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Article

Carps polyculture technique in Mohanpur, Rajshahi region of Bangladesh

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Abstract: The present study was undertaken with a view to finding out the carps poly-culture technique, pond management and cost analysis in Mohanpur, Rajshahi region of Bangladesh. The study was conducted for a period of four months (October 2010 to February 2011). It provides an overview on the guiding principles, aspects and tasks, and presents the applicable production techniques and patterns of carp polyculture. It is expected that this publication will help identify resources and contribute to the successful planning and realization of fish production by those fish pond owners and operators who need to strengthen and improve their knowledge on the subject.

Keywords: carps; pond management; farmer; carps polyculture

1. Introduction

The polyculture of major and exotic carps and monoculture of catfish (*P. sutchi*), Telapia are the most widely practiced culture system in Bangladesh. Three Indian major carps namely, *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* and one exotic carp, *Hypopthalmichthys molitrix* now account for more than 78% of total pond production (ICLARM, 2002). The concept of polyculture of fish is based on the concept of total utilization of different trophic and spatial niches of a pond in order to obtain maximum fish production per unit area. Different compatible species of fish of different trophic and spatial niches are raised together in the same pond to utilize all sorts of natural food available in the pond.

The possibilities of increasing fish production per unit area, through polyculture, is considerable, when compared with monoculture system of fish. Different species combination in polyculture system effectively contribute also to improve the pond environment. Algal blooming is common in most tropical manure fed ponds. By stocking phytoplanktophagus Silver carp in appropriate density certain algal blooming can be controlled. Grass carp on the other hand keeps the macrophyte abundance under control due to its macrovegetation feeding habit and it adds increased amount of partially digested excreta which becomes the feed for the bottom dweller coprofagous common carp. The bottom dwelling mrigal, common/mirror carp help re-suspension of bottom nutrients to water while stirring the bottom mud in search of food. Such an exercise of bottom dwellers also aerates the bottom sediment. All these facts suggest that polyculture is the most suitable proposition for fish culture in undrainable tropical ponds.

Actually the development of aquaculture production technology is a continuous process. System approach should be addressed in education and research process so that we can find the need or problem of rural farmers and thereby suggest for appropriate aquaculture technology.

According to geographical characteristics, Bangladesh is classified into 30 agro ecological zones. To recommended suitable aquaculture practice, it is necessary to understand the agro-ecosystem with emphasis on the biodiversity, resources and arming system.

In past, rural people had very little interest for aquaculture as they met their protein from open waters are dramatically decreased due to some man made and natural causes. So aquaculture is the only way to increase the fish production at present in Bangladesh.

Generally the rural aquaculture is followed by the practice involving low cost and easily available inputs. Again, the necessary inputs required for aquaculture cannot be applicable at a same measurement for all the regions of a country even for the entire place within a region. So, based techniques are necessary to develop the rural aquaculture in Bangladesh.

Actually the development of aquaculture production technology is a continuous process. System approach should be addressed in education and research process so that we can find the need or problem of rural farmers and thereby suggest for appropriate aquaculture technology. This realization is felt by the Department of Fisheries and provided scope for the students of B.Sc. Fisheries (honors) to gather practical experience on rural aquaculture practices under a specified agro-ecological zone.

2. Materials and Methods

2.1. Study area

The present study was conducted in Hatra village of Mohanpur Upazilla under the Rajshahi district of Bangladesh.

2.2. Study period

The present study was conducted for a period of four months (October 2010 to February 2011).

2.3. Pond selection

Only one pond was selected for the present study. The name of the farmer is Sultan Ahmed. Some important information regarding the study pond is given as follows: area: 100 acre, shape: Rectangular, and ownership pattern is Leased pond.

2.4. Pond management

Management data collect followed by the selected fish farmer includes pre-stocking, stocking and post stocking management information.

2.4.1. Pre-stocking management

It includes site selection, bottom and dike repair, control of aquatic weed, and removal of predatory and unwanted fish, liming and fertilization.

2.4.2. Stocking management

Stocking management data includes the information of management steeps followed by the fish farmer during stocking the culturable species in the selected pond. It includes Fry collection, stocking density rate, testing of water toxicity and Observation of natural food and Release of seed.

2.4.3. Post-stocking management

Post-stocking management data includes the information about the management steps followed by the fish farmer after stocking the culture species in the study pond. It includes pond monitoring, liming, fertilization, feeding, sampling and harvesting.

2.5. Production

This includes information about the production of the different species in the study pond production was calculated by deducting the average initial weight from the corresponding weight recorded for eight month. The following parameters were used to evaluate the production:

Weight gained = Mean final weight-Mean initial weight

$$\text{Specific Growth Rate (SGR\%)} = \frac{\text{LogW2 - LogW1}}{\text{T2 - T1}} \times 100$$

Where, W2 = Weight of fish at time T2

W1 = Weight of fish at time T1

T2– T1 = Culture period

2.6. Cost-benefit analysis

The total expenditure during the culture period (includes fixed and variable costs are summation) and the total income from fish productions are recorded, finally the total expenditure was subtracting from the total incomes and got the benefit.

2.7. Data collection method

During the study data are collected by applying following methods, which are

Survey method: From the selected pond, data is collected through the direct inspection of this pond using part II questionnaires.

Interview method: During the study data are collected by direct interviewing method using parts (part-I, part -III and part-IV) of the questionnaires.

3. Results

3.1. Pond management

The pond management steps followed in different stages by the farmer of the selected pond was observed and data were recorded which are given below:

3.1.1. Pre-stocking management

The selected pond was in good condition where communication access, water supply and other aquaculture facilities were available. In the study pond, the dyke was found in good condition. There are less aquatic weeds are found; generally three types of aquatic weeds were found in the study pond including *Colocasia esculenta*, *Enhydras* sp., and *Marsilea quadrifolia*. The farmer removed the aquatic weeds manually. The farmer removed predatory and unwanted fish species by frequent netting and used plant origin chemical origin poison i.e. Rotenon and Phostoxin tablet respectively. Total amount of poison is 6 Kg. for 100 decimal. In the study pond, the used limes mainly lime stone at the time of the pond preparation. Application rate is 1 kg/decimal. Total amount of limestone is 100 Kg. The method of lime application was in diluted form. The farmer used both organic (cow dung) and inorganic (Urea and T.S.P.) fertilizers. The application method of fertilizer; inorganic fertilizer (in diluted form) is applied by throwing and organic fertilizer is transferred into sacks and placed them under the pond water with the help of bamboo poles or in diluted form.

3.1.2. Stocking management

Generally poly culture system was practiced in the study pond. The farmer selected those fish species, which have faster growth, good market demand and more social acceptability. The selected fish species and namely; Rui (*Lebeo rohita*), Catla (*Catla catla*), Mrigal (*Cirrhinus mrigala*), as native species and Silver carp (Hypophthalmichthys molitrix), Common carp (*Cyprinus carpio* var. *communis*), Grass carp (*Ctenopharynogodon idella*), Rajputi (*Puntius gonionotus*) and Monosextelapia (*Oreochromis mossambicus*) as exotic species. The farmer collected fish seeds from two major sources for culture. These are govt. and private hatchery. Size of the stocked species found to be varied form50g to 100g. During the release of fry, the farmer did not consider the quality of fry, proper technique of fry release and the rate of stocking density is 68 fishes/1deci. and the total number of stocked fish is 6750 (for 100 decimal).

3.1.3. Post-stocking management

The farmer in the study pond monitored his pond regularly. He monitored his pond to observe the watercolor, abundance of food, growth performance of the fry and to prevent pouching. The farmer did not applied lime at the time of post-stocking management but applied both organic and inorganic fertilizers into his pond to increase the primary productivity. The farmer practiced regular feeding for his cultured species and used mainly high cost fish feeds and low cost feeds also used as supplementary feeds like mustard oil cake. The farmer in the study pond practiced Sampling. Partial harvesting was found as most common harvesting technique in the study pond. The farmer used kheplajal (Cast net) and angling to partial harvest for his household consumption. In the study area there are less stealing tendency although to protect fishes from stealing the operator used bamboo poles. At the end of the culture period, the farmer did final harvesting. Final harvesting was carried out by using seine net. After four months the total production of the pond is 2207.5 kg.

3.2 Cost-benefit analysis

Cost benefit analysis of the study pond is shown in following Tables 1, 2, 3 and 4. The total cost, benefit and CBR (%) was found as 1:0.50, respectively

3.2.1 Cost analysis

Cost benefit analysis of the studied pond (100 decimal) duration (October, 2010 to February, 2011)

Table 1. Pre-stocking management cost.

Sl. No.	Inputs	Amount (kg/100 deci.)	Unit price (Tk.)	Cost (Tk.)
1	Pond leased value		30000 (Per yr./100 deci.)	15000
2	Poisoning	6	340	2000
3	Liming	100	10	1000
4	Fertilizers			
	I. Cow dung	300	1	300
	II. Urea	50	12	600
	III. T.S.P.	25	24	600
Total			19,500	

Table 2. Stocking management cost.

Sl. No.	Inputs	Amount (No.) (for 100 deci.)	Unit price (Tk.)	Cost (Tk.)
1	Fish seed stocking			
	I. Silver carp	400	4	1600
	II. Catla	200	6	1200
	III. Grass carp	50	7	350
	IV. Mrigal	300	5	1500
	V. Carpio	200	7	1400
	VI. Rui	500	6	3000
	VII. Raj puti	100	8	800
	VIII. Monosextelapia	5000	1	5000
2	Fry transportation		1000	
Total			15,850	

[Seed size:Monosextelapia 10-30g and others 50-100 g]

Table 3. Post-stocking management cost.

Sl. No.	Inputs	Amount (Kg./100 deci. /4 months)	Unit price (Tk.)	Cost (Tk.)
01	Feeding			
	I. Fish feed	3000	24	72000
	II. Mustard oil cake	1800	25	45000
02	Fertilizers			
	I. Cow dung	6400	1	6400
	II. Urea	80	10	800
	III. T.S.P.	40	22	880
03	Netting for harvesting for marketing (10 times)			2000
04	Transpiration for marketing (10 times)			1500
05	Labour (1 person)			3000
06	Others			2000
Total			1,33,580	
Grand total			1,68,930	

Table 4. Total income duning the study period.

Sl. No.	Inputs	Amount (Kg.)	Unit price (Tk.)	Income (Tk.)
01	Silver carp	160 (400g/fish)	70	11200
02	Catla	150 (750g/fish)	120	18000
03	Grass carp	37.5 (750g/fish)	90	3375
04	Mrigal	75 (250g/fish)	100	7500
05	Caripo	150 (750g/fish)	120	18000
06	Rui	125 (250g/fish)	120	15000
07	Rajputi	10 (100g/fish)	100	1000
08	Monosextelapia	1500 (300g/fish)	120	1,80,000
Total			2,54,075	

Benefit = Total income-Total cost
= 254075-168930
= 85145

∴Cost benefit Ratio (CBR %) = Total cost : Benefit
= 168930 : 85145
= 1: 0.50

CBR (%) = 1:0.50 Tk. that means, 0.50 Tk. came from per 1.00 Tk.

4. Discussion

Prevailing culture practices in the study pond has been categorized on the basis of major operations done by fish farmer like pre-stocking, stocking and post stocking. Dyke and bottom is very important for fish culture. Some coconut tresses are present in the dyke. These are little obstructing to light penetration. The pond bottom was not repaired before the stocking the culturable species. Aquatic weeds in a suitable condition. The farmer was followed the traditional method to control aquatic weeds. Better fish production both predatory and unwanted fishes should removed from the cultured pond. Predator fish ate 12 kg other fishes for increase 1 kg body weight. The fish framer did netting for this purpose but it was not always effective. Farmer used lime (CaCO3) to improve the water quality for pond fish culture. The dose was 1 kg/deci. That follows the DoF (2005) recommendation. And the lime was applied into the pond in dilute form. Fish farmer applied both organic and inorganic fertilizer in the study pond after 7 days of liming. The doses of fertilizer were nearly same as the DoF (2005) recommendation.

Species selection is fully dependent on cultured technique, growth rate, market demand, market price and social acceptability. But the farmer did not the followed proper species selection. The fish fry stocked in the study pond which are produced in private hatchery. The farmer stocked fish fry on the basis of their choice. Conditioning is required to releasing fry in the pond for reduce mortality. But no conditioning process was followed by they pond operator before the fry releasing.

After releasing fry management the feeding of stocked fishes, water quality, must need to be observed. Supplementary feed should be applied in the cultured pond for increase fish production. For proper growth of cultured species feed should given in appropriate percentage of body weight. But the farmer did not follow that. Average application rate (per day) of fertilizers was not found similar to the recommendation rate of DoF (2005) the farmer of study pond applied fertilizer in monthly basis. Sampling is necessary to observe the growth performance of the culture species. But the farmer did not practice sampling. Partial harvesting was done by the farmer for household consumption and varies occasion. Harvesting was done when the fast gained a good marketable size and demand. Marketing system is a key factor for selling the fish product. The farmer sold harvested fishes at Keshorhat bazar.

Local environmental factors viz., soil condition play an important role in nutrient availability and its chemical transformation through the bio-geo-chemical cycle, which ultimately affects the fish production (Boyd, 1982). Growth rate of the fish is controlled by a variety of factors of which genetic growth potential; culture technique, environmental parameters and nutrients are the most important. The total fish production is 2207.5 kg.

Cost of the fish seeds, feeds, fertilizers and use of labor for different operation were the main cost items of variable cost while land lease cost was considered as fixed cost. Secondly not all variable costs were incurred at the beginning of the season; rather costs of fish production were spread over the whole production period. The total cost of this 4 months long fish culture was 168930 Tk.; whereas the total income was 254075 Tk. That gives 85145Tk. to the farmer as benefit. The calculated C.B.R. is 1:0.50 that means 0.50 Tk. comes from 1 Tk. investment.

5. Conclusions

The farmer in the study pond followed more or less semi-intensive fish culture system. The fish production of carp culture could be increased in sustainable way, if the fish farmer follow the proper semi-intensive fish culture management techniques and provide with better culture technique in need based approach. The farmer took necessary steps in the pre-stocking, stocking and post-stocking stage. The pond fish culture was reported mainly with three native and five exotic species. Due to high growth rate and suitable environment, exotic fishes like mono sex tilapia, silver carp and common carp occupied the major culture species the study pond. No native small species was cultured due to its less growth and seed unavailability. Water quality of the study pond was found as suitable for fish culture. The natural fish food organisms were observed in sufficient level that's why the production of the study pond was desired to the farmer.

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Conflict of interest

None to declare.

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