Popular Article
e-ISSN: 2583-0147
Volume 2 Issue 7
Page: 0194 – 0196

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Makhana-Fish Integration

Fish farming and livestock production are combined in integrated fish farming. Animal excrement is dumped straight into a fish pond as fertilizer, allowing photosynthetic organisms to thrive. Feed containing growth promoters is frequently fed to livestock, namely chickens and pigs. The impact of integrated fish farming on the levels of antimicrobial-resistant bacteria in a pond environment was explored in this study. The article discusses a method for synchronizing two crops in a pond: fish and makhana (*Euryale ferox Salisb*). Both crops gain from such environmentally friendly combination. Organic matter is formed when makhana crop plant pieces decompose, releasing nutrients into the pond to boost plankton population. Organic detritus offers a good substratum for the growth of zooplankton, insect larvae, nematodes, and gastropods, as well as providing food for bottom-dwelling fishes (mrigal and common carp).

INTRODUCTION

Integrated fish farming is built on the idea that "there is no waste," and that "trash" is only a misdirected resource that may be used to make another product. The main principles of integrated farming include utilizing the synergetic effects of interrelated farm activities as well as conservation, which includes the complete utilization of farm wastes. The article discusses a method for synchronizing two crops in a pond: fish and makhana (*Euryale ferox Salisb*). Both crops gain from such environmentally friendly combination. Organic matter is formed when makhana crop plant pieces decompose, releasing nutrients into the pond to boost plankton population. Organic detritus offers a good substratum for the growth of zooplankton, insect larvae, nematodes, and gastropods, as well as providing food for bottom-dwelling fishes (mrigal and common carp). Fish help to keep makhana bugs under control. Their faces serve as organic manure for the makhana crop. The D.O. content in the covered regions of the pond was reduced by Makhana leaves serving as a blanket barrier over the water surface.

Euryale ferox mainly tropical and subtropical parts of Southeast and East Asia are the only places where it may be found. *Euryale ferox* populations are known to exist in Japan, Korea, the former Soviet Union, North America, Nepal, Bangladesh, and parts of India. About 42 per cent of the entire water distributed land in north Bihar is suited for makhana cultivation. The majority of farmers grow makhana as a single crop. Bringing aquaculture and agriculture together is a better system. Fish culture in makhana ponds can be divided in different categories.

- After makhana, there comes a secondary crop of fish.
- During the makhana harvesting season, the fish are continuously cultured and transferred to specially constructed ponds or canals.

METHOD OF MAKHANA CULTIVATION

Makhana, also known as Fox Nut, is a plant that grows best in tropical and subtropical regions. For healthy growth and development, it requires a temperature range of 20 to 35 degrees celsius, as well as a relative humidity of 50 percent to 90 percent and an annual rainfall of 100-250 cm. Other ideal conditions for a successful crop include rainfall reaching water basins with less than 50 percent water transparency organically. Giant floating leaves on a water plant. It thrives in stagnant, shallow water (0.2-2.0 m deep). It has a rhizomatous stem with fleshy, thick root clusters that are deeply entrenched in mud. The upper side of the leaves is green, while the lower side is purple red. Thorny, oval, or rounded leaves with a diameter of 0.2-1.0 m. Due to its multi-purpose application in medicine, healthcare, and nutrition, the plant is also known as "Black Diamond." It can be taken in a variety of ways.

STEPS OF CULTIVATION

Clearing the pond or other water body, disseminating the seeds, thinning and filling gaps, safeguarding the plant, harvesting it, and eventually collecting the seeds are all part of the makhana cultivation process. Water bodies that are currently under cultivation do not require broadcasting since saplings grow from the seeds that are left behind. Experienced producers sweep the entire water body's floor, creating heaps of sunken seeds that are scooped out using the appropriate equipment. Smaller and lighter makhana seeds are collected with small and fine nets.

IMPORTANT FISH SPICES FOR MAKHANA CULTURE

After the makhana crop is harvested, some air-breathing fishes are released. Such as (magur, singhi, kawai, gorai, mud eel) trash fishes and the only crustacean *(Macrobrachium lammeri)* which generally get access and enter through paddy fields into ponds as wild fish are also being harvested by farmers as additional animal crop without introducing seed of these fishes.

Figure 1. Makhana cum Fish Integration

MAKHANA CYCLE IN FISH PONDS

Perennial ponds with a thick layer of very nutritious muddy bottom work best. Sowing usually takes place between October and November. In ponds that are sown annually, 90 -100 kilograms seed/ha is necessary for the first time planting, whereas just 35 kg seed/ha is required for the first time sowing. Seeds are distributed on the pond's surface in new ponds, sinking to the bottom and germinating in the muck. In February and March, geminated seeds sprout. Thinning operations are carried out at this time, and saplings are transplanted throughout the available water area, with a gap of roughly 1 m between two plants.

Figure 2. Makhana culture and Processing Makhana

During the months of April and May, the entire lake surface is covered in massive, spreading, thorny, elliptical leaves that float on the surface. In June, the

fruits begin to show. Around August-September, mature fruits burst, scattering seeds across the pond's bottom. During this time, farmers break the leaves into pieces and discard them for decay. During the months of September and October, the scattered seeds at the bottom are manually collected. Seeds are gathered and stacked in several heaps.

ADVANTAGES AND DISADVANTAGES MAKHANA-FISH INTEGRATION

ADVANTAGES

- The addition of fish to makhana ponds may help both crops in the long run.
- Because the same pond would be used for makhana and fish production, the most cost-effective use of water body (pond) could be attained.
- Because both makhana and fish may be cared for at the same time, there would be very little extra labour required to look after the fish. Because some of the fishes tend to lower the occurrence of weeds, this additional labout cost may be offset by labour savings for weeding.
- Supplemental fish feeds, if supplied at all, will be far less than those given to pond-cultured fish, and wasted feed promotes the fertility of the pond by acting as organic manure.
- Insects and their larvae are eaten by fish, which are dangerous organisms.
- Reduced insect pest pressure and increased organic fertilization would boost Makhana productivity.
- Makhana-fish culture can help prevent water-borne infections by feeding on aquatic intermediate hosts such as mosquito larvae (malaria) and freshwater mollusks (bilharzia).
- Fish movement would result in enhanced water aeration and more tillering of the makhana crop.

DISADVANTAGES

However, there are several drawbacks to Makhana-cum-fish culture.

- The fishes may harm the immature makhana plants if they are introduced too soon.
- To avoid damaging the makhana crop, fish species must be carefully chosen.
- From May to August, the makhana plant's massive sprawling leaves keep the water surface thickly shaded.
- The grazing chain is disturbed during this time because sunlight cannot reach the lake surface. The amount of dissolved oxygen in the water decreases, making the habitat unsuitable for Indian major and exotic carps.

CONCLUSION

Crop diversity also minimizes the likelihood of any of the two crops failing. This increases aquatic productivity and helps fish farmers improve their financial situation. Both the components (fish and makhana) profit from such a system. Makhana plants provide mechanical support as well as a suitable substratum for plankton and periphyton growth and reproduction. This also serves as a deterrent against fish poaching. The generation of plankton, insects, nematodes, and gastropods as natural fish feeding species enlivens the aquatic food chain as organic matter decomposes. If fish farmers implemented this strategy of integration on a greater scale, the aquatic system's productivity would improve.

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