Biomass Conversion Efficiencies of Fish Pond Fertilization and Feed Supplementation

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ABSTRACT : Biomass conversion efficiencies (B.C.E.) of six fish species viz., *Catla catla*, *Labeo rohita*, *Cirrhina mrigala*, *Hypophthalmicthys molitrix*, *Ctenopharyngodon idella* and *Cyprinus carpio* cultured under artificial feed (T1), broiler manure (T2), buffalo manure (T3), N:P:K (25:25:0) (T4) and control pond (T5) have been determined for the period of one year. The overall biomass conversion efficiencies under the influence of T2, T3, and T4 were statistically similar. However, the best (0.40) efficiency was determined under feed supplement-ation (T1).

(**Key Words**: Biomass, Isonitrogenous, Conversion Efficiency, Increase)

INTRODUCTION

Fish farming has, without doubt, a promising future in Pakistan as water, land and by-products of agriculture industry are available in abundance for utilization in commercial fish production. By intensive fish farming under composite culture system, it may become possible to obtain the yield many folds with a consequent increase in the good quality and low cost proteins can be enhanced. The availability of suitable food, i.e., planktonic life and ecological conditions for the fish in the pond is the basic need for securing high fish production (Hepher and Pruginin, 1981).

The seasonal variations in the water chemistry have profound effect on the distribution of fauna flora in the pond (Mahboob, 1986). The main objective of the study was to compare for the biomass conversion efficiencies of different treatments which depict the picture of the growth to be achieved by the fish.

MATERIALS AND METHODS

The experiment was started on December 31, 1992 under ambient conditions typical of Faisalabad area till December 26, 1993. Area of Faisalabad recognized for somewhat salty groundwater. Five newly dug earthen fish ponds of dimension 15 m × 8 m × 2.5 m (length × width × depth) located at Fisheries Research Farms, Department of Zoology and Fisheries, University of Agriculture, Faisalabad were used in the present experiment. After preliminary preparation of the ponds, approximately four months old fingerlings of *Catla catla*, *Labeo rohita*, *Cirrhina mrigala*, *Hypophthalmicthys molitrix*, *Ctenopharyngodon idella* and *Cyprinus carpio* were stocked randomly in each of the ponds in the ratio of 10:30:12.5:25:10:12.5, respectively with the stocking density of 2.87 m^3/fish (Javed, 1988). The interspecies ratio shown in table 1, was adopted according to Lakshmanan et al. (1971).

As shown in table 2, the percentage N, P and K of the four treatments materials in this study were obtained by A. O.A.C. (1984) methods.

Feed supplementation of T1 and fertilization of T2, T3, and T4 was done with broiler manure, buffalo manure and N: P: K (25:25:0) based on their nitrogen contents at the rate of 0.15 g nitrogen per 100 g of wet fish weight daily for one year. However, control pond (T5) remained without any additives. The percentage N, P and K contents of four treatment materials used in the study were obtained by A.O.A.C. (1984).

Artificial feed was composed of sesamean oil cake (32%), maize gluten meal 30% (20%), cotton seed meal decardicated 30% (40%), wheat bran (3.5%), rice polish (3.5%) and vitamin mineral mix (1%).

The cultivated fish stock was sampled randomly with three repeats fortnightly by using nylon drag net from each of the ponds under study. The morphometric characteristics of fish viz., body weight, fork length and total length were measured and recorded to monitor

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Table 1. Interspecies ratio, initial weight, fork length and total length of six fish species

Fish species	Individual	Ratio	Weight (gm)	Fork length (mm)	Total length (mm)
Catla catla	10	10	12.87 ± 0.08	53.23 ± 0.05	59.31 ± 0.09
Labeo rohita	32	30	11.93 ± 0.05	50.84 ± 0.08	57.62 ± 0.07
C. mrigala	13	12.5	16.80 ± 0.02	51.68 ± 0.06	61.22 ± 0.02
H. molitrix	26	25	22.14 ± 0.07	124.18 ± 0.09	143.74 ± 0.16
C. idella	10	10	19.57 ± 0.09	93.16 ± 0.07	97.82 ± 0.08
C. carpio	13	12.5	18.49 ± 0.10	81.32 ± 0.07	101.43 ± 0.23

Table 2. Percentage nitrogen and phosphorus contents of treatments materials under study

Treatment	Rond No.	Treatment material	% Nitrogen	% Phosphorus
T_1	1	Artificial feed (vegetable sources)	5.60 ± 0.03	2.05 ± 0.06
T_2	2	Broiler manure	4.62 ± 0.12	1.66 ± 0.14
T_3	3	Buffalo manure	1.02 ± 0.05	0.96 ± 0.02
T_4	4	N:P:K (25:25:0)	25.00 ± 0.04	25.00 ± 0.04
T_5	5	Control	No additive	No additive

growth performance under different treatments. The physico-chemical factors and planktonic life of each pond were determined following, Boyd (1981).

Dry weight of planktonic biomass was measured indirectly, from the values of total solids and total dissolved solids by the following formula as described by Mahboob (1986):

$$\text{Dry weight of planktonic biomass} = \text{Total solids} - \text{Total dissolved solids}$$

Biomass conversion efficiencies (B.C.E) of fish were estimated fortnightly by the following formula:

$$\text{B.C.E.} = \frac{\text{Average increase in fish production}}{\text{Average dry weight of planktonic biomass}}$$

The data obtained were subjected to statistical analysis by using Micro-Computer IBM-PC. The comparison of mean values was computed by using analysis of variance and Duncan's multiple range test through two-way classification (Factorial Experiment) with repeated sampling. MICROSTAT and MSTAT packages were used for the analysis.

RESULTS AND DISCUSSION

The standing biomass indicates the amount of planktonic life that must be existed at the end of certain period after the fish has been utilized to its maximum. This standing biomass may become a point to indicate the growth achieved/to be achieved by the fish (Javed, 1988). Thus it was suggested that the status of standing biomass in the ponds, treated with various fertilizers or feed supplementation, may be taken as a bench mark, which could be related with weight gain of fish, despite the fact that amount of biomass consumed by the fish for the growth at that particular point remained undetermined. The authors have made a hypothetical conversion efficiency based on the weight gain upto the point when the standing biomass was determined. The standing biomass, therefore, showed, although, the leftover quantity, yet may point out the level of biomass consumption by the fish, making some definite amount as surplus. If e.g standing biomass is less than the previous recordings, the fish has consumed the biomass from the last standing biomass plus may less from the newly produced biomass in the pond. This would leave to either reduce biomass as a standing one or reduced growth of the fish.

The dry weight of planktonic biomass during the experimental period ranged from 3 to 231, 4 to 310, 1 to 191, 2 to 259 and 1 to 37 g/m^3 under T1, T2, T3, T4 and T5, respectively. The biomass conversion efficiencies were from 0.07 to 0.87, 0.04 to 0.61, 0.04 to 1.26, 0.03 to 1.26 and 0.04 to 1.15 under the influence of T1, T2, T3, T4 and T5, respectively. The maximum values of conversion efficiencies as 0.87 and 0.61 under T1 and T2 were during 2nd fortnight during which the increase in fish production remained as 4.67 and 16.31 g/m^3, respectively. The maximum values of conversion efficiencies under the effect of T3, T4 and T5 were observed as 1.64, 1.26 and 1.15 g/m^3 during 5th, 1st and 7th fortnights, respectively. However, in T1 the conversion efficiencies remained significantly higher than the other treatments (except T5).

The higher values of correlation coefficients between dry weight of planktonic biomass and increase in fish production for T1, T2, T3 and T4 (0.554, 0.802, 0.701 and 0.862, respectively) predicted the reliability of the regression equations of increase in fish production on the dry weight of planktonic biomass under the effect of five treatments (table 3). The low value of 0.554 remained under T1 showing that the dependance of fish on planktonic biomass along with direct utilization of supplemented feed. While the value of "r" under T5 was 0.467, which might possibly be due to the poor response of this treatment towards planktonic productivity.

Table 3. Regression equations of average increase in fish production on an average dry weight of planktonic biomass under 5 treatments

Treatment	Averages		Regression equations	r^2
	Inc. in fish Y	Biomass X		
T_1	12.84	101.80	Y = 6.93 + 0.058 (0.014)	0.554
T_2	19.61	105.24	Y = 9.51 + 0.096 (0.032)	0.802
T_3	9.23	77.12	Y = 5.92 + 0.043 (0.013)	0.701
T_4	15.18	116.09	Y = 8.64 + 0.056 (0.020)	0.862
T_5	3.30	17.31	Y = 1.59 + 0.098 (0.024)	0.467

Critical value (one tail 0.05) = + or − = 0.344.
Values within brackets are the standard errors.

Duncan's multiple range test reveals maximum fish production under T2 (table 4). The increase in fish production was similar under T1 and T4. The minimum fish production was recorded with T5. The dry weight of planktoinc biomass was highest (19.61 g/m^3) with T2, followed by T4, T1, T3 and T5, while non significant differences were recorded between T1 vs T5 (table 4). The increase in fish production, planktoinc biomass and conversion efficiency values under five treatments were also compared at fortnight levels. The maximum values for increase in fish production remained at 17.37 to 17.46 g/m^3 during 8th to 12th fortnights, respectively. While the biomass production values were from 156.87 to 148.81 during 13th to 19th fortnights, respectively. However, the best period for converting biomass into fish weight was from 1st to 7th fortnights.

The differences in the production of planktonic biomass under different treatments served as the decisive factor to boost up fish production. The significantly higher biomass conversion efficiency under T1 (0.40) was due to utilization of feed by the fish, which increased the fish production. While second best biomass conversion efficiency computed under T5 (0.36) was due to better utilization of smaller quantity and available food in the form of planktonic life by the fish. These findings were in line with the results of Ashraf (1989) who found significant differences among biomass conversion efficien-

Table 4. Performance of various pond fertilization schemes for increase in fish production, average dry weight of planktonic biomass and biomass conversion efficiencies

	DF	Increase in fish production Prob.	Av. Dry wt. of plank. biomass Prob.	Biomass conversion efficiencies Prob.
Treatments	4	0.000	0.000	0.001
Fortnight	23	0.000	0.000	0.000
Error	92			
Total (n-1)	119			

Comparison of Means

Treatment	Increase in fish production	Av. Dry wt. of plant biomass gm/cm	Biomass conversion efficiencies
T1	107.09b	12.84c	0.40
T2	146.67a	19.61a	0.23b
T3	77.10c	9.23d	0.24b
T4	125.53b	15.81b	0.25b
T5	17.47d	3.30e	0.26a
S. E.	0.67	6.91	0.03

Similar letter within a column indicate that treatment means do not differ significantly at 5% level according to Duncan's multiple range test.

cies of artificial feed, cow manure fertilization and control pond at 0.08% nitrogen level of the live body weight per day on the major carps.

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