

UNIT:5

(AQUACULTURE)

Composite

Fish

Culture

11.9. POLY CULTURE OF INDIAN AND EXOTIC CARPS

Polyculture or composite fish culture is the modern carp culture technology in India that has revolutionized the fish production by maximizing the utilization of pond productivity at different ecological niches. Mono-species culture does not utilize all the varieties of food organisms generated in the culture pond while mixed species farming utilizes the different variety of productivity at different niches thereby resulting in very high yield of fishes.

11.9.1. Definition and species mix

Polyculture is the mixed culture of indigenous and exotic carp species in different proportions for maximizing the fish yield. Polyculture of carps is an intensive fish farming in which carrying capacity of the pond is maximized by using manures and fertilizers besides providing supplementary feed.

In this mixed farming 6 fish species of carps, both indigenous and exotic varieties are cultured together. These fish species include :

Indigenous carp

1. Catla (*Catla catla*) – a surface feeder that consumes zooplankton
2. Rohu (*Labeo rohita*) – a column feeder consuming decaying plants
3. Mrigal (*Cirrhinus mrigala*) – bottom feeder that consumes decaying plants and detritus

Exotic carps

1. Common carp (*Cyprinus carpio*) – omnivorous and bottom feeder.

2. Grass carp (*Ctenopharyngodon idella*) – a herbivorous fish that consumes coarse and macro vegetation
3. Silver carp (*Hypophthalmichthys molitrix*) – Herbivorous fish consuming surface phytoplankton

The choice of these 6 fishes for mixed farming is based on their following attributes :

1. They have complementary feeding habits
2. These fishes occupy different ecological niches in the pond
3. Marketable size is attained around same time
4. They tolerate well each other
5. All of them are non-predatory

This composite culture has become a very common practice in India. The breeding of these fishes is carried out separately. Indian major carps are induced to breed under controlled conditions with the help of hormonal injections while exotic carps breed normally with out any inducement.

Although the rearing practice of their early fry to fingerlings does not differ much but is managed separately. Production process of seed/fingerlings of these fishes involves as usual liming of the pond followed by fertilization and manuring of pond before stocking. The supplementary feeding during rearing is indispensable for maximum survival and fast growth of fry to fingerlings.

11.9.2. Intensive polyculture

The fingerlings of different species of carp are cultured in the stocking ponds till they attain table size. These ponds are 0.1 to 0.2 hectare in area with a depth of 2 to 3 meters (ponds with lesser depth are also put to use for composite fish farming). The inherent productivity potential of the pond is assessed on the basis of its soil and water quality. Ponds with loamy bottom soil, devoid of decomposing matter, with a pH range between slightly acidic to slightly alkaline (6.5 – 7.5) are considered productive for fish culture. The mineral content of such ponds comprises Nitrogen (30 – 50 mg/100g), Phosphorus (6 – 16 mg/100g) and organic carbon (1 – 2%). Similarly ideal pond water for fish culture has a pH of 7 – 8, turbidity

below 20 ppm, nitrate and phosphate in the range of 0.2 - 0.5 ppm each and dissolved oxygen between 5 - 10ppm.

Highly acidic soils (pH below 6.0) and highly alkaline soils (pH above 9.0) with a lot of organic waste are not considered fit for fish farming. However, in such cases some corrective measures are taken for restoration of normal ideal state of soil for culture like application of lime and cow dung. Lime helps in restoration of normal range of pH from highly acidic to slightly acidic besides facilitating the mineralization of organic load. Cow dung is used for the lowering of alkaline pH and correction of sandy bottom. The fingerlings are also given supplementary feed to maximize the yield.

11.9.3. Deweeding the stocking pond

Appearance of aquatic weeds in fish culture ponds, particularly after manuring and addition of inorganic fertilization, is a common feature. These should be removed immediately as they compete with the primary productivity of the pond which is necessary for generation of zooplankton, obstruct sun light thereby discouraging the production of phytoplankton, cause hindrance in the free movement of fishes in the pond, and create anoxic conditions in water after their death and decay.

The generally encountered weeds in fish ponds are free floating surface weeds (*Eichhornia spp.*, *Salvinia spp.*, *Pistia spp.* and *Lemna minor*), submerged weeds (*Hydrilla*, *Ceratophyllum*, *Vallisneria*, *Najas*), rooted emergents (*Nymphoides*, *Trapa*), marginal shallow water weeds (*Typha*, *Ipomea*) and algae (*Microcystis*, *Anabaena*, *Spirogyra*, *Pithophora*).

The eradication of weeds can be brought about manually, mechanically (by using sickle and barbed wire) or with the help of chemical herbicides like Ammonia, Dalapon and Diuron. The biological method of deweeding, which includes the introduction of grass carp (*Ctenopharyngodon idella*) and Yammuna turtle (*Kachuga tectum*), has proved very helpful. *Puntius gonionotus*, an herbivorous fish, is an ideal substitute for grass carp if deweeding is sought before stocking.

11.9.4. Eradication of undesirable fish

The eradication of undesirable fish from the stocking pond selected for composite culture

assumes significance as they compete with culture fishes for food, space and oxygen. Such fishes can even be predatory in nature and if present feed directly on the fingerlings of culture fishes. The different unwanted fishes found particularly in perennial ponds and different options for their eradication have been discussed in the chapter 'CARP CULTURE' under the heading, 'Removal of unwanted fish'.

11.9.5. Liming the pond

The significance of liming the fish pond stands already discussed in the previous chapter. For composite fish culture in the stocking pond, lime is applied @ 400 kg/hectare with initial dose of 100 kg/hectare to be added 7 days before stocking of fingerlings. The remaining lime is applied in equal monthly instalments.

11.9.6. Enriching the fertility of pond

The pond fertility is raised for intensive polyculture with the application of fertilizers and animal manures. The inorganic fertilizers applied include Urea or Ammonium sulphate or Calcium ammonium nitrate and Single super phosphate or Triple super phosphate. The schedule and rate of application of cow dung and inorganic fertilizers normally depends upon the quality of soil and water of the pond. However in the absence of soil testing facility, the following schedule is recommended.

TABLE 11.1. Generally recommended fertilizer schedule

Item	Quantity Kg/ha	Remarks
Cow dung	2000	Initial dose
Cow dung	1000	Monthly dose
Urea or	25	Monthly
Ammonium Sulphate or	30	Monthly
Calcium Ammonium Nitrate	30	Monthly
Single Super phosphate or	20	Monthly
Triple Super phosphate	8	Monthly

(Adopted from 'Technologies for Inland Fisheries Development' by CIFRI, Barrackpore, WB, India.)

The inorganic fertilizers and animal manures are applied alternately with a gap of 15 days, every month.

11.9.7. Stocking

The fingerlings of all the culture fishes are stocked simultaneously except that of silver carp as it competes with catla for food. The silver carp grows relatively at a faster rate for which its fingerlings are stocked about 2 months later. This allows the catla to grow to a size in 2 months in the absence of silver carp where from it can compete successfully for food.

The stocking ratio of different species has to be adjusted such that all the niches of the pond are utilized for maximum yield. In 6 species polyculture, the fingerlings are stocked in the following ratio.

- | | |
|----------------|------------|
| 1. Catla | (10 – 15%) |
| 2. Silver carp | (20 – 30%) |
| 3. Rohu | (15 – 20%) |
| 4. Mrigal | (15 – 20%) |
| 5. Common carp | (20 – 25%) |
| 6. Grass carp | (5 – 15%) |

Fingerlings measuring 50 – 100 mm are considered suitable for stocking. The total stocking density of all 6 species of fishes is maintained at the rate of 5000 fingerlings/hectare of pond with a water depth of 2 – 3 meters.

11.9.8. Supplementary feeding

Supplementary feeding is fundamental to intensive fish farming because the natural food of the pond can not meet the requirements of growing fish, even after manuring. However, supplementary feed has to be one that fulfills the nutritional requirements of fish which include proteins, carbohydrates, fats, vitamins, minerals and trace elements.

The commonly used artificial feed in polyculture is a mixture of mustard/groundnut oil cake and rice bran in the ratio of 1:1 and given @ 2 – 3% of body weight daily. This feed has conversion ratio of 2.5:1.0 and has ideally proved suitable for the culture of indigenous and exotic carps under polyculture practice except for grass carp.

The other feeds of plant and animal origin include tubers, leaves, roots, chironomids, maggots of housefly, fish meal, prawn meal, silk worm pupae etc.

The grass carp is offered cut plants like berseem and napier grass in addition to *Hydrilla*, *Najas*, *Ceratophyllum*, *Wolffia*, etc.

11.9.9. Harvesting

During rearing period, water level is maintained by allowing inflow during summer and outflow of water above 2 meter level during monsoon. The health condition is monitored and diseased fishes are culled.

The rearing of fingerlings continues for 1 year in the stocking pond till carps attain 1 – 1.5 kg of weight. This size is considered highly attractive for marketing. Towards the end of the rearing period (1 year) the fishes are harvested by netting. Through intensive farming under polyculture programme, it is possible to have the fish yield of about 11000 kg/hectare after a rearing period of 1 year.