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REVIEW ARTICLE

Composite fish culture for gainful employment

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Abstract: Composite fish culture is a most popular technique to obtain maximum yield of fish from a pond/reservoir. The technology involves employment of compatible and non-competing fish culture through utilisation of different feeding zones of the pond or reservoir, resulting maximum production of fish per unit area of water. It is accomplished in four steps i.e. Pre stocking, Stocking, Post stocking and harvesting.

Key words: Fish; Culture; *Catla*; Rohu; Mrigal; fertilization; manuring; Zooplankton; Omnivorous; Detritivorous.

Introduction

In order to obtain maximum yield of fish from a lake or reservoir, it is essential to culture fast growing compatible species of different feeding habits. Fish production by old traditional methods gives a low yield, but if several species are stocked together in proper proportion in the same pond, so that all the available ecological niches are exploited, the production increases several times Alikunhi *et al.,* (1957); Avnimelech *et al.,* (1994); EAFP (2002). This is known as composite fish culture or mixed farming or polyculture. This is based on the principle that compatible species do not harm each other, instead they utilise in the most efficient manner, all available food supply of the pond, for maximum production of fish yield. There is no competition between different species, on the other hand, they may have a beneficial effect on the growth of others Håstein, (2004). Mixed farming involves rational manuring and fertilization of pond, as well as feeding the fish with supplementary food consisting of oil cakes and rice or wheat bran Jhingran (1987); Krkošek *et al.,* (2007); Krkošek *et al.,* (2006. In India, mixed fish culture is an old practice, and species like *Catla catla* (surface feeder), *Labeo rohita* (column feeder), and *Cirrhina mrigala or Labeo calbasu* (the bottom feeders) are generally stocked together in the same pond. According to Alikunhi (1957), *catla*, rohu and mrigal are stocked in the ratio of 3:3:4 to give good yield from the ponds. Culturing of a single species is not profitable as one does not get the most from that particular water body. Therefore, a group of fishes are selected, each having different feeding habits from others so that all the food available in the different zones of the pond is used profitably. Stocking of the three Indian major carps *(Catla, Labeo, Cirrhina)* in the same pond is an excellent example of the correct selection of species for the maximum utilisation of the food from the different zones of the pond. *Catla* is the surface feeder and feeds mainly on the zooplankton and detritus. Bottom feeders like *C. mrigala and L. calbasu* can also be cultured along with *Catla,* thereby utilising the decayed vegetation, benthic animals, plants and epiphytic plankton from the bottom of the pond. *Labeo rohita* is a column feeder and can, therefore, be included in the same pond along with *Catla and* C *mrigala,* and the food in the mid water layers, especially decayed vegetable matter, epiphytes etc. can also be utilised.

Exotic carps: *Hypopthalmichthys molitrix* (silver carp).

Ctenopharyngodon idella (grass carp) and the *Cyprinus* Krkošek *et al.,* (2007); Manci, (2013); Manju lekshmi, *et al.,* (2014).

Fish species involved in composite fish culture

Depending on the compatibility and type of feeding habits of the fishes, the following types of fishes of Indian as well as Exotic varieties have been identified and recommended for culture in the composite fish culture technology: Morton, *et al.,* (2008); Naylor, *et al.,* (1998); Padhi, *et al.,* (2015).

Species	Feeding habit	Feeding zone
Indian Major Carp		
Catla	Zoo plankton feeder	Surface feeder
Rohu	Omnivorous	Column feeder
Mrigal	Detritivorous	Bottom feeder
Exotic carps		
Silver carp	Phytoplankton feeder	Surface feeder
Grass carp	Herbivorous	Surface, column and marginal areas
Common carp	Detritivorous/ Omnivorous	Bottom feeder

Potential

The area under tanks and ponds available for warm fresh water aquaculture is estimated to be 2.41 million ha. In addition, 1.31 million ha of swamps, beels, etc. and low lying water logged area not good for agriculture as also any land where there is copious water supply can be converted for fish farming. Out of the total inland fish production of 4.7 lakh tonnes, around 80% is contributed by the culture sector. The average productivity from ponds at present is to the tune of 2500 kg/ha/year. This shows the tremendous scope for fish culture in the country. Only 15 % of the potential area of tanks and ponds available is

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developed so far, showing immense possibilities for horizontal expansion of composite fish culture Jhingran, (1987); Krkošek, *et al.,* (2007); Krkošek, (2006); Martins, *et al.,* (2010); Morton, *et al.,* (2004).

Technical Parameters

Technical parameters of composite fish culture include site selection, items of development, pre and post stocking operations, stocking density, fertilisation, feeding etc.

A. Selection of Pond

The main criteria to be kept in mind while selecting the pond is that the soil should be water retentive, adequate supply of water is assured and that the pond is not in a flood prone area. Derelict, semi derelict or swampy ponds can be renovated for fish culture by dewatering, desilting**,** repair of the embankments and provision of inlet and outlet. The pond may be owned by the individual or taken on lease in which case the lease period should be more or coterminous with the repayment period. Construction of new ponds in ideal sites is recommended keeping in view the above parameters.

B. Pond Management

Pond Management plays a very important role in fish farming before and after the stocking of fish seed. Various measures that are required to be undertaken in pre and post stocking practices are tabulated below:

1. Pre-stocking

In case of new ponds, pre stocking operations starts with liming and filling of the pond with water. However, the first step for existing pond requiring development deals with clearing the pond of unwanted weeds and fishes either by manual, mechanical or chemical means. Different methods are employed for this.

i) Removal of weeds by Manual/Mechanical or through Chemical means.

ii) Removal of unwanted and predatory fishes and other animals by repeated netting or using mahua oil cake @ 2500 kg/ha metre or by sun drying the pond bed.

iii) Liming: The soils/ tanks which are acidic in nature are less productive than alkaline ponds. Lime is used to bring the pH to the desired level. In addition, lime also has the following effects –

a) Increases the pH.
b) Acts as buffer and avoids fluctuations of pH.
c) It increases the resistance of soil to parasites.
d) Its toxic effect kills the parasites; and
e) It hastens organic decomposition.

The normal doses of the lime desired ranges from 200 to 250 Kg/ha. However, the actual dose has to be calculated based on pH of the soil and water as follows:

Soil pH	Lime (kg/ha)
4.5-5.0	2,000
5.1-6.5	1,000
6.6-7.5	500
7.6-8.5	200
8.6-9.5	Nil

The pond is required to be filled with rain water or water from other sources after liming in case it is a new pond.

iv) Fertilisation/ Manuring: Fertilization of the pond is an important means for intensifying fish culture by increasing the natural productivity of the pond. The fertilisation schedule has to be prepared after studying the quality of the pond soil. A combination of both Organic and Inorganic fertilisers may be used for best results. The fertiliser programme has to be suitably modified depending on the growth of the fish, available food reserve in the pond, physico chemical conditions of the pond and climatic conditions.

a) Organic — Organic manure to be applied after a gap of 3 days from the date of liming. Cow dung @ 5000 kg/ha or any other organic manure in equivalent manurial value.

b) Inorganic — Inorganic fertilisation to be undertaken after 15 days of organic manuring. Requirement of nitrogenous and phosphate fertilisers would vary as per the nature of the soil fertility indicated below. However, any one of the nitrogen and phosphate fertilisers could be used as per given rate.

v) Inorganic Fertilizer Application (kg/ha/month) Soil fertility status	**Ammonium sulphate**	**Urea**
1. Nitrogen (mg/100g soil)		
i) High (51-75)	70	30
ii) Medium (26-50)	90	40
iii) Low (up to 25)	140	60

2. Phosphorus	**Single super phosphate**	**Triple super Phosphate**
i) High (7-12)	40	15
ii) Medium (4-6)	50	20
iii) Low (up to 3)	70	30

(mg/100 gm soil)

2. Stocking

The pond will be ready for stocking after 15 days of application of fertilizers. Fish fingerlings of 50- 100 gm size (approx) should be used for stocking @ 5000 nos. per hectare. However, if fingerlings of smaller size are used, suitable allowance may be made accounting for mortality. The present model envisages stocking of advanced fingerlings and rearing for 10-12 months. Depending on availability of seed and market condition, stocking can be of 3, 4 or 6 species combination in the following ratio.

Species combination (ratio) 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

Since the market demand for Indian major carps are very good especially that of Catla and Rohu, the model is prepared based on the stocking of Indian major carps alone in the stocking density mentioned above.

3. Post stocking

i. Supplementary feeding

Fishes need much more food than what is available naturally in the pond. Fishes can be fed with a mixture of rice bran and oilcakes in the ratio 4:1. Due to the high cost of Groundnut Oil Cake (GOC) farmers have tried using alternate sources like Cotton seed oil cake which is comparatively cheaper than GOC. GOC and cotton seed oil cake can be mixed in equal proportions and fed to the fish and is reported to give almost the same growth rate as that of GOC. The feed should be placed on a feeding tray or in feeding bags and lowered to the pond bottom or it can be dispersed at the corners of the pond. After some time, the fishes will get used to this type of feeding and aggregate at the same place at particular time for regular feeding thereby reducing the feed losses. The recommended feeding rate is 5 - 6 % of the body weight up to 500 gm size of fish and then reduced to 3.5% of body weight from 500- 1000 gm size. The feeding is supplementary in nature.

ii. Manuring

i) Organic manuring may be done in monthly instalments @ 1000 kg/ha.

ii) 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 result in eutrophication.

iii. Harvesting

Harvesting is generally done at the end of 1st year, when the fishes attain average weight of 800 gm to 1.25 kg. With Proper management a production of 4 to 5 tons/ha can be obtained in a year. Harvesting is done by partial dewatering and repeated netting. In some cases, complete dewatering of ponds is resorted to. Some farmers resort to partial harvesting also depending on the season and demand for fish.

iv. Vertical expansion of fish culture

A number of measures are now being employed by the entrepreneurs to increase the per hectare production of fish. Important measures adopted are stocking of advanced fingerlings / yearlings by stunning the growth of fish seed during first year, heavy stocking and multiple harvesting after the fishes attain a size of 500 gms., multiple stocking and multiple harvesting, use of aerators, integrated fish farming with animal husbandry activities like dairy, poultry, piggery or duckery to get daily organic manuring to the pond thus increasing its fertility. It is possible to increase the per hectare production of fish to 7 to 10 tonnes per ha per year by employing different methods as indicated above.

Subsidy

Subsidy is available for various items like renovation/ repair of ponds, construction of new ponds, first year inputs etc. under a centrally sponsored subsidy scheme implemented by majority of the State Governments through FFDA's for different categories of farmers and also from National Fisheries Development Board (NFDB) details of which may be obtained from concerned Fisheries Departments or from the website of NFDB ***www. nfdb.ap.nic***.in respectively.

Eligible Borrowers

The following categories of borrowers are eligible to avail credit.

a) An Individual.
b) A company.
c) A Partnership firm.
d) A co-operative society.
e) A group of fish farmers.

Training in fish farming is being provided by the FFDA's to the eligible borrowers and it is essential that the borrower has prior knowledge of fish farming before availability of bank loan.

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