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Pond preparation in shrimp farming of Nagapattinam and Mayiladuthurai Districts

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Introduction

After selecting the ideal site for shrimp farming and completing the design and construction of the ponds, the next essential step is pond preparation. Pond preparation is a crucial step in setting up the environment needed for a successful aquaculture operation. Pond preparation of shrimp farming involves eliminating wastes through tilling and drying, adjusting pH and nutrient levels with lime and fertilizers and enforcing strong biosecurity measures. This article highlights the procedures of pond preparation particularly in Nagapattinam and Mayiladuthurai districts, offering a comprehensive overview of the practices that contribute to the success of Vannamei shrimp farming in these dynamic coastal regions.

Pond preparation

Pond preparation varies between newly constructed ponds and existing culture ponds. In newly dug ponds, it is crucial to first understand the soil characteristics before implementing various preparation measures. Soil samples from different areas of the pond should be thoroughly mixed, and a representative portion must be analyzed. Early Identification and addressing soil deficiencies is important, rather than waiting until poor bottom soil quality becomes apparent. Understanding the soil parameters helps in determining the appropriate management strategies including liming, manuring, fertilization, and water management. In existing culture ponds, before starting the next culture, the pond must be prepared for stocking shrimp post-larvae. This includes removing metabolite loads and contaminants (both chemical and biological) from the soil of

the previous culture cycle through tilling, ploughing, and drying.

Additionally, pests and predators are eliminated, and pH and nutrient levels in the water and soil are adjusted to optimal concentrations using lime, organic manures, and inorganic fertilizers. In India, shrimp farming generally involves two crop cycles, often referred to as summer and winter crops. In Nagapattinam and Mayiladuthurai districts, shrimp farming involves two crop cycles: the first crop runs from February to June and the second crop runs from August to November. Pond preparation for the first crop begins at the end of January, while for the second crop, it starts at the end of July. The preparation activities for both crops are similar and include several key steps: draining and drying the pond, tilling the soil, applying lime, infrastructure setup, and fertilization and implementing biosecurity measures.

Draining and Drying: The first task is to drain the cultured water from the grow-out ponds using a slurry pump. Unlike in Nagapattinam, where pond waste is typically removed only once a year, in Mayiladuthurai, waste is removed at the beginning of each crop. After drainage, the ponds should be left to dry for at least 10 to 15 days until the bottom is well cracked and loses its moisture content. Drying and cracking of pond bottom helps in microbial decomposition of soil organic matter and mineralization of organic nutrients (nitrogen and phosphorus).

Tilling: After the pond bottom has dried, the next step is tilling the soil using a tractor with a disk harrow or rototiller to further prepare the soil for next crop. Tilling soils can enhance aeration, accelerate organic matter decomposition and also aid in the oxidation of reduced compounds. In both districts, lightweight tractors (Mahindra) which are commonly used in Northern part of India are preferred because they are well-suited for the small and uneven terrains of shrimp farm ponds. These tractors are typically operated by workers from Bihar, Haryana, and Maharashtra, who are familiar with the local conditions and ploughing requirements.

EHP Management

In Nagapattinam and Mayiladuthurai districts, many shrimp farms have been significantly affected by Enterocytozoon hepatopenaei (EHP), primarily due to continuous culture without sufficient time for proper soil treatment. EHP prevents the shrimps from reaching their full size by harvest time, leading to reduced profits for farmers. Shrimp farmers in both districts have started using hydrogen peroxide as a eradicative measure. For ponds with EHP spores in the sediments, hydrogen peroxide at a concentration of 30-50% is applied at a

rate of 20-30 liters per pond to effectively eliminate the spores.

Liming:

In some culture ponds, water may persist in depressions for a long time after the rest of the pond bottom has dried or they may not dry thoroughly due to water infiltration from adjacent ponds or canals. Since complete bottom dry-out can be challenging, particularly during the rainy season, farmers use burnt lime (calcium oxide) or hydrated lime (calcium hydroxide) on the pond bottoms. This practice is crucial as it increases soil pH, kills unwanted organisms and pathogens and thereby improves overall pond health, especially in areas that do not dry completely. Pond bottoms with a soil pH less than 7 should be limed to raise the pH. Effective treatment requires a high application rate, with a minimum of 3,000 kg/ha (300 grams/sq.m) of burnt lime or 4,000 kg/ha (400 grams/sq.m) of hydrated lime. Although some farmers apply lime to the entire pond bottom after each cycle, the best approach is to dry the pond bottoms and reserve lime treatment for areas that do not dry completely. Calcium hypochlorite can also be applied to wet areas for disinfection, with an application rate of 100 to 200 grams/sq.m. While alternatives such as copper sulphate (10 to 15 kg/acre) and potassium permanganate (10 to 15 kg/acre) are used for soil disinfection but they are less effective compared to lime and calcium hypochlorite. When burnt or hydrated lime is used for disinfection, it also helps in neutralizing soil acidity. If the pond dries completely and lime is not used for disinfection, agricultural limestone (30kg/acre) is a more cost-effective option for neutralizing soil acidity.

Water filling and treatment

The source of water for shrimp farming in Nagapattinam district is estuarine water bodies, while in Mayiladuthurai district, it is groundwater. Water from these sources is pumped into the grow-out pond to a depth of 5 feet using high-power water pumps, which are covered with screens to prevent the entry of unwanted organisms. Generally, 5HP and 10HP motors are used in both districts. In some regions of Nagapattinam district, diesel engines are employed for pumping water during power outages. Estuary water can have high organic matter and turbidity which requires chlorination, while groundwater has very low turbidity and minimal organic matter reducing the need for chlorination. Chlorination is the process of disinfecting the water and removing organic matter, as it effectively destroys disease-causing organisms. Bleaching powder or calcium hypochlorite ($Ca(OCl)_2$) is used for this treatment, with high grade calcium hypochlorite (70% available chlorine) commonly employed in water treatment in

both districts. Chlorination is carried out in the evening, 12 hours after the water has been filled. A 70mm mesh bag filled with bleaching powder is then distributed across the pond at an application rate of 300 to 500 kg per acre.

Infrastructure setup

In Nagapattinam and Mayiladuthurai districts, aerators with varying power capacities such as 2HP and 4HP are installed in the ponds to enhance water movement and oxygenation. These aerators come with long arms and are equipped with 4-paddle, 6-paddle and 12-paddle wheel, depending on the size of the pond. Check tray bridges (catwalk) are platforms present in ponds that facilitate feeding operations by holding trays where feed is placed for shrimp. Two to four check tray bridges are required per pond and they are constructed using logs of casuarina wood or eucalyptus wood. To properly feed the cultured shrimp, strong ropes should be securely tied to all four sides of the pond, allowing workers to move across the pond while holding onto the ropes to evenly distribute the feed. Installation of aerators and construction of check tray bridges must be completed before the chlorination process begins. This preparation helps in controlling the spread of disease factors in the pond.

Chain system

The chain system is an important post-chlorination activity in shrimp farming of Nagapattinam and Mayiladuthurai districts. It is employed to ensure that the bleaching powder used during water treatment is evenly distributed and thoroughly mixed into the pond bed and also dislodge the benthic algae. It is typically done in 3 to 5 days after the bleaching powder has been applied to the pond. Iron chains are mostly used for this activity in both districts, while in some parts of Nagapattinam district, shrimp farmers use oak trees to drag the pond surface.

Fertilization

The purpose of fertilization is to ensure the growth of primary producers (phytoplankton) in culture ponds. They initiate natural food web in the aquatic ecosystem (Muralidhar and Gupta, 2006). Shrimp farmers in Nagapattinam and Mayiladuthurai districts use probiotic juices and powders to promote the growth of phytoplankton in ponds. The probiotic juice is prepared by mixing 10 kg of rice bran, 5 kg of wheat bran, 30 to 45 kg of jaggery, 500 gm of yeast, and 10 kg of tapioca flour with 50 liters of clean water. This mixture is left to ferment for two days, after which the fermented juice is sprinkled in farm ponds to encourage phytoplankton growth. Following this, minerals are added to the water at a rate of 30 to 50 kg per acre. In

ponds where phytoplankton does not grow properly, algae species such as spider web algae and hair thread algae begin to proliferate. Shrimp seeds can become entangled in these algae and die, leading to reduced survival rates. Super Biotic from CP Company is widely used as soil and water probiotics in both districts to promote healthy plankton growth. In Nagapattinam and Mayiladuthurai districts, during the summer season, phytoplankton growth is limited. To enhance this, shrimp farmers use NOVA BLUE, a natural dye that imparts a blue coloration to the pond, preventing sunlight from penetrating and thereby promoting plankton growth.

Biosecurity measures:

Biosecurity measures in shrimp farming are critical for preventing disease spread and protecting stock health. These measures include controlling farm access, deterring predators like birds, and managing pests and pathogens that can enter through water, animals, or human activities. Effective biosecurity is essential for profitable operations, especially in Nagapattinam district, which features numerous estuarine water bodies and significant bird population due to the Vedaranyam bird sanctuary. This abundance of bird species, frequently visit farm ponds posing a significant risk of transmitting diseases to the shrimp. Farmers' face numerous challenges with biological issues which are the major problems encountered during shrimp farming. The most significant concerns in biological issues include predation and disease transmission by birds, disease outbreaks and high biological oxygen demand. In addition, crabs and turtles can invade shrimp ponds, causing structural damage to embankments and posing a significant risk of disease transmission. Crabs can carry pathogens like the white spot syndrome virus (WSSV) pose a significant risk in areas like Vedaranyam in Nagapattinam district.

To combat these issues, shrimp farmers employ various biosecurity measures, starting with the erection of nylon net barriers around the ponds to prevent bird access. Following this, they utilize additional techniques such as floating thermocol pieces, tying polythene bags and bursting crackers. These measures are commonly adopted by shrimp farmers to enhance biosecurity. For long-term protection, shrimp farmers build wire fences to keep birds and larger animals away from ponds. They install polypropylene predator barrier nets at a height of 5 feet on 10-foot posts, securing them tightly. In some villages, used fishing nets are repurposed as cost-effective bird deterrents, with nets and nylon threads in bright colors like blue or red often employed to discourage birds from approaching or getting entangled in the

nets. Crab barriers, made from small-gauge nylon netting or high-density polyethylene sheeting, are installed at a height of 3 feet above the ground level to prevent crabs and turtles from entering farm ponds. Additionally, maintaining cleanliness and self-hygiene among farm workers is vital. Workers are advised to clean their feet with potassium permanganate solution (100ppm) before entering the farm and avoid visiting other ponds or untreated water bodies to minimize the risk of spreading disease agents. By implementing these biosecurity measures, shrimp farmers can significantly reduce the risk of disease and protect their shrimps from various threats, ensuring the long-term sustainability of shrimp farming operations.

Conclusion

The success of shrimp farming in Nagapattinam and Mayiladuthurai districts is deeply rooted in the careful execution of pond preparation and stringent biosecurity protocols. By focusing on essential practices such as soil management, liming, water treatment, shrimp farmers ensure that the foundational conditions for shrimp culture are optimal, paving the way for a successful harvest. Equally critical is the implementation of biosecurity measures that protect the farms from potential threats posed by predators, pathogens and environmental factors. Adhering to these detailed pond preparation processes will not only improve yield and profitability but also contribute to the sustainability and resilience of aquaculture operations in these districts.

References

Muralidhar, M., & Gupta, B. P. (2006). *Training manual on shrimp farming* (pp. 14–17). ICAR – CIBA Publication.

Illustrations

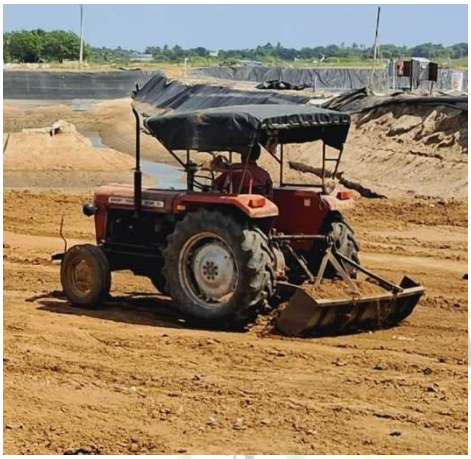

Fig.1 Tilling done by lightweight tractor in Nagapattinam

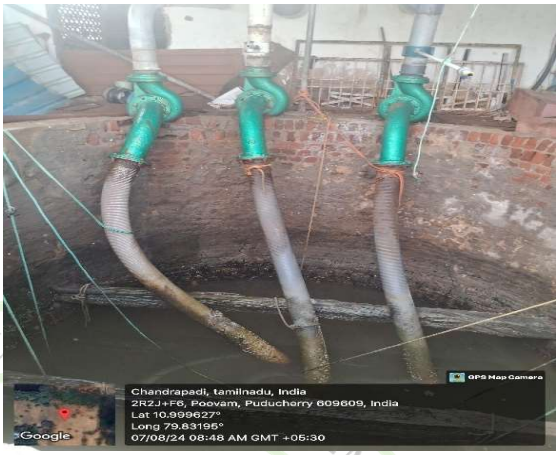

Fig.2 Ground water is extracted using high-power pumps

Fig.3 Water is drawn from estuarin bodies in Nagapattinam region

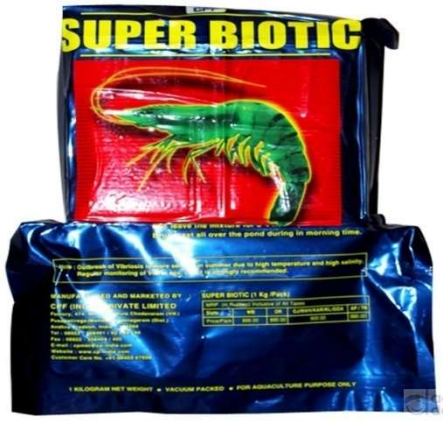

Fig.4 Super Biotic used in Nagapattinam to promote phytoplankton growth

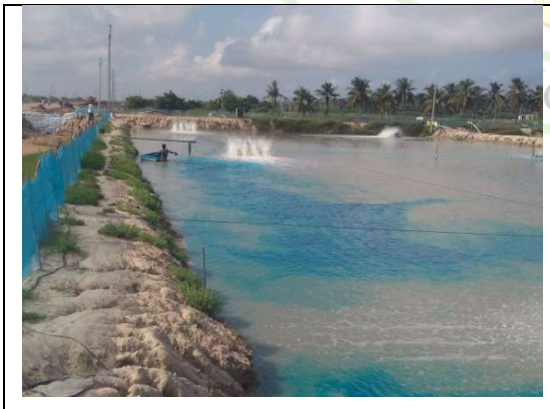

Fig.5 Application of NOVA BLU (dye) imparts blue coloration t pond

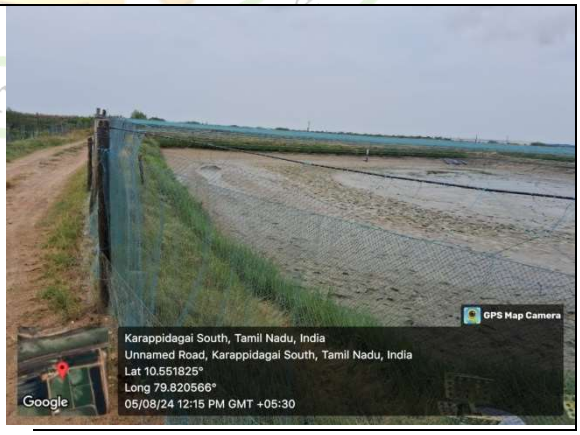

Fig.6 Biosecurity measures in Nagapattinam