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Influence of Different Levels of Supplementary Feeding on the Growth Performance of Major Carps

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Abstract: An experiment was conducted in earthen ponds to observe the effect of varying levels of supplementary feed on the growth performance of Indian major carps and to evaluate the optimum feeding level for these species. Although the total fish production increased with increasing feeding levels, yet statistically there was an increase in weight gain up to 6% of feeding rate, but the difference between 6 and 8% feeding level was non significant. Feed to weight gain ratios (FCR) showed increasing trends, while feed conversion efficiency (FCE) decreased with increase in feeding levels. There was a highly positive correlation between feed added and weight gain in all treatments. Specific growth rate was maximum in *Cirrhinus mrigala* followed by *Labeo rohita* and *Catla catla*. Net profit was maximum at 6% feed supplementation.

Key words: Indian carps, *Labeo rohita, Catla catla, Cirrhinus mrigala*; growth performance, feeding, feed conversion efficiency, feed conversion ratio

Introduction

Semi intensive and intensive freshwater fish farming is gaining importance in Pakistan. As a result, use of supplementary feed has become inevitable for the success of fish culture. In order to get maximum yield of fish from confined water, it is essential to use supplementary feed along with chemical fertilizer and organic manure. Supplementary feeding is known to increase the carrying capacity of culture systems and can enhance fish production by many folds (Hepher, 1975; Devaraj *et al*., 1986). It also offers the best means of fish production within the shortest possible time in the ponds. Attempts have been made to understand the gross level of nutrient requirements viz., protein, lipid, carbohydrate, vitamin and mineral premix for Indian major carps (De Silva and Gunasekera, 1991; Khan and Jafri, 1991; Balogu *et al.,* 1993; Saeed, 1996; Mahboob *et al*., 1997). The optimum feeding rate for catfish was 3% of body weight/day according to Hasan and Jafri (1994). *Catla catla*, common carp and *Tilapia zilli* showed maximum growth at 4% body weight per day (Akram *et al*., 1994; Janjua, 1996; Ghosh, 1984; Omar, 1986). For common carp fry (46-73 mg body weight) the optimum feeding rate was 30% of body weight at 32°C. (Hasan and Macintosh, 1991). Although these workers have reported different levels of artificial feeding, yet in earthen ponds, polyculture system no optimum supplementary feeding level has been reported for Indian major carps. So keeping in view all these facts the underlying experiment was planned to study the effects of different levels of supplementary feeding (25% crude protein) and to evaluate the optimum supplementary feeding rate in earthen ponds for major carps viz., *Labeo rohita, Catla catla* and *Cirrhinus mrigala.*

Materials and Methods

In order to investigate the influence of different levels of supplementary feeding (25% crude protein) on the growth performance of major carps, an experiment was conducted in 2000, at the Fisheries Research Farms, Department of Zoology and Fisheries, University of Agriculture, Faisalabad. Duration of experiment was 180 Days. The experiment was performed in 4x3 factorial experiment with 3 replications. There were 4 feeding levels, i.e. 2% of body weight (T_1), 4% of body weight (T_2), 6% of body weight (T_3) and 8% of body weight (T_4). The culture system consisted of four earthen ponds, each measuring 25 x 8 x 1.5 m and was supplied with tube well water. To disinfect the ponds and to stabilize the pH of water, the ponds were limed at the rate of 200 kg ha^{-1}. All the ponds were initially filled with tube well water up to a level of 1.5 m and this level was maintained throughout the experimental period. The experiment was divided into three Phases, i.e. Phase I (1-60 days), Phase II (60-120 days) and Phase III (120-180 days).

Each pond was stocked with 20 *Labeo rohita*, 15 *Catla catla* and 15 *Cirrhinus mrigala.* At the time of stocking, morphometric characteristics such as body weight and total length were measured and recorded. Each pond was supplemented with feed mixture containing 40% sunflower

meal, 30% gluten and 30% rice polishing. Feed was supplied daily at the rate of 2, 4, 6 and 8% of the total wet fish body weight. Weight of feed was calculated fortnightly on the basis of wet fish body weight. Supplementation of feeding was continued for a period of 60 days (Phase I). After 60 days the cultured fish stock was randomly captured with the help of nylon dragnets from each pond. The wet body weight and the total length were recorded to observe their growth performance. After obtaining required data, fishes were released back into their respective ponds and feeding was continued for next 60 days (Phase II) to observe their growth performance. Then their body weight and length were again recorded and fishes were restocked into their respective ponds. After next 60 days (Phase III) all fishes were captured and their weight and length were measured.

The data was subjected to statistical analysis for the compression of growth performance at different feeding levels and to compare the growth of major carps (Steel and Torrie, 1986). The comparison of mean values of various parameters was computed by ANOVA table and Duncan's multiple range test with repeated sampling.

Results and Discussion

Weight gain: In all the phases a significant differences were observed in live weight gain of major carps at different levels of supplementary feeding (Table 1). In phase I and III the gain in weight significantly differed from T_1 to T_3 but there was non significant difference between T_3 and T_4 (Fig. 1) which showed that feeding above 6 % of body weight is wasteful, while in Phase II maximum gain in weight was found in T_4 but in overall period there was no significant difference between T_3 and T_4. These results are in accordance with the results obtained by Hasan and Macintosh (1991) and Omer (1986), who observed the increase in body weight with the increase in feeding levels. Our findings are in contradiction with the findings of Akram *et al.* (1994), Ghosh (1984) and Janjua (1996). They reported that increase in feeding rates till 4% body weight increased the growth of the fish, while feeding beyond 4% was wasteful. Non-significant differences were observed in the specific growth rate between T_3 and T_4 while difference between T_1 and T_3 was highly significant. It showed that there was a difference in the per day increase in weight from 2 to 6 % feeding rate while above 6% feeding rate was wasteful.

Different species of major carps have also significant differences in the live weight gain in all the phases. Maximum weight gain was obtained by *Labeo rohita* followed by *Catla catla* and *Cirrhinus mrigala* during phase I, III and overall experimental period (Table 1), while during phase II the maximum weight gain was observed by *Catla catla* and minimum by *Cirrhinus mrigala*. The reason for this variation in growth rate trend is not clearly known. The highest specific growth rate (SGR) was obtained for *Cirrhinus mrigala* followed by *Labeo rohita* and *Catla catla* (Table3), which indicated that maximum growth rate per unit body weight, was obtained in *Cirrhinus mrigala*. Javed *et al.* (1993) also reported similar results.

There was a linear relationship between feed added and weight gained (Fig. 3), indicating that feeding is definitely the most important factor in the growth of fishes. The

Table 1: Weight gain (g) by major carps at different feeding rates

	Treatment				
Species	T_1	T_2	T_3	T_4	Mean
Phase 1 (1-60 Days)					
Labeo rohita	12.00	26.70	52.43	51.13	35.57A
Catla catla	4.53	7.23	54.27	50.0	29.97B
Cirrhinus mrigala	6.73	6.10	6.30	12.73	7.97C
Mean	7.76C	13.34B	37.67A	37.97A	
Phase II (60-120 Days)					
Labeo rohita	29.87	45.63	75.1	92.2	60.70B
Catla catla	19.27	27.1	121.47	118.23	71.52A
Cirrhinus mrigala	17.73	16.47	16.43	31.53	20.54C
Mean	22.29D	29.73C	71.00B	80.66A	
Phase III (120-180 Days)					
Labeo rohita	50.33	101.0	109.97	120.9	90.07A
Catla catla	32.1	33.93	92.67	93.20	62.98B
Cirrhinus mrigala	34.27	39.9	53.30	51.07	44.63C
Mean	31.57C	58.31B	85.31A	88.39A	
Total Weight Gain (1-180 Days)					
Labeo rohita	12.2	173.46	237.5	264.23	191.85A
Catla catla	55.96	68.26	266.5	261.43	162.67B
Cirrhinus mrigala	58.73	62.47	76.03	95.33	73.14C
Mean	68.94C	101.40B	192.87A	206.99A	

Table 2: Effect of different feeding rates on profitability of fish culture

Treatment	Feed cost (Rs)	Total price of Fish (Rs)	Net profit (Rs)	Net profit/ ha (Rs)	Difference in profit /ha (Rs)
T_1	34.4	180	146	9125	-
T_2	96.0	330	234	14625	5,500
T_3	296.0	594	298	18625	4,000
T_4	461	696	235	14688	-3,937

Table 3: Specific growth rate* of major carps at different feeding rates

Species	Treatments				
	T_1	T_2	T_3	T_4	Mean
Labeo rohita	0.32	0.39	0.43	0.44	0.40C
Catla catla	0.26	0.27	0.42	0.42	0.34B
Cirrhinus mrigala	1.62	1.65	1.74	1.83	1.71A
Mean	0.73C	0.77B	0.86A	0.90A	

$$*= \text{Specific growth rate:} \quad \frac{\ln \text{Final weight} - \ln \text{initial weight}}{\text{Initial weight} \times \text{No. of days}} \times 100$$

Table 4: Food Conversion Ratio (FCR) and Food Conversion Efficiency (FCE) at different stages of growth

	Phase I (0-60 days)				Phase II (60-120 days)				Phase III (120-180 days)				Total (0-180 days)			
Treatment	Feed (g)	Weight gain (g)	FCR	FCE	Feed (g)	Weight gain (g)	FCR	FCE	Feed (g)	Weight gain (g)	FCR	FCE	Feed (g)	Weight gain (g)	FCR	FCE
T_1	381.9	408.99	0.93	107.09	1094.8	1152.3	0.95	105.25	2827.7	1562.16	1.81	55.24	4304.4	3123.49	1.38	72.56
T_2	854.0	733.95	1.16	85.94	3115.28	1566.2	1.99	50.27	8251.0	3129.49	2.64	37.92	12220.3	5429.61	2.25	44.43
T_3	2310	1957.16	1.18	84.72	10960.7	3570.5	3.07	32.57	23864.4	4388.84	5.44	18.39	37135.1	9916.51	3.74	26.70
T_4	3311.8	1963.7	1.69	59.29	16428.2	4090.5	4.02	24.89	38007.8	4582.0	8.23	12.05	57747.8	10636.1	5.4	18.42

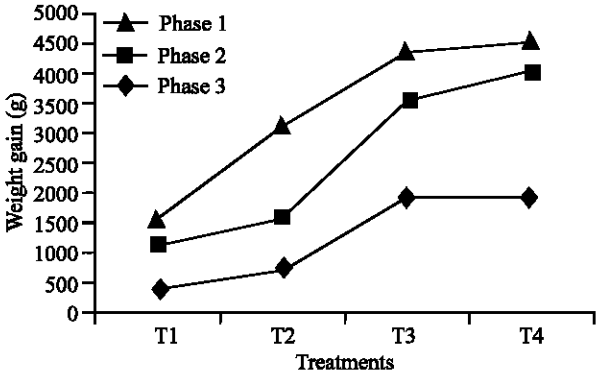

Fig. 1: Growth of Indian carps at different feeding rates

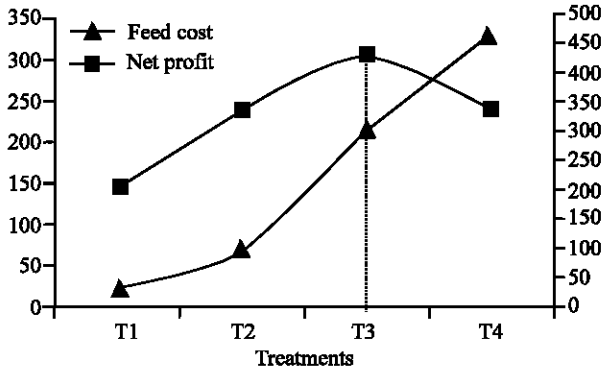

Fig. 2: Relationship between profit and cost of major carps at different feeding rates

regression analysis showed that in Phase I a unit increase in supplementary feeding (1.0 g) resulted in 0.62 g increase in weight gain while in Phase II and Phase III it is 0.224 and 0.091g, respectively. In total experimental period change in weight gain by unit change in feeding was 0.141. These results indicated that at the earlier stages of life fish utilize most of its feed for growth but with the passage of time growth of fish decreases and most of the feed is used for the maintenance purpose. Similar results were also reported by Cui-YiBo *et al.* (1996), Seenappa and Devareak (1991) and Sen *et al.* (1980) They concluded that growth rate and food utilization by fish decreased with increase in fish body weight and that the decrease in growth rate in terms of wet weight with increasing body size was mainly caused by an increase in the final energy content per unit weight of fish.

FCR and Cost-Net profit Relation: Significant differences were observed in feed to weight gain ratio (FCR) among different levels of feeding. By increase in feeding level FCR increased while FCE decreased. The best FCR was at (2%) feeding level (Table 4). It indicates that when we give feed at satiation or over satiation FCR of fishes increases. This means that by increasing feeding rate, the ability of fish to convert feed into biomass becomes very less. Such results were also reported by Mazur *et al.* (1993), who concluded that when fish is fed at satiation or over satiation, digestibility of feed ingredients is

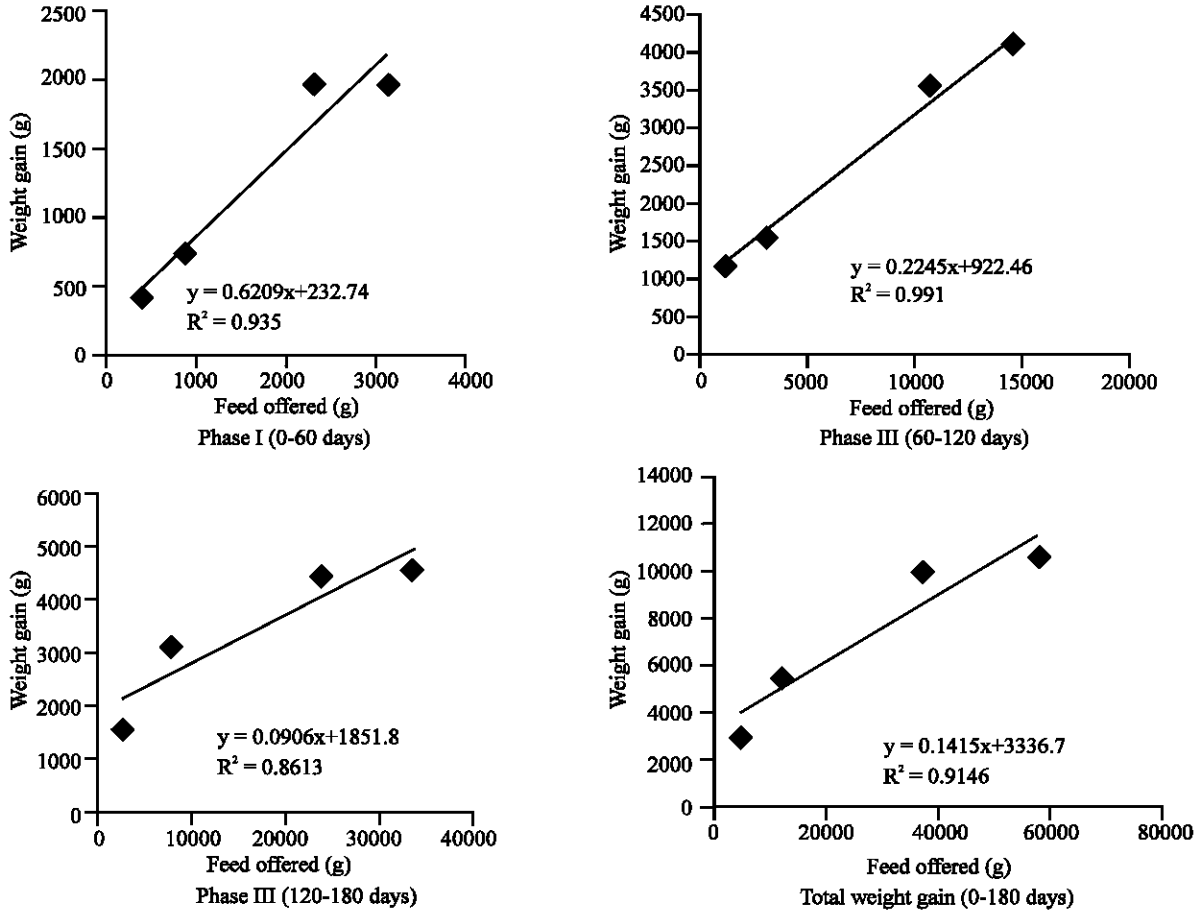

Fig. 3: Feed offfered and weight again relationship (regression analysis)

decreased. From economical point of view net profit was increased with the increase in feeding level up to 6% but above 6% feeding level in net profit was negative (Fig. 2). The maximum net profit was at 6% feeding level (Table 2), which indicated that in the earthen ponds optimum feeding level for major carps was 6% of their wet body weight per day.

In the polyculture earthen pond system optimum supplementary feeding level is 6% of fish body weight per day for maximum growth and Net profit. *Cirrhinus mrigala* showed better growth rate than *Labeo rohita* followed by *Catla catla*. Growth rate and food utilization by fish decreased with an increase in fish body weight.

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