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Enhancing productivity by integration of fish culture in Makhana ponds of North Bihar (India)#

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Abstract : Gorgon Nut / Fox Nut (*Euryale ferox*) commonly known as Makhana is a popular crop amongst fishermen. Makhana is an aquatic nutritional, medicinal and organically grown crop in the wetland and ponds of 14 districts of North Bihar (India). The crop is generally grown as mono crop in the region and therefore the economic returns from the crop is not adequate. The available water bodies in which the Makhana is growth, fish can be successfully integrated, thereby enhancing the production of the pond as well as profitability of the fishermen. A systematic and scientific study to explore the integration of fish with Makhana was conducted in Darbhanga District in the farmers pond. For the purpose, a 10% refuge area was left vacant in the centre of the pond to enable fishes swift movement & breathing. Fingerlings of common carp was integrated in the pond in mid April when the Makhana was in early stage. Makhana was harvested in September. Approx fish weight of 500gm of common carp was harvested in late September and approx fish weight of 900gm in December. A total produce of 3.25/ha of Makhana and an addition 5qut/ha of fish was harvested, which fetched an average net profit of Rs. 50,000 per year in comparison to monocrop of Makhana. Farmers of Makhana got convinced and now encouraged to take up integrated fish cum Makhana culture on large scale for better profitability.

Keywords : Productivity increase, integrated fish & makhana farming, North Bihar.

INTRODUCTION

Gorgon nut (*Euryale ferox*, local name Makhana) is the main aquatic crop of Mithila, growing naturally alone. It is livelihood of a large number of men & other stakeholders in several districts of North Bihar in India. It supports a full fledged industry which is intimately linked with the livelihood & economic activity. The edible seeds of Makhana is traded and exported raw or roasted. This aquatic crop has a high nutritional and medicinal value and is easily and economically cultivated in suitable stagnating ponds. It could serve as an alternative source of food in India & abroad. The cultivation of Makhana is practically limited to only few district of North Bihar viz. Darbhanga, Madhubani, Saharsa, Purnia, Katihar and to some extent Sitamarhi & Arania on a very small state.

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It is also grown in West Bengal, Assam, Uttar Pradesh, Madhya Pradesh and Manipur in rural farm on limited scale. The cultivation of Makhana is a cumbersome process. Traditionally it is grown in ponds that are continuous & used for its cultivation year after year. Usually Makhana seeds are sown in the bottom of the ponds as a mono cropping. The productivity of Makhana is not very high and therefore cultivators do not fetch a high remunerative price. Keeping in view the difficulty in its cultivation. *Euryale ferox* crop exist in pond for over 8 month in ponds having at least 3.5 feet water through its life cycle. After the convert of the Makhana seed (Guri), the left over seed in the bottom of pond serve as planting material for the next crop. These Makhana growing pond undergo gradual distraction and get enriched in nutrients through anthropogenic and biotic pressure leading to the development of entropic to hyper entropic state offering conducive condition for in luxurient growth of macrophyte,

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phytoplankton, zooplankton, periphyton and benthic organism that can't be utilized for interpreted aquatic farming system with fish & chestnut. Makhana cum fish culture provides ample opportunity to fisherman to enhance the productivity and thereby profitability.

Notable contribution are those of Verma et al (2014)¹, Free brain et al.(1986)², Behera et al (2008)³, Kuyvewhoven et al. (2002)⁴ Jha (1968)⁵, 'Leal' (1981)⁶, Singh (2003)⁷, Jha et al. (2003)⁸, Choudhury et al. (2003)⁹, Mandal et al (2010)¹⁰.

MATERIALS AND METHODS

Systematic and scientific experimentation are conducted in fisherman pond in the district of Madhubani (Village Aadharathadi) for successive two cropping in ponds with integrated Makhana based farming system. The leaves & stems of Makhana plant are highly prickly. Flowering and pollination takes place in deep water, fruit ripen and drop in the pond bottom. Gathering of ripe nuts and its curing is not only labor intensive but very difficult. Therefore, farmer of the selected ponds were extensively trained to apply, the treatments in time under direct supervision. Data were collected on various parameters at the time of harvesting. The local variety of Makhana was used as no improved variety of Makhana has been developed. Normal practice used by cultivators in the region was carried out in all ponds (N=4). A refuge covering approx 10% of the net water body as a central vacant space was created with help of bamboos for integrated aquaculture experimental ponds. Fish (Rohu & common carp) was used as component of integration in this with objective of enhancing the productivity & profitability of the pond in the same time span and water area.

RESULTS AND DISCUSSION

Ponds soil play an important role in regulating the concentration of nutrients in the pond water. Knowledge of the nature & properties of pond soil help the fishermen to develop efficient management practices that boost production of Makhana and fish. The most important chemical properties of bottom soil influencing the nutrient management practices of pond include Soil Reaction (pH), Organic Carbon Content, Carbon to Nitrogen Ratio and

Nutrient status. In experimental ponds, the Soil Reaction (pH) varied from 6.5 to 7.7, Electrical Conductivity 0.03 to 0.17dsm/l, Organic Carbon content 0.41 to 2.70(%), available Phosphorus Content 27.5 to 45.4kg/ha and available Potassium Content 155 to 378kg/ha. A rich diversity of phytoplankton, zooplankton, and benthic organisms were recorded with mean population density of phytoplankton from 305.7 to 450.3ml, periphyton from 70.0 to 1702cm⁴, zooplankton 60.3 to 120.5 ml⁴ and benthos 107.5 to 209.3L⁴. (Mean value of 4 study site).

The result of the integration of fingerlings of Rohu and common carp of 10.20gm weight in the refuge area of pond in month of April after removing carnivorous fishes recorded an average weight of 250gm to 500gm in September and 400 to 800gm in December. The integration of fishes with Makhana exhibited fish yield of 2.75 of ha (Harvested in December) whereas, Makhana yield was recorded 15.75q/ha (Harvested end of August) which contributed to an average out profit of Rs.74000/ha/year in comparison to sole Makhana cultivation of Rs.40500/ha/year. The economic analysis of integrated system mode of Makhana production revealed that the cost of Makhana cultivation is approx 30,000/ha fish integration 10,000/ha thereby resulting approx 70% profit over cash.

Productivity of the water bodies in North Bihar can be increased by cultivation of Makhana with integrated of fish farming, it ensure higher income per unit area & maximization of water productivity. It also helps in utilizing the water body throughout the year. The recommended practices for Makhana cum fish cultivation in proportion of 50% Rohu, 50% each of common crop can help the fishermen to fetch of a high remunerative price.

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