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# FISH POND FERTILIZATION. III. EFFECT OF LAYER MANURE FERTILIZATION ON THE GROWTH PERFORMANCE OF *CATLA CATLA, LABEO ROHITA* AND *CIRRHINA MRIGALA*

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Growth response of major carps in a pond fertilized with layer manure, at the level of 0.10 g nitrogen/100 g of wet fish weight daily and control (without additives) was examined. Individual weight, fork length and total length gains were better for *Cirrhina mrigala*. However, the trend of weight gains among three fish species was significantly different. Increase in fish yield, under treated pond, remained maximum at water temperature range of 30.5-33.0° C. Treated and control ponds responded differently for the planktonic productivity and fortnightly increase in fish yield. However, the correlation coefficients between planktonic productivity and increase in fish yield, under both treated and control ponds, were significant. The net fish yields of 4875.42 and 767.29 kg/ha were computed under treated and control ponds, respectively.

## INTRODUCTION

Aquaculture in Pakistan can well progress and plays an important role, particularly, in supporting rural economy and in increasing foreign exchange earnings from non-oil commodities. The contribution of aquaculture to the overall fish production is very much less than that from capture fisheries, however, its contribution in terms of values and socio-economic benefits to the rural and coastal communities is becoming increasingly significant. The average annual fish consumption is becoming increasingly significant. The average annual fish consumption in Pakistan is still very low. It is thus obvious that there is an urgent need to increase fish supply, especially for rural people.

The production of major carps such as *Catla catla, Labeo rohita* and *Cirrhina mrigala*, in ponds, could be increased by the application of organic and inorganic fertilizers which tend to produce an abundance of zooplankton and phytoplankton, respectively (Javed, 1988). Banerjee *et al.* (1979) reported a fish yield of 670 kg/ha/90 days by using unspecified poultry manure. Javed *et al.* (1990) used broiler droppings (4.60 ± 0.09% nitrogen) to fertilize major carp ponds and reported a net fish yield of 5050.83 kg/ha/year.

## MATERIALS AND METHODS

The methods adopted were the same as given by Javed *et al.* (1989) with the exception that layer manure (3.84 ± 0.10% nitrogen) was added to the treated pond at the rate of 0.10 g nitrogen (from 100/3.84 x 0.10 = g layer manure) per 100 g of wet fish weight daily for one year. However, the control pond received no additives.

**Table 1. Analysis of variance on fish weights, fork lengths and total lengths**

| S.O.S. | Df | Mean squares | | |
|---|---|---|---|---|
| | | Weight | Fork length | Total length |
| Treatment | 1 | 22172882.25** | 692737.46** | 931865.02** |
| Species | 2 | 342637.15** | 16513.31** | 17302.90** |
| Treatment x Species | 2 | 133612.55** | 9753.78** | 6669.87** |
| Error | 120 | 450.94 | 127.77 | 60.49 |

** = Siginificant at P<0.05.

| Fish species | Comparison of means | | | | | |
|---|---|---|---|---|---|---|
| | Weight (g) | | Fork length (mm) | | Total length (mm) | |
| | Treated | Control | Treated | Control | Treated | Control |
| *Catla catla* | 1017.92 ± 4.18 b | 128.29 ± 3.34 d | 341.62 ± 1.08 b | 180.63 ± 2.03 d | 411.84 ± 1.23 b | 224.08 ± 1.63 d |
| *Labeo rohita* | 850.58 ± 5.44 c | 140.85 ± 3.60 c | 361.83 ± 0.98 a | 191.45 ± 2.20 d | 406.36 ± 0.97 b | 221.05 ± 2.83 d |
| *Cirrhina-mrigala* | 1134.57 ± 6.47 a | 216.96 ± 4.24 f | 357.24 ± 2.21 a | 243.73 ± 1.60 c | 422.26 ± 1.80 a | 279.33 ± 1.42 c |

Treatment means with similar letters in a column are statistically similar at 5% level of significance.

## RESULTS AND DISCUSSION

**a. Wet fish weight**

i. *Catla catla:* The average initial and final weights of *Catla catla* in treated and control ponds were 2.68 ± 0.02 and 1017.92 ± 4.18 g, respectively. Fortnightly weight gains varied from 0.85 to 120.09 g during first (Dec.) and 16th fortnight (July), respectively. In control pond the initial and final average weights of *Catla catla* remained at 2.68 ± 0.06 and 128.29 ± 3.34 g, respectively. Maximum increase in average weight of this species was noticed during 13th fortnight (12.33 g) which was closely followed by an increment of 10.35 g during 14th fortnight.

ii. *Labeo rohita:* The initial average weight of Labeo rohita in both treated and control ponds was 2.46 ± 0.03 g. However, the final weights remained at 850.58 ± 5.44 and 140.85 ± 3.60 g under treated and control ponds, respectively (Table 1). This species of fish gained maximum weights during 16th and 15th fortnights with increments of 99.68 and 13.15 g in treated and control ponds, respectively.

iii. *Cirrhina mrigala:* The experiment was started with an average weight of 2.25 ± 0.04 g in both treated and control ponds, while the final average weights were 1134.57 ± 6.47 and 216.96 ± 4.24 g, respectively. Fish gained maximum weights during 18th (120.00) and 17th fortnight (18.50 g) under treated and control ponds, respectively.

**Table 2. Regression equations of increase in fish weight (Y) on water temperature of pond (x)**

| Treatment | Species | Regression equation | r |
|---|---|---|---|
| | *Catla catla* | Wt. Inc. = -7.09 + 0.81 W. Temp. (0.003) | 0.829 |
| Treated | *Labeo rohita* | Wt. Inc. = -6.92 + 0.67 W. Temp. (0.012) | 0.931 |
| | *Cirrhina mrigala* | Wt. Inc. = -7.82 + 0.83 W. Temp. (0.011) | 0.892 |
| | *Catla catla* | Wt. Inc. = -2.89 + 0.22 W. Temp. (0.002) | 0.563 |
| Control | *Labeo rohita* | Wt. Inc. = -5.31 + 0.45 W. Temp. (0.021) | 0.620 |
| | *Cirrhina mrigala* | Wt. Inc. = -9.10 + 0.37 W. Temp. (0.041) | 0.425 |

Critical value (1-tail, 0.05) = + or -0.344

(Values within brackets are the standard errors)

There existed significant differences between treated and control ponds for the

performance of the three fish species (Table 1). The interaction (treatment x species) also remained highly significant. Among the three fish species, *Cirrhina mrigala* performed significantly better in both treated and control ponds. However, in treated pond the performance of *Labeo rohita* remained significantly poor as compared with other two fish species.

Linear regression equation (Table 2) reveals highly significant correlation between water temperature and growth rate of all the three fish species under treated and control ponds. However, *Cirrhina mrigala* in treated pond performed better when increase in weight in relation to unit increase in water temperature was considered, followed by *Catla catla* and *Labeo rohita*. Increase in fish yield, under treated pond, remained maximum at water temperature range of 30.5-33.0 °C. These results are in close agreement with the findings of James *et al.* (1990) who reported temperature as the only water quality variable which affected significantly the growth of Rainbow Trout and Channel Catfish. In control pond low value of r (correlation coefficient) predicts that factors other than temperature were responsible in increasing fish growth.

**b. Fish fork length and total length**

The initial fork and total lengths of *Catla catla, Labeo rohita* and *Cirrhina mrigala* were 55.30 ± 0.07, 65.29 ± 0.04, 55.00 ± 0.05, 65.02 ± 0.09 and 59.03 ± 0.07, 69.11 ± 0.08 mm in treated and control ponds, respectively. *Catla catla, Labeo rohita* and *Cirrhina mrigala* gained maximum fork lengths of 34.62, 21.18 and 29.45 mm during 16th, 14th and 8th fortnights, respectively. As regards the total length increase *Catla catla, Labeo rohita* and *Cirrhina mrigala* gained maximum total lengths of 39.20, 29.48 and 29.21 mm during 6th (Feb.), 17th (Aug.) and 8th fortnight (March), respectively. However, in control pond *Catla catla, Labeo rohita* and *Cirrhina mrigala* gained maximum total lengths of 21.05, 16.80 and 18.39 mm during 10th, 9th (April) and 20th fortnight (Sep.), respectively. *Labeo rohita* and *Cirrhina mrigala* in treated and *Catla catla* and *Labeo rohita* in control ponds showed non-significant differences as to the increase in fork length. As regards the total length increase *Catla catla* and *Labeo rohita* performed similarly in both treated and control ponds (Table 1). There existed highly significant correlation between increase in weights and fork lengths of fish with the correlation coefficient of nearly one (r = 0.998) for all the three fish species in treated and control ponds. Kartha and Rao (1990) reported significant correlation between weight and length of *Catla catla* in commercial landings of Gandhi Sagar reservoir in India.

**c. Increase in fish yield and dry weight of planktonic biomass**

Regression equations of fortnightly increase in fish yield on the existing dry weight of planktonic biomass were computed (Table 3). An equation under treated pond explains about 84.60% of the variations in fish yield due to planktonic productivity i.e. dry weight of the planktonic biomass. This relationship reveals one unit increase in planktonic productivity (one $g/m^3$) increase in fish yield. However, the regression equation under the influence of control treatment explains only about 30.50% of the variations (with non-significant $R^2$) in the fish yield due to planktonic biomass.

Under the present experimental conditions the performance of all the three fish species together, could be explained on the basis of the response of treatments towards planktonic productivity. The average dry weights of the planktonic biomass in treated and control ponds were 95.26 and 10.52 $g/m^3$, respectively. However, the average

values for increase in fish yield (for one year) under treated and control ponds remained at 13.50 and 2.29 g/m$^3$, respectively. Correlation coefficients between planktonic biomass and increase in fish yield were significant and positive (Table 3). These findings substantiated the results reported by Javed *et al.* (1990).

yields of 4875.42 and 767.29 kg/ha were computed under treated and control ponds, respectively. These results could be compared with the findings of Javed *et al.* (1990) who reported a net fish yield of 5050.83 kg/ha by using broiler manure in major carp rearing ponds. The present results also sub-

**Table 3. Regression equations of increase in fish yield (Y) on dry weight of planktonic biomass (x)**

| Inc. in fish yield (g/m$^3$) | Plank. biomass (g/m$^3$) | Regression equation | r | $R^2$ |
|---|---|---|---|---|
| Treated pond | | | | |
| 13.50 ± 1.03 | 95.26 ± 3.79 | $Y_{SE}$ = 1.62 +0.125 x (0.011) | 0.920 | 0.846** |
| Control pond | | | | |
| 2.29 ± 0.08 | 10.52 ± 1.11 | $Y_{SE}$ = 1.04 +0.119 x (0.038) | 0.552 | $0.305^{NS}$ |
| | | Critical value (1-tail, 0.05) = + or -0.344 | | |

r = Correlation coefficient; ** = significant at P<0.01.

A total of 28.75 kg nitrogen (in the form of 32.67 and 4.28% uric acid and urea, respectively) from 748.72 kg layer manure was added to get 233.27 kg of fish in one year. The added nitrogen showed close inter-relationship (r = 0.629) with the fish yield increase. Javed *et al.* (1990) reported positive significant correlation between nitrogen added (in the form of broiler manure) and increase in fish yield under polyculture of major carps.

**d. Net fish yield**

At the end of one year experimental period all the three fish species were harvested for final net pond yields. The net fish

stantiated the findings of Banerjee *et al.* (1979) who reported fish yield of 2717.27 kg/ha by using unspecified poultry manure.

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