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COMPARISON OF GROWTH PERFORMANCE THROUGH DIFFERENT LEVELS OF SUPPLEMENTARY FEED IN FISH POLYCULTURE SYSTEM

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Abstract

An experiment was carried out to evaluate the growth performance of carp polyculture system supplemented with different levels of supplementary feed. To undertake this investigation, two earthen ponds were stocked with 25% *Labeo rohita*, 25% *Catla catla*, 20% *Labeo calbasu*, 20% *Ctenopharyngodon idella* and 10% *Hypopthal-michthys molitrix* with a total stocking density of 10000/ha. The net fish production was found to be 2,166 and 3,874 kg/ha/yr in pond-01 and pond-02, respectively. The total cost of fish farming of pond-01 and pond-02 were 64,268 BDT and 88,568 BDT per ha. The total return of pond-01and pond-02 were BDT 1,04,280 BDT and 1,69,250 BDT per ha. Net benefit from pond-01 and pond-02 was 40,312 BDT and 80,682 BDT respectively. Net profit margin of pond-01 and pond-02 was 62.73% and 91.10%. And finally the benefit cost ratios (CBR) were found to be 0.62:1 and 0.91:1 in pond-01 and pond-02, respectively.

Key words: Carp polyculture, Supplementary feed, Cost-benefit ratio

Introduction

Aquaculture plays an important role in food production as well as creates an employment opportunities in the world. Bangladesh is blessed with water resources and aquaculture is one of the fast growing sectors in this country. Fishes serves as valuable ingredient to a healthy diet because of its easily digestible high protein and unsaturated fat contents. It is often recommended for heart patients by doctors, since it is an excellent source of Omega-3 fatty acid. Fish are also rich in vitamins (fat-soluble vitamins A, D and E, and water-soluble vitamins, B complex) and minerals (especially calcium, phosphorus, iron, selenium and iodine in marine fishes) (Choo and Williams 2003, Sandhu 2005, Razvi 2006, Salim 2006 and Yildrim 2008). Therefore, fish can provide an important source of nutrients, particularly for those whose diets are lacking these nutritional constituents (World Aquaculture 2010). The demand for fish as main protein source increases every year due to increase of population in the country. But scientists, fish farmers and fishers face various constraints and vulnerabilities as they are main triggers for technology generation, production enhancement and sustainable fisheries development. The basic principle of this polyculture system is that the fish species with different feeding habits

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are cultured together to increase productivity by a more efficient utilization of the ecological resources in the aquatic environment (Lutz 2003).

Supplementary feeding is a management protocol to enhance the fish production in a pond culture system within the shortest possible time. Supplementary feeding increases the carrying capacity of culture systems and can enhance fish production by manifold (Hepher 1975 and Devaraj *et al*. 1986). Supplementary feed is found to be a useful tool for providing nutrient components and energy required for better fish growth and production (Abdelghany *et al*. 2002). According to Azim *et al*. (2002), specific growth rate of major carps were higher in fertilized pond supplemented with supplemental feed than in control (fertilization alone). Use of supplementary feed is also recommended along with the organic manure and chemical fertilizers in order to get maximum fish production from limited water bodies within the shortest possible time (Mahboob *et al*. 1995). Ali *et al*. (2003) also observed prominent increment in weight gain, feed conversion ratio (FCR) and net production in major carps supplemented with supplementary feed at the rate of 6% of body weight. These feed can be utilized in different combinations to provide optimum source of dietary nutrients. Combination of fish meal, sesame oil cake and mustard oil cakes proved to be cost effective and significantly affect on the growth performance of fish (Stickney 2000). Keeping in view the significance of supplementary feeding, the present study was conducted to assess the growth performance of carps in semi-intensive culture system.

Materials and Methods

The experiment was carried out in two earthen ponds (pond-01 and pond-02), measuring 890 and 2200 m^2, respectively, located at Sagar para of Boalia thana under Rajshahi district of Bangladesh. Before starting the experiment, all aquatic weeds and unwanted biota were removed. Aquatic weeds were removed manually and unwanted fish was removed by using Phostoxin tablet at the rate of 4-5 pieces/decimal in pond-01 and 6-7 piece/decimal in pond-02. Then agricultural lime (calcium carbonate, $CaCO_3$) was applied at the rate of 230 kg/ha. After primary preparation, both ponds were fertilized with cowdung and triple super phosphate (TSP) at the rate of 1720 and 20 kg/ha, respectively. Each pond was stocked with 25% *Labeo rohita* (individual weight 5-6 g), 25% *Catla catla* (6-7 g), 20% *Labeo calbasu* (4-6 g), 20% *Ctenopharyngodon idella* (4-5 g), 10% *Hypophthalmichthys molitrix* (4-5 g) with a total stocking density 1000/ha. Both ponds were fertilized with above mentioned rate at 10 days intervals at. Two ponds were supplemented with mustard oil cake, rice bran, maize bran at the rate of 1.09 kg/ha and 1.336 kg/ha, respectively for a period of six months as daily basis. After that period, fish were caught and measured in terms of body weight.

Fish survival rate (S) was calculated as the number of fish harvested as percentage of the number of fish stocked, S (%) = (Number of fish /Number in stocked) × 100

Fish yield (kg/ha/month)/Total production = Fish biomass at harvest – Fish biomass at stock

Finally, fish were harvested and counted.

Economics of two ponds : An economic analysis of two ponds was performed on the basis of the expenditure incurred and the total estimated return from the sale price (BDT) of the harvested fish. At the end of the experiment, all fish were sold locally and the total return was estimated. The following factors were used to the economics of different treatments of two ponds.

Net benefit (Tk.) = total return (sale) – total cost (investment)

$$\text{Net profit margin (\%)} = \frac{\text{Net benefit}}{\text{Total investment}} \times 100$$

$$\text{CBR} = \frac{\text{Net benefit}}{\text{Total investment}}$$

Data and statistical analyses were done by using Microsoft Excel-add-in-DDxl. All data were checked for homogeneity of variance.

Results and Discussion

Production : The initial average body weight, the average body weight at the time of harvest, net body weight gain, survival rate and total yield of *Labeo rohita, Catla catla, Labeo calbasu, Ctenopharyngodon idella* and *Hypophthalmichthys molitrix* of pond-01 and pond 02 are presented in Table 1.

Table 1. Growth performance and survival rate of carps in pond-01 and pond-02.

Ponds	Carp variety	Initial average Weight (g)	Final average Weight (g)	Average Weight (g)	Survival rate (%)	Total Production (kg/ha/yr)
Pond-01	*L. rohita*	5.5	400.6	395.1	96	1976
	C. catla	6.5	550.7	544.2	96	
	L. calbasu	5	360.8	355.8	95	
	C. idella	4.5	500.6	496.1	95	
	H. molitrix	4.5	380.2	375.7	94	
Pond-02	*L. rohita*	5.5	600.8	595.3	97	2791
	C. catla	6.5	800.7	793.8	98	
	L. calbasu	5	550.6	545.6	97	
	C. idella	4.5	700.5	696	94	
	H. molitrix	4.5	650.2	654.7	93	

Economics analysis: A simple economic analysis was performed to estimate the net profit (total returns from harvest - total cost of production) and cost benefit-ratio (CBR = total benefit – total cost) from polyculture of carps of two ponds separately which is shown in Table 2.

Table 2. Economics of two cultural ponds.

Parameters \ Pond	Pond-01	Pond-02
Total cost (BDT/ha)	61628	104158
Total return (BDT/ha)	118190	169250
Net benefit (BDT/ha)	56562	65092
Net profit margin (%)	91.779	62.494
CBR	1:0.91	1:0.62

The result of the present study shows that net body weight of all fishes in pond-02 was higher than in pond-01. The use of supplementary feed caused a significant increased yield in pond-02. The net fish production in pond-02 was found to be 3874 kg/ha/yr while it was 2166 kg/ha/yr in pond-01. So feed based on semi-intensive culture system gave 1.41 times greater fish production than the simple extensive one. The yield of this semi-intensive polyculture system is similar to several production levels obtained in other semi-intensive polyculture in the South Asian region, e.g, Shahabuddin *et al.* (1994) obtained yields of 2000-3400 kg/ha/year. The result found to be similar with pond-02. Mahboob *et al.* (1995) suggested that application of supplementary feed along with chemical fertilizers and organic manure is the best mean to obtain maximum production in fish culture practices from confined water bodies within the limited possible time in semi intensive culture system.

The production cost was higher in pond-02 but the highest net revenue was obtained from this pond. The feeding rate was relatively higher in pond-02 that's why the total production might be higher than pond-01. However, the simple economic analysis showed that the cost benefit-ratio (CBR) was higher in pond-02. Net benefit in polyculture of carps ranged from Tk. 88,745 to 93,805/ha/l0 months (Miah *et al*. 1993) which is found similar with pond-02. In another study cost-benefit ratio (CBR) revealed significantly higher ratio (1:0.69) where formulated feed was used with fertilizer (Samad *et al*. 2014).

A simple cost and return analysis were done on the basis of both cost and full cost to determine the profitability (Zaher and Mazid 1993). Use of higher level of inputs usually results in higher outputs, consequently higher investments produces higher gross and net return on per unit water body of ponds (Rahman1995 and Biswas1990). Higher net return from the pond fish production is influenced by the price of outputs and economic use of both material inputs and labor (Rahman 1995).

This study indicated that the higher level of supplementary feeding increased cost of polyculture system of carps but it is more profitable and economically feasible than application of lower rate of supplementary feeding. The enhanced production in second

pond can be justified by the increase of supplementary feeding which contributes to increase fish yield and finally total aquaculture production. This research could be helpful for sustainable aquaculture with supplementary feeding in North West of Bangladesh as well as also other parts of the country.

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