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Biofloc Technology inAquaculture: Environmental and Economic Wellness

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Introduction

Aquaculture is the farming of aquatic animals, including finfish, crustaceans, molluscs etc. and aquatic plants, mostly algae, using or within freshwater, sea water, brackish water, and inland saline water. World aquaculture production reached its all-time high production of 114.5 million tonnes (live weight) in 2018. Presently, India ranks second in the world in total fish production with an annual fish production of about 9.06 million metric tonnes and contributing about 1% to the country's Gross Value Added (GVA) and over 5.37% to the agricultural GVA. Fisheries and aquaculture continue to be an important source of food, nutrition, income, and livelihood to millions of people. Southern states having enormous coastal area are major contributors to fish production in India, however northern and north-eastern states are also involved in intensive fisheries production using ponds and tanks and also inland fisheries production.

With the objective of new Blue revolution and to double the farmers income, the introduction of Biofloc technology (BFT), will provide a boost to already blooming fisheries production in India. The BFT will address issues of inland fisheries and its easiness have already allowed many entrepreneurs to invest and engage in fisheries production, including youths and farmers.

Biofloc Technology

Biofloc technology (BFT) makes the use of aggregates of phytoplankton, bacteria, algae, or protozoa, held together along with particulate organic matter in tanks/ponds. This technology utilizes the microbial processes inside pond/tank to provide food resources for

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cultured organism (fish/shrimp) while at the same time improving water quality, waste treatment and disease prevention in intensive aquaculture systems. This system is also known as active suspension ponds or heterotrophic ponds/green soup ponds.

Mechanism of BFT

BFT works by maintaining the higher C-N ratio by adding carbohydrate source and the water quality is improved through the production of high-quality single cell microbial protein. In such condition, heterotrophic microbial growth occurs which assimilates the nitrogenous waste, which is utilized by the cultured species as feed and that also works as bioreactor controlling water quality.

Components Needed for Biofloc

Earth work excavation and construction of bund, Polyethylene lining, Inlet, outlet, and central drainage system, PVC pipe fittings for air, water flow, Pump house-100sqf, Pumps-1 nos. 3 HP, Aerator-4 nos., Air Blower, Aeration tubes, Generator set 10 KVA, Net, Imhoff cone, weighing balance, water testing kits and other accessories, Bio security Measure-Bird net, crab net, Electrification L.S., Watchman shed-10sqf etc. (**Fig 1**).

Fig. 1. Representative Biofloc Tanks

What Makes Biofloc Environment Friendly?

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The Biofloc technology is a symbiotic process, where bacteria and other microbes helps in the living of aquatic creatures and vice versa. This is totally an environmentally friendly approach as water quality is maintained by the acceptance of nitrogen compounds generating "*in situ*" microbial protein; and nutrition, increasing culture feasibility by reducing feed conversion ratio and a decrease of feed costs. Complete recycling of nutrients is there which means there is no expenditure of the nutrients. The waste material of aquatics is consumed by the microbes and the microbes become a good nutritious meal for the aquatic creatures. Aerobic microorganisms are efficient in converting feed to new cell material (40-60% of conversion efficiency), rather than higher organisms that spend about 10-15% to rise in weight.

Which Species Can Be Used?

The best species for culturing are bottom dwellers especially shrimps and tilapia fishes. The culture of these fishes under BFT is most economical and profitable for the farmers. The culture of heterotrophic bacteria (in some cases *Vibrio* also) is more suitable rather than autotrophs, as the nitrogenous waste material of the fishes are well utilized by them, which further makes the water quality better and effective utilization of feed. Most suitablespecies for biofloc system are those which can tolerate high solids concentration in water and are generally tolerant of poor water quality. The species which are suitable for BFT are:

- ✓ Air breathing fish like Singhi (*Heteropneustes fossilis*), Anabas/Koi (*Anabas testudineus*), Pabda (*Ompok pabda*), Magur (*Clarias batrachus*), Pangasius (*Pangasianodan hypophthalmus*).
- ✓ Non-airbreathing fishes like Tilapia (*Oreochromis niloticus*), Common Carp (*Cyprinus carpio*), Milkfish (*Chanos chanos*) and Rohu (*Labeo rohita*).
- ✓ Shellfishes like Vannamei (*Litopenaeus vannamei*) and Tiger Shrimp (*Penaeus monodon*) etc.

Economical Aspect

Export earnings from the fisheries sector has been INR 45106.89 crores during 2017-18 with impressive average annual growth rate of about 19.11%. The fisheries sector provides livelihood support to about 160 lakh people at the primary level and approximately double the number along the value chain and the annual average growth rate in the Fisheries

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sector is over 7% over the last few years according to Handbook on Fisheries Statistics 2018 by Govt. of India.

The introduction of biofloc technology in aquaculture is a boon to the aquatic farmers and especially in the brackish water as shown in Fig. 2.

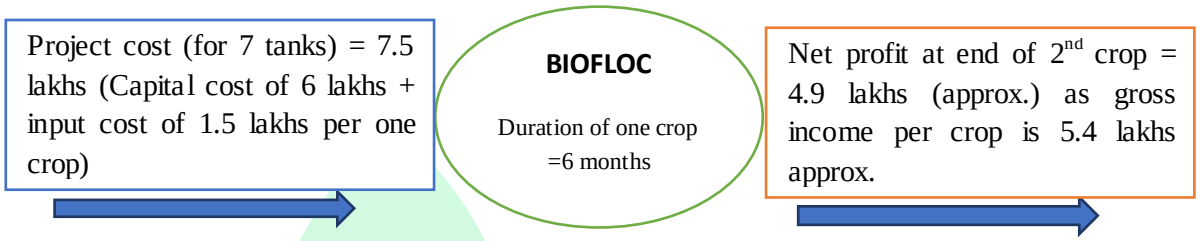

Fig. 2. Project cost and Net profit analysis for 7 tanks of Biofloc as per National Fisheries Development Board, India.

Thus, BFT has the potential to double the farmers income, given the condition that it needs to be subsidized at initial stages of establishment. If managed properly and guided by experts and professionals, this technology can be adopted rapidly in rural settings of India just like commercial poultry farming and can bring a change in the economical standards of Indian farmers.

Conclusion

Biofloc Technology by reducing water pollution and by providing effective utilization of land and water resources is thus environment friendly as well as cost effective. It provides sustainable development and reliable sources of vitamins and proteins for fishes and creatures of water, decrease the mortality rates, improves larval growth and adult's growth rate and there is no need to change water from the pond with time. The interest of farmers has been increased towards this sector with the introduction of Biofloc technology. Biofloc technology may be regarded as "money maker tank" with some initial investments in terms of profit. Before going to setup, the farmer should have a complete knowledge of microbes and fish species to be developed in the pond to prevent the losses, which is provided by state govt. and central govt. institutes. Although some constraints that limit the use of BFT are there, but state and central govt. has launched several schemes and initiative to cut down on the

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limitation such as to bring down the high input cost by subsidizing the ventures, by providing trainings etc.