmotic agents of high relative molecular mass (Poly Ethylene Elycol) with different osmotic potential and have control on the level of hydration i.e. controlled hydration. Commonly used osmotic agents are PEG 6000 and PEG 8000.
- ***Chemo priming***: Chemo-priming involves the use of various chemicals to in-vigor the seeds.
- ***Halo priming***: Seeds are dipped in various salt solutions e.g. NaCl.
- ***Solid matrix priming***: Solid matrix priming is a type of seed priming in which seeds are mixed with solid materials and water.
- ***Bio-priming***: Bio-priming is also a type of priming in which seeds are primed in a solution containing bio-control agents (bacteria).
- ***Priming with plant growth regulators*** - Seed treatment with plant growth regulators (PGR) is known to mitigate the harmful effects of several environmental stresses (Jisha*et al*. 2013).
- ***Priming with Plant Extract***–Allelochemicals such as phenolic compounds, terpenoids, flavonoids, saponins, alkaloids, and steroids may inhibit or stimulate

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plant growth (Narwal 1994). Saponins can accelerate nutrient absorption as they are readily soluble in water. Alkaloids, saponins, and phenolic compounds present in the leaves of various plants are involved in the production of antioxidant activities and protect the plants against pathogens (Satish *et al*. 2007).

B. Advanced method of seed priming

- ***Seed Priming through Nanoparticles***- Nanotechnology utilizes nanoparticles less than 100 nm in size, and it has a promising role in transforming food production and agriculture (Fraceto *et al*. 2016).

- ***Seed Priming through Physical Agents***- The magnetic field, UV radiation, gamma radiation, X-rays, and microwaves are some of the physical agents used for seed priming (Bilalis *et al*. 2012). Priming with magnetic field found to improve germination rate, vigor, and seedling biomass as well as tolerance to various environmental stresses.

Factors affecting seed priming

Seed priming is highly affected by various biotic and abiotic factors such as

1. Aeration
2. Temperature.
3. Time.
4. Seed quality.

Conclusion

Seed priming is the need of prime importance in agriculture as it not only helps to influence germination but also has multiple attributing benefits. Their role in increasing nutrient content in food and seed is much valuable. Seed priming facilitates plant growth promotion and influences yield. Despite these factors, they also positively impact decreasing fertilizer rate, influencing nutrient uptake, maintaining plant growth vigor, and tolerance to different biotic and abiotic stress.

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MEDICO-NUTRITIONAL VALUE AND PROFITABILITY OF BLACK RICE- THE NEW BLACK GOLD OF INDIAN AGRICULTURE

Article Id: AL2021165

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Rice is the staple food of South Asia, in particular, the Indian sub-continent. Like India, China, Japan, the Philippines, and other neighboring South and South East Asian populations also prefer rice to wheat.

Indians used to have the general propensity for white Rice, not only for their habitual preference but also due to some sort of a perception of the cleaner appearance of the polished grain. That's why it is not surprising that 'Black rice' is relatively under-preferred rather unknown to most Indians. Black rice is actually indigenous to North-East India and is extensively grown in Odisha, West Bengal, and Jharkhand. It is commonly consumed in Manipur because of its numerous medicinal values. In their indigenous language, it is called as '*chak-hao'*, ('*chak'* meaning rice, '*ahaoba'* meaning delicious), which is eaten during traditional feasts. In imperial China, black rice (*Orayzasativa*L.) was forbidden, not because it looked poisonous because of its black color, but because of its high nutritional value, which meant it could only be consumed by the Emperor.

In recent times, rice researchers have begun to study the sticky varieties of black rice, rediscovered and re-explored its several medicinal and nutritional properties. Black rice is a range of rice types of the species *Orayza sativa* L. some of which are glutinous rice. Several varieties of black rice are available in the market today. It is gradually gaining consumer preference and getting popularised especially among the health-conscious people of the world because of its high nutritional value as well as other medicinal properties, including better antioxidant activity and anti-carcinogenic property.

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History of Black Rice

It has a rich cultural history, called "Forbidden" or "Emperor's" rice; it was reserved for the 'Emperor' in ancient China and considered as a tribute food. In the time since it remained popular in certain regions of China and recently has become prized worldwide for its high levels of antioxidants. Despite its long history, the actual origin of black rice is still obscure. Black rice cultivars are found in several locations scattered throughout Asia (Oikawa, 2015).

Varieties of Black Rice

1. **Kalabhaat-** Kalabhaat is speckled black in appearance, slender, and firm. Once cooked, it produces rich purple glutinous rice.

2. **Kalanamak-** Kalanamak rice is said to outshine even the most exclusive Basmati rice in all quality traits except grain length. It is non-basmati rice with short to medium grain length. The aroma of Kalanamak rice, considered to be the gift of 'Gautam Buddha,' is stronger than all Basmati varieties. Elongation after cooking, which is one of the most important quality traits in the international rice market, is 40% greater than Basmati rice.

3. **Manipuri Black Rice**- The unique properties of Manipuri Black rice, offering multiple health benefits, make it completely peerless. This glutinous rice variety is called 'ChakhaoAmubi', which is one type of sticky black rice indigenous to Manipur, whereas 'Chakho' means delicious and'Ambui' means black.

4. **Black Jasmine Rice -** In Thai, the Black Jasmine Rice is called Khaw-Hom-Nil, which translates as 'Aromatic black onyx rice'. While cooking, the rice gives off an aromatic whiff, one which may remind you of a jasmine infusion.

Nutritional Superiority of Black Rice over other Types of Rice- (100 Gm Cooked Rice)

- **Polished white rice** – 6.8 g protein, 1.2 g iron, 0.6 g fibre
- **Brown rice** – 7.9 g protein, 2.2 g iron, 2.8 g fibre
- **Red rice** – 7.0 g protein, 5.5 g iron, 2.0 g fibre
- **Black rice** – 8.5 g protein, 3.5 g iron, 4.9 g fibre

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Black rice is rich in amino acids, fatty acids, antioxidants, flavonoids, anthocyanins, and other phenolic compounds. There are 18 amino acids with a mix of essential and non-essential types, iron, zinc, copper, carotene, and several important vitamins in black rice. Amino acids are crucial to many of the human body's functions, from helping repair skin and tissues to improving energy levels and digestion. (Saikia, Partha 2020)

Health Benefits of Black Rice

The main component of black rice that provides almost all of its health benefits is anthocyanin. This protein works as a powerful antioxidant and serves a number of functions like fighting cancer, preventing cardiovascular diseases etc.

1. Rich Source of Antioxidants:

The bran of the grains of black rice contains the highest levels of anthocyanins found in any food. In fact, it has the highest anthocyanin content compared to all other rice varieties (Chang *et al.*, 2010).

2. Fights against Cancer:

The anthocyanin content of black rice lends it an anti-cancer characteristic. It can successfully suppress tumor growth and the spread of breast cancer (Hu C *et al.*, 2003).

3. Improves heart health:

High cholesterol is a leading cause of a number of cardiovascular diseases. But the anthocyanin content of black rice has been found to have a significant effect in reducing cholesterol.

4. Helps in liver detoxification:

Fatty liver disease is, as is obvious, characterized by excessive fat deposit build-up in the liver. The effectiveness of black rice in treating this condition was tested in mice.

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5. Prevents diabetes:

Whole grain black rice has its bran intact, which is a storehouse of dietary fibre. Since fibre takes a longer time to digest, it makes sure that the sugar in the grain is absorbed over a longer period, maintaining normal blood sugar levels.

6. Protects from high blood pressure:

The dietary fibre obtained from black rice (or any whole grains in general) has been found to protect cardiovascular health by not only maintaining normal blood pressure but also by reducing lipid levels, regulating body weight, improving glucose metabolism, and reducing chronic inflammation.

7. Improves Eye health:

Along with protective anthocyanins, black rice contains a high amount of lutein and zeaxanthin, two carotenoids known for their role in supporting eye health. These antioxidants help to protect the cells in the eyes and to reduce the effects of ultraviolet (UV) radiation.

Area Expansion under Black Rice Cultivation

In India, black rice or Chak-hao (delicious rice) has been indigenous to the north-eastern state of Manipur for centuries. Till some years ago, it was mostly consumed locally, and little was exported. However, better price realisation and growing demand for this paddy internationally has been enticing farmers across the country to cultivate rice grains of a different colour. In recent times, Assam, West Bengal, Jharkhand, Odisha, Karnataka, U.P are all cultivating this nutrient-dense rice and boosting their farm incomes considerably with exports to Australia, UK, USA, Thailand, Denmark, and Malaysia, among others.

Table 1: Financial profitability of Black rice cultivation over HYV rice cultivation

Particulars (Rs/acre)	High yielding variety of rice	Indigenous aromatic rice
Input cost (Rs/acre)	9300	8200
Human labour cost (Rs./acre)	8200	7300
Total cost of cultivation (Rs./acre)	17500	15500
Average yield (q/acre)	26	11

Price (Rs./q)	1850	6500
Gross Return (Rs/acre)	48100	71500
Net Return (Rs/acre)	30600	56000
B:C	1.74	3.61

Though much lower yield is generally attained from Black rice as compared to high yielding rice varieties but it can fetch a higher market price that in turn will offer higher profit to the farmers if proper procurement facilities and stable marketing channel can be established and ensured (Sharma *et al*., 2019).

Conclusion

A promising prospect of Black rice can be expected in the near future as it may earn much more net returns and achieve a stable benefit-cost ratio as compared to high yielding rice varieties. Besides economic benefit, the nutritional and medicinal superiorities of black rice over normal white rice makes its cultivation popular in recent times all over India.

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FISH DISEASE AND HEALTH MANAGEMENT

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In terms of the number and variety of species, aquaculture is developing rapidly. The current trend development direction of aquaculture is the intensification and commercialization of aquaculture produce. As in other agricultural sectors, the possibility of major disease problems varies with Aquaculture activities have intensified and expanded. The disease is considered to be the main constrain of the cultivation of many aquatic species prevents the economic and social development of many nations. Many diseases such as epizootic ulcerative syndrome(EUS), skin erosion, gill damage, tail and fin rot, etc., Are very common in farmed fish. In the pond aquaculture system, the stocking density is high, and the feed's irregular supply is extremely prone to disease outbreaks. Most pond fish farmers do not have a good understanding of fish health and disease issues in the system. Many fish diseases are caused by environmental damage, and they can be prevented through proper management.

Fish diseases can be separated into 4 general sorts, including bacterial infections, fungal infections, parasite or protozoan infections, as well as physical diseases and wounds.

- **Bacterial diseases:** Bacterial diseases usually appear as red streaks or spots or swelling on the abdomen or eyes. These are best treated with antibiotics such as penicillin, amoxicillin, or Erythromycin.
- **Fungal diseases:** Common fungal infections usually look like gray or white fluffy patches.
- **Parasitic disease:** The most common parasitic disease called "Ich" can be treated most effectively by the appropriate dose of copper or malachite green. Most treatments use copper as an ingredient. Many water treatments (such as "Aquari-Sol") will also contain copper as an ingredient. If treated using antibiotics or copper, remember to remove all carbon from the filter system.

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- **Physical discomfort:** Physical discomfort is usually caused by the environment. Poor quality water conditions may cause the fish to panting, not eat, jump out of the fish tank, etc. Tank teammates problems can cause fins to be bitten and bitten.

Type of Fish Diseases

Bacterial

- Fin Rot
- Pop-Eye
- Cloudy Eye
- External Infections
- Fish TB
- Dropsy
- Septicemia
- Swim Bladder Disease
- Enteric Red Mouth

Parasitic

- Argulus
- Anchor Worm
- Black Spot - Black Ick
- Ergasilus
- Flukes
- Nematoda
- Leeches
- Uronemamarinum

Protozoan

- Velvet or Rust
- Marine Velvet
- Brooklynella/Clownfish Disease
- Costia
- Hexamita
- Ich - White Spot
- Marine Ich - Crypt/Marine White Spot
- Neon Tetra Disease
- Glugea and Henneguya
- Chilodonella

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Fungal

- Fungus
- Ichthyosporidium

Viral

- Herpesvirus disease
- Epitheliomapapillosum (Fish Pox)
- Infectious Hematopoietic Necrosis (IHN)
- Viral Hemorrhagicsepticemia
- Spring Viremia of Carp (SVC) and
- Swim Bladder Infection virus (SBI)

Non-infectious

- Congenital Abnormalities
- Injuries
- Constipation
- Tumours
- Head and Lateral line Erosion 'Hole-in-the-head' Disease
- Eye Problems
- Swim-bladder Disease

Health is a limiting factor in aquaculture

The current trend of aquaculture development is the intensification and commercialization of aquatic products. Like other agricultural sectors, the possibility of major diseases high with the strengthening and expansion of aquaculture activities. More and more problems have occurred due to viruses, bacteria, fungi, parasites, and other undiagnosed and emerging pathogens. The disease has now become a major obstacle. This situation can be attributed to various multifaceted and highly interconnected factors such as the increasing globalization of trade in live aquatic animals and their products; this strengthen aquaculture by planting fish, after larvae, fry and fry translocation, fish species development, and expansion of ornamental fish trade; strengthening of the ocean stocking through aquatic animals raised in hatcheries; and in coastal areas; misunderstandings and misuse of specific pathogen-free (SPF) populations (eg. shrimp); unexpected negative interactions between farmed and wild fish populations; poor or lack of effective biosecurity measures; slow

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awareness of emerging diseases; climate change; all other human-mediated movements aquaculture commodities.

However, once the pathogen or disease pathogen is introduced and established as a natural in the environment, there is little or no possibility of treatment or eradication. Although the consequences "Trickle" infections from wild to farmed populations have predictable consequences due to accessibility. The consequences of host culture spread to wild populations under breeding conditions are hard to predict.

Fish Health Management

This requirement recognizes that it applies to two related aspects of fish health management for aquaculture operations, these are:

- Trans-boundary movement of fry, fingerlings, and market size fish should be carried out in ways to reduce the risk of transmission of fish pathogens; and
- Aquaculture farms should adopt effective farm and fish health management support health measures and vaccines.

Trans-boundary diseases are highly contagious and can spread quickly across national borders. Cause serious socio-economic and public health consequences. Expansion of fish seed trade for farming and the live reef food fish trade without proper quarantine and health measures, Increase the risk of pathogen transmission. Provisions of the FAO technical guidelines for aquaculture development, the transfer of eggs, fingerlings, and adults between watersheds or large bodies of water should be avoided. Introduced species are usually preferred because they attract higher prices and have expensive export potential.

Where possible, governments should assist in ensuring that the sale of fish seeds and parents are not disease:

- Requirement to maintain the breeding and disease history of broodstock and seeds transfer or export in the country.
- Require the use of approved chemicals and drug use before and during seed transportation and marketable fish and develop guidelines for the certification of transboundary seed movement.

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Most disease outbreaks occur within the first 2 to 12 weeks after the initial placement of the cage. And it depends on the condition of the arriving fish, the size of the fish, and the species involved. Regular monitoring of the health of farmed fish is important for effective disease prevention caused by infectious microorganisms or stress and early detection of health problems. Main areas that need to be considered for disease prevention and control include:

- Poor handling and transportation techniques can cause stress, reduce water quality and cause trauma
- Transmission of diseases during transportation of contaminated water
- The spread of diseases caused by breeding multiple species from different places close contact and regularly expose newly introduced larvae to existing pathogens In the cage
- Poor feed handling and storage of garbage fish or artificial feed

The socio-economic impact of high costs on small-scale aquaculture nursery operators, the use of disease prevention and treatment plans should be considered for higher benefits. Governments, non-governmental organizations, and regional institutions should promote, outreach and technical support activities have increased farmer's, and aquaculture industry's awareness of aquaculture health management issues include:

- Technical training for farm managers and workers, including monitoring and early detection of diseases in fish and measures to be taken once diseased fish are found, determine
- Provide diagnostic services to identify pathogens that are already present in pathogens the cultivation environment and the method of submitting specimens for inspection;
- Common diseases of fishes and their prevention and treatment.

The prevention of routine diseases should be included in the transportation at the same time packing fish seeds for new seed/fish farm management activities. The main principles of disease treatment and control are:

- Establish an accurate diagnosis;
- Choose appropriate environmentally responsible treatment; and

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- Evaluate management practices and identify areas that are critical to preventing the future break out.

In terms of risks to human health, any chemicals or drugs used should be acceptable. The environment and the final market should be easily available and, importantly, must be used correctly.

Responsible Approach

- Trans-boundary movement of fry, fingerlings, and fish,market-scale fish should be conducted in a way that minimizes the risk of transmission of fish pathogens.
- Use of Existing International Code of Practice dealing with trans-boundary movement and the use of introduced species in aquaculture used as a framework for the formulation of regulations related to tropical latitudes and species. The existing database should be used to identify and determine risks from imported species.
- Reproductive history and disease history should maintain aquaculture stocks to promote disease-free breeding stocks and seed exchange in domestic and export.
- The aquaculture farm should use eggs or seeds free of specific pathogens (including eggs supplied to the backyard nursery)
- Governments, NGOs, and Regional agencies should promote outreach, extension, and technical support activities in order to raise farmer's and aquaculture industry's awareness of sanitation management issues, including Technical training, diagnostic services, and disease prevention and treatment.
- Fishermen, exporters, and farms should adopt effective fish health management measures to ensure fish health.

Aquaculture farms should take effective preventive measures to prevent, treat and control diseases through the following methods:

- Reduce the pressure that may cause injury during handling and transportation,
- Implement good handling and storage practices for trash fish and artificial feed
- Establish effective and accurate diagnostic procedures
- Choose treatments that meet acceptable environmental and human health risks
- Evaluate management practices and identify key prevention areas

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- Recognize the socio-economic impact: Adopting disease prevention, and treatment plans should offset the potential higher benefits.

Good Aquaculture Health Management Practices

A health management plan has several requirements and must cover all aquaculture industries' activities. At the production level, the requirements for a healthy environment include strong health seeds and young fish, proper nutrition, proper waste management, optimal water quality, and monitor regularly. On the farm site, keeping good records is essential. It should cover all aspects of farm operations. Farmers should be trained to understand the importance and value of this approach. Information that determines the course or nature of a disease outbreak can provide accurate and fast information to diagnose and make wise management decisions for intervention and control. Keeping records essential to aquaculture and can go a long way in supporting effective health and productivity management work.

A good farm configuration file should contain the following information:

- Conduct treatment;
- Clinical signs (behavior, appearance);
- Farm layout (inflow, outflow, pond connection);
- Breeding animals (species, number, origin, age group);
- Yield (per pond, each cage, each farm, normal survival rate);
- Nutrition (live food, processed food, source, feeding method);
- Management practices (continuous stocking, closed operation, stocking density);
- Mortality data (affected locations, cages, ponds and approximate percentages and Numbers); and
- Unusual events (abnormal weather changes, higher-than-average mortality rates, lower-than-average yields, Land use activities, runoff, overflow, abnormal growth, spawning events).

In addition to keeping records regularly, it should also be continuously monitored and updated Information (new animals in the farm, replacement of feed, connection of new ponds and new farms upstream).

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Conclusion

Solving health problems through active planning and passive planning has become a major requirement for aquaculture production and product trade. Asia-Pacific region's current strategy emphasizes responsible health management to minimize the risk of disease invasion; it is brought about by the movement of live aquatic animals and their products. The risk of major disease invasion and emerging diseases will continue to threaten the sector unless appropriate and effectively implemented health management measures maintain; the government and the private sector will face more costs in terms of production losses and the effort required. Control and eradicate diseases, funds that could have been better used to prevent the entry of diseases system. Focus on prevention, better management practices, and maintaining healthy fish may be more important than paying attention to why the fish is sick. Health management is a shared responsibility, and the contribution of each stakeholder is essential to the health management process.

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OVERVIEW OF COMMODITY TRADING AND MARKET IN INDIA

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The commodity markets began with the trading of agricultural products such as corn, cattle, wheat, and pigs in the 19th century. Chicago was the main hub for trading due to its geographical location near the farm belt with railroad access. In India, commodity trading began with the set up of the Bombay Cotton Trade Association in 1875, which laid the foundation of futures trading in India. The nature of commodities exchanges is changing rapidly. Currently, the trend is in the direction of electronic trading, which is away from traditional trading, where traders meet face-to-face. A commodity market is a physical or virtual marketplace for buying, selling, and trading commodities. It is also called a futures market, futures exchange, organized market for the purchase and sale of enforceable contracts such as derivative products, agricultural products, and other raw materials. A farmer raising corn can sell a futures contract on his corn, which will not be harvested for several months, and gets a guarantee of the price he will be paid when he delivers. This protects the farmer from price drops and the buyer from price rises. Commodity exchange is a legal entity that determines and enforces rules produces for the trading standardized commodity contracts. From 2015, SEBI became a regulatory body for any updates and developments relating to the commodity derivatives market in India

The Commodities Traded are Usually Classified Into Four Segments

i. **Agricultural Commodities**: These are generally perishable agricultural products such as soybean, cotton, chana, maize, sugar, guar seed etc. Processed agricultural commodities like soybean oil, palm oil, guar gum etc. are also considered agricultural commodities.

ii. **Bullion and Gems**: This segment predominantly consists of precious metals like gold, silver and precious gems like a diamond.

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iii. **Energy commodities**:. These commodities are traded in both the unprocessed form in which they are extracted or in various refined forms or by-products of refining.. Crude oil, natural gas etc. are examples of energy commodities.

iv. **Metal commodities**: This segment includes various non-precious metals that are mined or processed from the mined metals such as copper, brass, iron, steel, etc.

Different Types of Commodity Exchange

Trading in the commodity exchanges is very transparent. The price discovery is done without any manipulation, and orders are executed only when there is a match between a buyer's and seller's order. The margins in commodity markets are low; therefore, traders use this market to hedge their position and for higher leverage. In India, there are 6 National level exchanges and 21 regional exchanges that allowed for derivate trading.

a) Multi-commodity Exchange (MCX): It is located in Mumbai and was established in the year 2003. It is India's largest commodity derivative exchange where the clearance and settlement of the exchange happens. MCX offers options trading in gold and futures trading in non-ferrous metals, energy, and a number of agricultural commodities. In 2016, MCX was seventh among global commodities in terms of having more future contract trades.

Metals: Aluminium, Brass, Copper, Zinc, Lead, Nickel.

Bullion: Gold, Silver

Agricultural Commodities: Rubber, Black Pepper, Mentha Oil, Crude Palm Oil, Palmolien, Cardamom, Cotton, Castor Seed.

Energy: Natural Gas, Crude Oil

b) **National commodity and Derivative Exchange (NCDEX)**: It is located in Mumbai and came in the year 2003. It is a leading agricultural commodity exchange in India. NCDEX is extremely trusted for the trading of agri-based foods like crude oil and oilseeds, cereals etc. It is managed by ICICI Bank , LIC, NABARD, NSE, Canara Bank, Punjab National bank

Fibres: Cotton, Guar Gum, Guar Seed

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Oil and Oilseeds: Crude Palm Oil, Cotton Seed Oil Cake, Castor Seed, Mustard Seed, Refined Soy oil, Soybean

Cereals and pulses: Wheat, Barley, Paddy, Chana, Maize Rabi, Maize

Spices: Jeera, Turmeric, Coriander, Pepper

c) National Multi-commodity Exchange (NMCE) and Indian Commodity Exchange (ICEX): It is located in Ahmedabad and was established in the year 2001. It is the First demutualised online multi commodities Exchange that has been established in the country. It promoting and managing institutions are CWC, NAFED, NIAM. As of July 2016, the NMCE listed futures contracts on a total of 13 different commodities, ranging from oils and oilseeds to rubber, sacking, raw jute, coffee, Isabgul seed, chana, pepper, and cardamom.

ICEX came in 2008, and its headquarter in Mumbai. It offers diamond contracts and plans to offer crude oil and Brent crude oil contracts but had suspended trading in 2014 as its volumes dipped to a level that made it unviable to continue the business. It got permission to relaunch its operations after it raised its networth again. The NMCE and ICEX agreed to merge in 2017. At the time of the merger, the NMCE's net worth was Rs 76 core, while ICEX's net worth was Rs 100 core. ICEX was given regulatory approval in 2017 to restart its operations. The merged entity has prominent shareholders from both exchanges, including Indiabulls Housing Finance, MMTC, Indian Potash, Punjab National Bank, Krishak Bharti Cooperative (Kribhco), IDFC Bank, Reliance Capital, Bajaj Holdings, CWC, and Gujarat Agro Industries.

d) ACE Derivatives & Commodity Exchange: It is formally known as Ahmedabad Commodity Exchange**.** It came in the year 2010. It **is** primarily organising trading futures in certain commodities like **a** gold hedge, gold, silver, crude oil, and base metals. However**,** the commodity exchanges were suspended with effect from 2015.

e) Universal Commodity Exchange (UCX): It came in the year 2012 and is located at Mumbai. It was promoted by IT Professional Ketan Sheth from Commex technology Ltd (40%) and institutions such as IDBI Bank (10%), IFFCO (15%), National Bank for Agriculture and Rural Development (16%), Rural Electrification Corporation (16%) are shareholders. The board of UCX had suspended trading operations with effect from 2014 in view of the drastic decline in trading volume. As per the SEBI regulation, if there is no

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trading operation on the platform of any commodity derivatives exchanges for more than twelve months, then such exchange is liable to exit.

Stock Exchange

Commodity exchanges provide facilities for the purchase and sale of agricultural goods, minerals as well as manufactured goods. Stock exchange, is, on the other hand, to assist the purchase and sale of securities. India has two major stock exchanges the National Stock Exchange and the Bombay Stock Exchange. NSE was established in 1992 and BSE in the year 1875. With the help of the government, the NSE and BSE successfully offer services such as online trading, clearing as well as settlement in debt and equities comprising domestic and international investors. In 2018 both NSE and BSE launched trading in commodities.

Regulatory Body for Commodity Exchanges

Forward Market Commission (FMC) had been regulating commodities markets since 1953, but the lack of powers has led to wild fluctuations, and alleged irregularities like the NSEL scam has rocked this market in the recent past, and the subsequent regulatory and government interventions in this case eventually led to the government announcing FMC's merger with SEBI. It was proposed by Finance Minister Arun Jaitley in his Budget for 2015-16. This is the first major case of two regulators being merged. The merger will enable commodity exchanges to expand in segments permitted under a stock exchange and vice-versa. Stock exchanges will be able to become universal exchanges wherein equities, debt instruments, and currencies are traded under the same roof as commodity derivatives. Stock exchanges have depositories and clearing corporations which will also cater to the needs of commodity traders.

Conclusion

A commodity exchange provides a convenient place where the member can transact business in a commodity according to certain well-established rules and regulations and ensuring fair play of business transactions, and facilitates real price discovery. By providing hedging facilities, the commodity exchange reduces the effect of fluctuations of price and produces an opportunity to transfer their risk to the professional risk bearer. It also provides

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facilities and opportunities for arbitrary and thus equalize the price levels of commodities at various centres.

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SUMMER KILLS IN FISH PONDS AND ITS PREVENTION MEASURES

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Temperature is the primary factor that influences the metabolism of many organisms. So many metabolic activities are temperature regulated. Sometimes reactions will have negative impacts too. Thermoregulation is one of the most critical metabolic processes by which an organism controls its internal temperature. Fish have many mechanisms for regulating their temperature; based on this mechanism, fishes are classified as ectothermic, using their environmental temperature to manage their body temperature, but some fish are endothermic, having the metabolic ability to handle temperature internally. Poikilothermic fish are ectotherms that do not control their body temperature; their core body temperature conforms to ambient temperature. Eurythermal fish have evolved to survive in a wide range of environmental temperatures, but stenothermic fishes are very poor tolerant to stay in a narrow range of temperatures. Enzymes can degrade and deactivate; organs can fail, which finally leads to the organism's death.

Understanding thermoregulation for fish species is particularly important when considering implications for climate change.

Mortality of fish in the cultural pond is a natural process, and frequent noticing of the dead fish along the dikes of the pond areas is not unusual. Natural causes may include predation, old age, minor disease outbreaks, handling, spawning, and environmental stresses. However, if you find large numbers of dead fish at one time, we need to think about it. Unfortunately, by the time dying fish are observed, it is often too late to stop the fish kill; however, to prevent fish kills, understanding the causes is necessary.

Oxygen-Related Fish Kills

The decline in Dissolved oxygen levels in aquatic ponds is the most common cause of fish kills is suffocation. Algae and aquatic plants produce the most dissolved oxygen through

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a biological process called photosynthesis. Another side, a lesser but also important source of oxygen in water is diffusion from the atmosphere, enhanced by wind-induced surface water turbulence, called artificial aeration. During the night hours, oxygen is utilised for respiration by plants, animals, and bacteria during organic material decomposition. When more oxygen is consumed by the aquatic organisms than produced, oxygen levels can be depleted, leading to fish kills. Ponds suitable for supporting fish should have a minimum oxygen level close to optimal levels required by the fish. Tropical fish require oxygen levels of 5 ppm (parts per million), and temperate fishes require around 6.5 ppm to maintain good health. A sign of oxygen stress is fish gulping for air at the surface, particularly in the early morning. Larger fish will die first since they have greater oxygen demands than smaller ones. When water temperature increases, the solubility of gases decreases. So water temperature plays a crucial role in dissolved oxygen solubility. The following are scenarios that can lead to oxygen depletion and fish kills unless precautions are taken.

$$Temperature \frac{1}{\text{Diffusion of gases}}$$

Summer Kills in Fish Ponds

Excessive Vegetation in Culture Ponds

Fish ponds covered by larger aquatic plants for more than 60 to 80% with shallow water levels may have the highest number of summer kills. Under these conditions, problems can arise after long periods of hot, cloudy, still, (windless) weather conditions at which water temperatures rise above 85°F (29°C). High temperatures will limit the oxygen to dissolve into the water, cloudy skies prevent plants from producing sufficient oxygen through photosynthesis, and calm winds stop the turbulence and mix atmospheric oxygen into surface layers of water. Ponds can usually withstand several consecutive hot days and nights, but oxygen levels may decline to levels lethal to fish if these conditions persist. Larger fish typically die first because their oxygen requirements are greater than those of smaller fish.

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Figure 1: Excessive vegetation in culture ponds

Phytoplankton Crash

Eutrophicated ponds often produce dense blooms of microscopic algae (called phytoplankton), giving them a deep green coloured appearance. A sudden drop of phytoplankton can occur due to following consecutive days of cloudy, hot, windless conditions. When an algal bloom "crash" occurs, the water will appear to have turned black or clear overnight suddenly.

Figure 2: Fish mortality due to the depletion of Dissolved Oxygen

The sudden die-off of algae will result in a rapid decline in dissolved oxygen as bacteria decompose the dead algae by consuming the oxygen. This can lead to deficient levels of dissolved oxygen, which can result in fish kills.

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Stratification

Other than the above said reasons, the cause of fish kills during summer months could be overuse of herbicide leading to massive death of either algae or aquatic weeds. Pond owners often wait until their ponds are overrun with aquatic plants or algae before starting any control practices. When all the vegetation is treated simultaneously with a herbicide/algaecide, a massive die-off of the foliage will occur shortly after the treatment. If this happens, bacteria will immediately start the decomposition by breaking down the dead plant materials, which rapidly reduces the dissolved oxygen levels. Still, no longer oxygen is being produced by the plants/algae that were killed by the herbicide/algaecide. Under these stressful conditions, oxygen consumption far outpaces oxygen production, and levels decline rapidly, leading to fish kills.

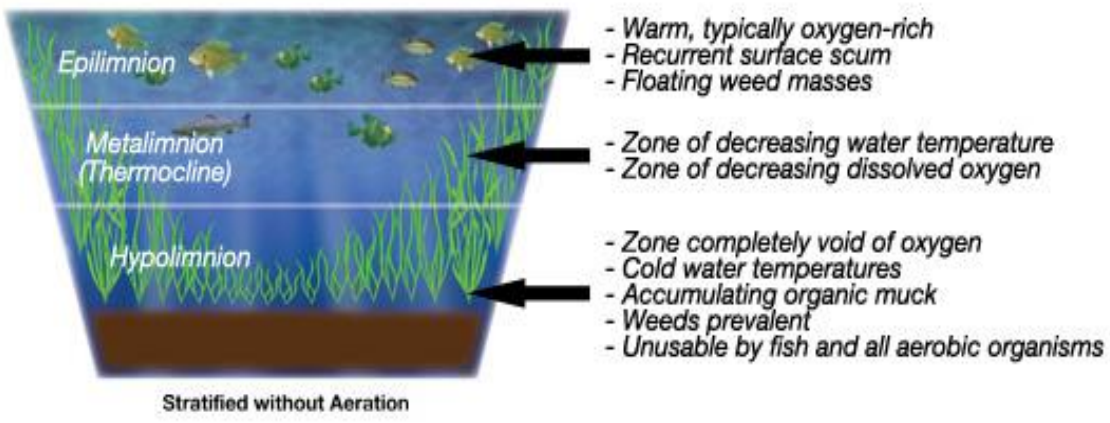

Figure: 3 Thermal stratification in fish ponds

Premature Turnover Following Heavy Rains

During summer, many ponds deeper than 8 to 10 feet tend to stratify, resulting in a warmer, lighter, more oxygenated upper layer on top and a colder, denser one at the bottom layer. This stratification will break down naturally in the fall of temperature. The increasingly cooler, denser water of the upper layer begins to sink due to its density. They are mixing the entire water column results in the lowest chances of oxygen diffusion into water. Over the course of the summer, large amounts of organic matter can accumulate in the deeper areas of stratified ponds. After completion of the summer, oxygen in this bottom layer will be used up by this organic material decomposition. Premature mixing of these stratified layers can occur

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during the summer after heavy cold rain. Oxygen-poor bottom layers mix with upper layers, resulting in critically low oxygen levels throughout the water column, fish starts suffocation and possible fish kills.

How to prevent Summer Fish Kills?

In all cases described above, Dissolved oxygen depletion is the prime most cause of fish kills. Preventing oxygen depletion is difficult, but proper pond management and construction can help to prevent fish kills. The following suggestions will help.

- ✓ Installing an aeration system to circulate and aerate oxygen-deficient water is recommended. So many types of aerators are available in the markets, including fountains and pump-operated bubblers or diffusers aerators. For effective, bubbler/diffuser systems must be turned on early in the spring and run nonstop all summer until temperatures begin to cool. If you opt for the diffuser-type of the aerator, keep it at least one feet above the pond bottom; otherwise, this will stir up organic materials and leads to increased oxygen consumption as bacteria break down the material. Aeration also speeds up the decay of organic matter, which helps reduce toxic gasses.

Figure-4 Paddlewheel type Aerator

- ✓ The paddle wheel type aerator is especially effective because it moves a large amount of water by its rotating fan mechanism. During scorching weather, check your pond regularly in at early morning for signals of any stressed fish. If you observe fish

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gulping at the surface during early morning hours, immediately stop feeding them and start aeration.

- ✓ Cultural methods, such as the addition of fresh water and deepening shallow water areas of ponds (when possible) to limit aquatic vegetation growth and increase water volume, are also recommended.
- ✓ The recommended slope of the pond is 3:1 (for every 3 feet of distance from the shore, there is a 1-foot drop).
- ✓ Limit animal waste from entering the pond to prevent excess organic matter accumulation; extra organic matter can utilise oxygen for bacterial breakdown.
- ✓ Do not allow livestock to wade in the pond.
- ✓ Don't allow the aquatic weeds from accumulating to excessive levels since they will use up large amounts of oxygen when they decompose. So many methods are there to remove these plants, like mechanical, cultural, and chemical methods. If a herbicide application is necessary, treat not more than 25 % of the pond at a time with a 10 to 14 days gap between treatments to prevent oxygen depletion.

Conclusion

During the summer session, excessive aquatic vegetation in the cultural pond may influence the dissolved oxygen levels, which triggers the suffocation of fish and finally leads to the mortality of fishes. In the water compartment, such as alteration of water quality (Temperature, Dissolved oxygen and pH) in the aquatic system may directly or indirectly influence the aquatic species. Better pond management is foremost essential to prevent summer kills to a certain extent.

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