Pakistan Vet. J., 23 (3): 2003

GROWTH RATE AND FEED CONVERSION RATIO IN MAJOR CARPS FED ON RICE POLISHING AND MAIZE OIL CAKE

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ABSTRACT

In two earthen ponds of 200 m^2 areas, major carps were stocked in the ratio of 20 *Labeo rohita*, 15 *Catla catla* and 15 *Cirrhinus mrigala*. One pond was given rice polishing and the other pond was given maize oil cake as supplementary feed, both at rate of 4% of wet body weight of fish daily for 136 days. The overall growth rate was recorded to be 92.06 g/day in pond given rice polishing and 120.68 g/day in that given maize oil cake. The overall feed conversion ratio was 2.47 for rice polishing and 2.79 for maize oil cake.

Key words: Major carps, growth, feed conversion ratio.

INTRODUCTION

Fish culture is one of such food development programs, which are now being considered as highly remunerating and demanding. According to the expectations of Sinha (1991), the demand for fish by the year 2000 would have been about 130 million tones as against the expected production of about 90 million tones. Sactivel (1987) suggested that a production and marketing strategy should be worked out to take full advantage of the expanding marketing opportunities for aquatic food in the world. Both, the need to compete for water and to cover area-related costs demand that high yields per unit area be obtained. This yield can not be obtained on natural food only and intensification by artificial feed is required in order to increase the yield per unit area and per unit of water (Hepher and Pruginin, 1981). The feed conversion ratio (FCR), which expresses food consumed per unit gain in weight, is a good mean to measure the output and profitability of a feed applied. Shim and Chua (1983) studied the growth and food conversion efficiency of guppy (*Poecilia reticulate*) fed on artificial diets containing different levels of protein and reported that the diet containing 30% protein gave the best weight gain and feed conversion efficiency in the ornamental fish guppy. The present project encompasses the studies on the growth rate and feed conversion ratio in major carps, viz. *Labeo rohita, Catla catla* and *Cirrhinus mrigala*, fed on two commonly available local supplementary feed ingredients, i.e. rice polishing and maize oil cake.

MATERIALS AND METHODS

The experiment was conducted in two earthern ponds having their dimensions of 25 X 8 X 15 m^3 situated at Fisheries Research Farms, University of Agriculture, Faisalabad. After preliminary preparation of ponds, major carps were stocked at the rate of 20 *Labeo rohita*, 15 *Catla catla* and 15 *Cirrhinus mrigala*, in each of the pond, with a water level maintained at 1.0 m. One pond was treated with rice polishing (T_1) at the rate of 4% of live wet fish body weight daily whereas the other pond was given maize oil cake (T_2) at the same rate. The amount of feed applied was increased after every fortnight according to the measurement of fresh fish body weight. Care was taken while treating the ponds that the feed is given daily at the same time so as to acclimatize the fish to feed on supplementary feed and to render lowest feed wastage.

At the time of stocking, the fish were measured for their body weight and total length. These morphometric characteristics were also monitored fortnightly from both the ponds by taking a sample of five fish of each species. These fish were released back into their respective ponds after recording the morphometric data. The amount of feed was increased at the start of every fortnight based on the above mentioned morphometric data. The physico-chemical factors, i.e. temperature, light penetration, pH, dissolved oxygen, alkalinity, hardness and planktonic biomass of pond water were also measured to monitor the hydro-biological conditions of local aquatic environment. All the fortnightly observations were made at an approximately fixed time i.e., just at sunrise.

The growth rate was measured on each sampling, as per day increase in the wet body weight of fish in grams. The feed conversion ratio (FCR) was measured after Jhingran (1991) by the following formula:

$$\text{Feed conversion ratio} = \frac{\text{Quantity of feed}}{\text{Gain in weight}}$$

Any observation was assumed to follow the following statistical model:

$$X_{ijkl} = \mu + T_i + S_j + (T^* S)_{ij} + O_k + \varepsilon_{ijkl}$$

Where,

T_i = the effect of i th treatment
S_j = the effect of j th species
$(T^* S)_{ij}$ = the interaction between treatment and species
O_k = the effect of k th treatment
ε_{ijkl} = random error associated with the observation

RESULTS AND DISCUSSION

The pond treated with rice polishing was assigned as T_1 and that treated with maize oil cake was assigned as T_2. At the beginning of experiment, in T_1 the average body weights of *Labeo rohita, Catla catla* and *Cirrhinus mrigala* were 11.4, 1.8 and 27.2 g, respectively, while at the end of experiment these values were 251.0, 320.9 and 223.4 g, respectively. Thus for T_1, the total gain in weights were calculated to be 239.6, 319.1 and 196.2 g for *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*, respectively. As for T_2, the initial weights of *Labeo rohita, Catla catla* and *Cirrhinus mrigala* were 13.4, 1.8 and 26.6 g, while the average final weights were 343.5, 390.0 and 290.6 g, respectively (Table 1). At the end of experiment, on the basis of the productivity obtained per pond, the total net production per hectare per year was estimated to be 1680.5 kg for T_1 and 2199.0 kg for T_2 (Table 1). Analysis of variance of average body weights of fish showed significant difference between T_1 and T_2, and also among different fortinights (Table 2). The average growth rate among different fortnights was also higher in T_2, calculated as 120.06 ± 36.56 g/day for 50 fish, and lower in case of T_1, calculated as 91.86 ± 42.97 g/day for 50 fish (Table 3).

The results show that maize oil cake gave better growth than rice polishing in major carps. Morrison (1959) reported that maize oil meal had 22.4% protein out of which 16.1% was digestible, whereas rice polishing had 12.8% protein out of which 9.7% was digestible. So the feed having more digestible protein gave better growth. This gives us an obvious decision about the importance of protein in diets of fish. Many workers have worked out the relationship of dietary protein and growth of fish. Rajbanshi *et al.* (1989) showed that 45 days old rohu (*Labeo rohita*) fingerlings gave higher growth rate on diets containing 39.18% protein than the diets containing 25.4% protein. Santiago and Reyes (1991) also observed significant influence of dietary protein level for growth of big head carp.

The growth was highest in *Catla catla* (2.35 g/day), followed by *Labeo rohita* (1.76 g/day) and *Cirrhinus mrigala* (1.44 g/day) in T_1. Same was the case in T_2, calculated to be 2.86 g/day for *Catla catla*, 2.43 g/day for *Labeo rohita* and 1.94 g/day for *Cirrhinus mrigala*. This gave a contradiction to the results obtained by Javed *et al.* (1993), who observed maximum weight gain for artificial feed obtained in *Cirrhinus mrigala*, followed by *Labeo rohita* and *Catla catla*.

On the other hand, feed conversion ratio (FCR) also showed great variation in both the ponds. At the end of experiment, the total FCR for T_1 was calculated to be 2.47, which fluctuated around 2.67 ± 2.37 in different fortnights. As regards T_2, the total FCR was calculated to be 2.79, which fluctuated around 3.06 ± 2.49 in different fortnights (Table 4).

The above results indicate that a greater amount of maize oil cake is required for a unit weight gain of fish as compared to that of rice polishing. These results are in accordance with the results obtained by Jhingran (1991), who reported that maize oil cake gave an FCR value up to 6, while rice bran gave 5.08. the lower FCR values recorded in this study might be due to other factors relating to fish growth, as Jhingran (1991) has further reported that the value of FCR is dependant upon the species, kind of feed, size of fish, stage of maturity and environmental temperature. According to Hasan and Das (1993), factors other than protein in feed are also important to determine the FCR value. When iso-proteineous diets of different compositions were fed to fingerlings of carps, the feed conversion ratio was different in different treatments.

As Table 4 shows that the FCR value was lowest in the beginning of experiment and gradually rose as the experiment proceeded in both the experimental ponds. Initially, the FCR values were 0.695 and 0.410 in T_1 and T_2 respectively. These results are related to the age, weight gain and stage of maturity of fish. As Faturoti and Lawal (1986) reported that the food intake, protein intake and feed conversion ratio were positively correlated with average weight gain. This verifies results obtained in the present study giving non-significant and positive correlation with average body weight ($r = 0.4792$) in case of rice polishing and a highly significant and positive correlation ($r = 0.9313$) in case of maize oil cake.

Table 1. Fish production of major carps in T_1 and T_2

Parameters	T_1			T_2		
	Lebeo rohita	*Catla catla*	*Cirrhinus mrigala*	*Lebeo rohita*	*Catla catla*	*Cirrhinus mrigala*
No. of fish stocked	20	15	15	20	15	15
Survival rate (%)	100	100	100	100	100	100
Initial average weight (g)	11.4	1.8	27.2	13.4	1.8	26.6
Final average weight (g)	251.0	320.9	223.4	343.5	390.0	290.6
Increase in average weight (g)	239.0	319.1	196.2	330.1	388.2	264.0
Gross fish production/pond/136 days (g)	5020.0	4813.5	3351.0	6910.0	5820.0	4359.0
Gross fish production/pond/year (kg)	13.47	12.92	8.99	18.55	15.70	11.70
Gross fish production/ha/year (kg)	673.5	646.0	449.5	927.5	785.0	585
Net fish production/pond/136 days (g)	4792.0	4786.5	2943.0	6602.0	5823.0	3920.0
Net fish production/pond/year (kg)	12.86	132.85	7.90	17.72	15.63	1063
Net fish production/acre/year (kg)	260.20	260.01	159.90	358.55	316.26	215.09
Net fish production/ha/year (kg)	643.0	642.5	395.0	886.0	781.5	531.5

	T_1	T_2
Total gross production/ha/year (kg)	1769.0	2297.5
Total net production/ha/year (kg)	1680.5	2199.0

Table 2. Analysis of variance of average body weight (g) of major carps in T_1 and T_2

S.O.V.	Df	SS	MSS	F-ratio
Treatments (T)	1	37001.67	37001.67	34.539
Species (S)	2	1833.185	916.59	0.8556^{NS}
T x S	2	880.920	440.46	0.4111^{NS}
Observations	9	629265.600	69918.40	65.26^{NS}
Error	45	48208.625	1071.30	
Total	59	717190.00		

Table 3. Fortnightly growth rate (g/day) of major carps in T_1 and T_2

Fortnights	T_1	T_2
Stocking	--	--
1	43.15	73.11
2	51.91	108.83
3	78.87	108.83
4	86.75	160.20
5	104.10	191.33
6	195.00	129.13
7	116.40	139.33
8	91.40	86.47
9	59.21	84.36
Average	91.86 ± 42.97	120.06 ± 36.56

Average growth rate (g/day) of major carps in T_1 and T_2

Treatments	*Lebeo rohita*	*Catla catla*	*Cirrhinus mrigala*
T_1	1.76	2.35	1.44
T_2	2.43	2.86	1.94

Table 4. Fortnightly feed conversion ratio (FCR) in major carps for T_1 and T_2

Fortnighst	T_1	T_2
Stocking	--	--
1	0.695	0.4103
2	1.156	0.9194
3	1.078	1.3783
4	1.556	1.5605
5	1.825	1.5679
6	1.282	3.4848
7	3.178	3.5885
8	4.814	6.9389
9	8.444	7.7053
Average	2.67 ± 2.37	3.06 ± 2.49

The hydro-biological parameters were seen to be fluctuating during different fortnights. The ponds were statistically different for only three of these parameters, viz. pH, dissolved oxygen and total dissolved solids, pH fluctuated around its mean value of 8.01 ± 0.30 in T1 and 7.81 ± 0.33 in T_2. Dissolved oxygen averaged 6.78 ± 1.21 ppm in T_1 while in T_2, it was 3.97 ± 0.64 ppm. The mean total dissolved solids (TDS) in T1 were 927.7 ± 30.0 mg/L and 944.7 ± 28.6 mg/L in case of T_2.

The above stated results and discussion show that although maize oil cake gives better growth than that given by rice polishing, yet more amount of maize oil cake is required to obtain unit weight gain in major carps. As the price of maize oil cake is almost double that of rice polishing in local market, it is not economical to use maize oil cake than to use rice polishing as supplementary feed for major carps.

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