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Scientific management for improved fish culture in Ponds of North Bihar: A Review

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ABSTRACT

The productivity of the pond depends up-to its soil base can be greatly enhanced by (a) control ship of vegetation and (b) cleaning of pond bottom. Control of fish gill rot and other diseases is also necessary.

Fish culture ponds needs maintenance and improvement and hence it is necessary to maintain the whole eco-biological system of pond. The review paper is as above all for the ponds of north Bihar.

Keywords: *Fish culture pond, Productivity, Vegetation, Eco-biological system, Scientific management.*

INTRODUCTION

Higher utilization of the ponds productivity for maximization of fish yield, the main goal in pond fish culture, is achieved through intensive culture of fast growing, compatible fish species with complementary feeding habits occupying different ecological niche in the pond. Carps satisfy these demands and since they feed on the lower links in the food chain and accept low-cost feed are economical to be cultured.

The objective of the raising healthy and economically viable fish crops is maintained through appropriate management of fish stock and pond ecology. (Sarkar *et al.*, 2018; Robert, 2005; Brajesh *et al*., 2013; Kumar, 2008; Kumar *et al.*, 2005 and Delgajo *et al*., 2003).

STEPS OF SCIENTIFIC MANAGEMENT FOR IMPROVING FISH CULTURE IN PONDS OF NORTH BIHAR

Following ten steps should be marked necessary:-

1. Pre-stocking management 2. Control of noxious aquatic vegetation 3. Eradication of fish enemies 4. Liming 5. Fertilization 6. Selection of species 7. Stoking density and species ratio 8. Post-stocking operations 9. Pond sanitation and 10. Fish diseases and control.

1. **Pre-stocking management :** This refers to pond preparation to ensure maximum survival and proper growth of cultured fishes and involve repairs of embankments, removal of weeds and undesirable aquatic biota and correction.
2. **Control of noxious aquatic vegetation:** In view of adverse effects exercise aquatic plans expert on the pond with regard to living space sunlight penetration, oxygen circulation, sheltering of fish enemies, they should either be kept under check or cleared from the pond. This needs (a) increasing the depth of the ponds (b) manual means, (c) mechanical means, (d) chemical means and (e) biological means.
3. **Eradication of fish enemies:** Draining of ponds or repeated netting where draining is not

possible would help remove the predators and complete removal is ensured by the application of pesticides. Derris powder, Rotenone, Saponins, TFN, Niclosamide, Bayluscide, Fintrol, Aldrin, Dieldrin, Endrin and Organo-phosphate groups like Thiometon, D.D.V.P. (Konar, 1969) are used. However, in view of the harmful residual effects these leave in the pond, get stored in fish tissues and take a longer time to detoxify, their use is not advocated. But besides detoxification being quicker, bleaching powder disinfects the pond and helps in faster mineralization of organic matter.

4. **Liming:** Ground limestone ($CaCO_3$) and slaked lime {$Ca(OH)_2$} or quick lime *i.e.* calcium oxide, are applied at the pond bottom or spread over the water surface for correcting pH of water and soil, maintaining the sanitation of the pond, checking marked fluctuations in pH and hastening mineralization of organic malts (Table -1)

Table 1

Soil pH	Soil Type	Lime (kg/ha/yr)
5.0 – 6.5	Moderately acidic	1000
6.5 – 7.5	Near Neutral mildly	500
7.5 – 8.5	Alkaline	200

A pH range of 6.5 – 9.0 is observed as ideal for soil water interaction resulting in a satisfactory biological regime, so liming is an essential preliminary to success pond manuring.

5. **Fertilization:** It helps the metabolic cycle in operation, increases natural productivity and fish production (Godara *et al*., 2015; Sandhu, 2005 and Dhawan and Kurer, 2002). Cowdung, pig and poultry manures, spoiled oil cakes, spoiled cotton and soybean meal, compost, ammonium sulphate, ammonium superphosphate, murate of potash as inorganic manures are used in fish ponds.

6. **Selection of species:** Selection of species is the most important as it decides ultimate fish production (Kumar *et al*., 2005 and Delgago *et al.*, 2003)

7. **Stocking density and species ratio:** stocking with fingerlings of 100 – 150 mm. is done at a rate carrying capacity of pond. The prerequisite for evolving any sound stocking program is information on the food requirements of cultivated fishes. Number of fish to be stocked in computed by the following formula.

   No. of fishes to be stocked per unit area = Total expected increase in weight + mortality (not more than 10%).

8. **Post stocking operation:** This includes (a) Supplementary feeding and (b) Harvesting and marketing.

   (a) Supplementary feeding : Since natural fish food produced in a limited way can't supply the energy required for growth, the need for supplementing the food arises. Artificial feeding enhances fish production (Chakrabarty *et al*., 1975 b. and Sinha, 1979). Extent of intensive feeding is an economic question which depends on the cost of the foods and their conservation rate termed also 'food quotient' which varies considerably will variations in temperature, oxygen content of water, size of the fish, feeding habits and general conditions.

(b) Harvesting and marketing: Harvesting of stock can effectively be done by dray netting (Chakrabarty *et al*., 1975a). Fishes attaining the marketable size are harvested to reduce the pressure of density on the pond and thereby provide sufficient space for the growth of other fishes. Replenishment of the harvested species ensures maintenance of the ecological balance that the particular species exhibit and ultimately increases fish production.

9. **Pond sanitation:** Liming wards off the ill-effects of organic matter decomposition and restores hygienic conditions in the pond. Raking helps releasing of noxious gases from the bottom. Feeding is stopped when algal booms appear. Aeration of the pond water from the bottom, surface agitation, replenishment of water and netting are measures taken to counteract periods of oxygen depletion consequent on putrefaction of organic matter (Hora and Pillay, 1962).
10. **Fish diseases and their control:** Fish culture under artificial conditions make fish prone to parasitic and non-parasitic diseases by covering their resistance power when adverse hydrological conditions sets in prophylactic measures are taken for the few diseases encountered. Methods of diagnosis and treatment of fish diseases are being evolved at FARTC. Affected fishes are treated with solution of either $KMnO_4$ (2 mg/100 ml) or common salt (3gr/100 ml) or $CuSO_4$. Gammaxene solution (3gm/100 ml.) for fish lice infection. Rational management of stock ponds with cautions exercised at energy phase of management can give rich dividends making fish culture a profitable proposition.

RECOMMENDATIONS

- The pond should be notified as protected area. The Municipal department should take care of it.
- Illegal Fishing and hunting of fish should immediately be checked by enforcing the laws.
- Eutrophication should be checked by gradual removal of weeds to keep the pond alive.
- A proper inlet and outlet are required to flush out the pond water.
- Indiscrimate use of fishing boat and uncontrolled fishing should be avoided.
- Regular survey of the pond area by the guards or local police is urgently needed to save the flora and fauna of the pond.
- Physico-chemical test of water and soil should be conducted at regular intervals.
- To create awareness among the villagers, fisherman and local people towards the conservation of local fishes may be most effective tool towards the context.
- Few sign boards with appropriate slogans may be fixed at certain places around the pond to aware the local people.
- Few workshop and training programmes should be implemented by the government or fisheries department for the proper improvement of the pond as I noticed.
- At the last, a proper management plan to maintain its identity is another request to save the ecosystem of the pond.
- After proper preparation, the pond should be stocked with 100–150 mm long fingerlings of desired carp species.

- In case the fingerlings are not available, the pond can also be stocked with advanced fry or early fingerlings in absolutely predator-free ponds.
- The stocking rate depends primarily upon the volume of water and on the oxygen balance of the pond.
- Depending on availability of seed and market condition, stocking can be of 3, 4 or 6 species combination in the following ratios.

Species	3-species	4-species	6-species
Catla	4.0	3.0	1.5
Rohu	3.0	3.0	2.0
Mrigal	3.0	2.0	1.5
Silver Carp	-	-	1.5
Grass Carp	-	-	1.5
Common Carp	-	2.0	2.0

- Stocking of spawn, fry and fingerlings should be done very carefully to avoid any post-stocking mortality due to shock or infections.
- To minimize post-stocking mortality the fry/fingerlings should be slowly and gradually acclimatized to the temperature and quality of the water in the stocking pond.
- To do so, open the mouth of the seed transport bag/container and gradually add the pond water in phases and after 15–20 minutes slowly dip and tilt the bag/container in the pond so that the spawn/fry/fingerlings are free to swim out.
- Stocking should preferably be done in the cool evening hours.
- Post-stocking management involves increasing the pond productivity in the form of natural fish food, maintenance of pond environment congenial to the cultivated fish and fish husbandry, mainly feeding and health care.
- Soon after stocking, the fish start grazing natural food available in the pond irrespective of their stage of life cycle.
- Spawn feeds voraciously on plankton. Therefore, immediate steps must be taken for providing supplementary feed.

Stage	Daily feeding rate
Spawn to fry	4–8 times of the initial body weight
Fry to fingerlings	50–100% of the initial body weight
Growers	1 – 2%
Brood fish	1 – 3%

- Ensures replenishment of nutrients and consolidation of the energy base for microbial decomposition activities.
- Lime should be applied first followed by the organic manure and finally the inorganic fertilizers.

- These fertilizers should be applied only when the physical conditions of the water are most suitable such as plenty of sunlight, adequate oxygen, optimum temperature, adequate water level and low wind velocity.
- Turbid water with a high content of suspended solids are not preferred.
- Fertilizer should be sprayed or distributed properly over the water surface during the daytime when the top layer of water is warmer and lighter.
- Inorganic fertilization may be done at monthly intervals alternating with organic manuring.
- However, the monthly rate of fertilization will depend on pond productivity and the growth of the fishes.
- It should be ensured that excess fertilization does not take place, which may results in eutrophication.

Ponds	Manure	Periodicity
Nursery ponds	Organic manure	3 weeks
Rearing ponds	Organic manure and Inorganic fertilizer	3 weeks - daily
Stocking ponds	Organic manure and Inorganic fertilizer	Monthly

- All the fish species cultured under fish culture ponds are prone to many communicable and non-communicable diseases, the most significant among them are described here under four groups.
- Viral Diseases

  As far as carp species are concerned, mainly two viral diseases are of importance

  (i) Spring viremia of carp (SVC)

  (ii) Rhabdovirus diseases of grass carp
- Bacterial Diseases
- Although a number of pathogenic bacteria have been isolated from diseased fishes cultured in ponds, the following are worth mentioning
- Columnaris disease
- Bacterial hemorrhagic septicemia
- Carp erythrodermatitis
- Bacterial gill disease
- Fungal Diseases
- Saprolegia infection
- Environmental and Nutritional Diseases
- Therapy of fish diseases
- Therapy can be applied in two ways: external treatments or treatment via diet.
- External treatments

- There are two methods of application of external treatments.
- *Immersion in chemical solution*
- The most common method of administering therapeutic agents to fish is immersion in water soluble compounds. These are baths in lower concentration of chemicals ranging from short to prolonged periods and dips where the fish are dipped into a chemical solution of high concentration for a very short period ranging from a few seconds to 5 minutes.
- *Swabs*
- Swabbing is application of drugs in high concentration when dealing with individual fish with localized external infections. For better convenience it is desirable to immobilize the big-sized fish prior to swab application.
- Treatment via diet
- This method is usually applied for treating the systemic bacterial diseases or gut parasites by incorporation of the drug into the feed. Loss of appetite is one of the first signs of a disease and hence in such cases the use of drugs in proper doses through supplementary feeding becomes difficult. Leeching of drug is another problem. If some of the water-soluble drugs are properly mixed with vegetable oil prior to its final mixing with the feed, such losses may be minimised. Generally, feeding medicated feed is considered to be a prophylactic rather than a therapeutic measure.
- Harvesting
- Growth rate of the fish, market demand, desired market size, availability of seed and pond condition, are the major considerations for deciding on the time of harvesting.
- Complete harvesting
- Usually the carp species attain marketable size within one year and hence the shorter rearing period of less than a year is not recommended unless there is an exceptional threat of flood or outbreak of disease, or for financial reasons. Post-flood stocking and pre-flood harvesting should be done in flood prone ponds while in seasonal ponds harvesting should be done before the water level falls below the critical level. In regions where seeds of desired cultivated species are available only during post-monsoon period, i.e. October/November, the stocking should normally be done during this period and the crop should be harvested by next October.
- Partial harvesting
- It has been experienced that even under the best management, Indian major carps on an average attain hardly 1 kg in size in a year, while Chinese carps reach over 2 kg. or so. This kind of differential growth complicates the final harvesting programme and hence in such areas partial harvesting of marketable size fish is carried out.
- Further, the market price of fish is directly related to its size.
- This factor should also be considered before deciding on the harvesting programme. Possibility of partial harvesting very much depends on the availability of fingerlings of desired carp species. In such cases the fish already reached the marketable size should be

harvested and the stock should be replenished. Usually fish over 500 g should be harvested every 3–4 months with simultaneous stocking with fingerlings. Such partial harvesting programme should be synchronised with peak market demands depending on seasons, festivals, *etc.*

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