

FISH POND FERTILIZATION. IV. EFFECT OF COW-DUNG ON THE GROWTH PERFORMANCE OF MAJOR CARPS

Muhammad Javed, Muhammad Hassan & M.B. Sial

Fisheries Research Farms,
Department of Zoology and Fisheries,
University of Agriculture, Faisalabad

One year pond fertilization trial was conducted with the rearing of major carps such as *Catla catla*, *Labeo rohita* and *Cirrhina mrigala*, so as to test cow-dung treatment with control (no additives). Based on its nitrogen contents cow-dung was added at the rate of 0.10 g nitrogen per 100 g of wet fish weight daily. The effect of treatment on fish weight, fork and total length increase was highly significant. However, differences among species in gaining weights were non-significant between *Labeo rohita* and *Cirrhina mrigala*. The response of treated and control ponds towards planktonic productivity, phyto- and zooplankton populations and phytoplankton/zooplankton ratios were significantly different. Increase in fish yield and nitrogen incorporation efficiency of fish were positively and significantly correlated with water temperature and planktonic productivity in both the ponds. Planktonic biomass was positively and significantly correlated with water temperature also. The net fish yields of 2928.54 and 767.29 kg/ha/year of major carps were obtained from treated and control ponds, respectively.

INTRODUCTION

During the recent past a great deal of interest both by public as well as private sector has been shown for making a breakthrough in animal protein shortage by maximizing production of freshwater fish. There is a huge potential for such products because of widespread water resources in the country. Almost all types of fish, commonly used on the table, are available in Pakistan and can be reared in such water resources. Through the exploration of these resources it is possible to attain a level of 1 g protein per kg of human body weight in the face of rapidly growing population.

Pakistan has been blessed with a vast and intensive resource of both marine and inland fisheries which supports a wide variety of nutritionally important and economic fish and possesses a great potential for

development. In Punjab, the fish fauna is rich and as many as 140 species of freshwater fish are found, out of which 20 species are edible. The carps such as *Catla catla*, *Labeo rohita*, *Cirrhina mrigala* and *Cyprinus carpio* are culturable. Chinese grass and silver carps have also been recently introduced in this province.

Production of cultivated fish can be increased by introducing organic and inorganic fertilizers of different origin in fish ponds to increase the primary productivity. Organic and inorganic fertilizers tend to produce an abundance of zooplankton and phytoplankton, respectively (Javed, 1988). By using manure as a pond fertilizer, two purposes are served. Firstly, it provides a convenient method of dealing with pollution problems resulting from livestock industry. Secondly, nutrients (nitrogen and phosphorus) from the manure can be utilized to sup-

port the natural food system of the pond. Javed *et al.* (1990) reported a fish yield of 5055.83 kg/ha/year by using poultry manure. Hora and Pillay (1962) reported that a mixture of organic and inorganic fertilizers in a ratio of 3:1 (cow-dung:phosphate) was quite effective in increasing pond production when applied at a rate of 500 kg/ha. According to Pullin and Shehadeh (1980), organic matter of cow manure, added at the rate of 3-4% of standing fish biomass, gave a fish yield of 20 kg/ha/day.

MATERIALS AND METHODS

The methods adopted were the same as given by Javed *et al.* (1989) with the exception that sun-dried cow-manure (with $1.48 \pm 0.04\%$ nitrogen; $0.08 \pm 0.03\%$ phosphorus and $1.27 \pm 0.05\%$ potassium) were added to the treated pond at the rate of 0.10 g nitrogen (from $100/1.48 \times 0.10 =$ gram of cow manure) per 100 g of wet fish weight daily for the period of one year. However, control pond received no additives.

RESULTS AND DISCUSSION

The study was started with the following average weights, fork and total lengths of three major carps in both treated and control ponds:

Fish species	Average weight (g) (\pm SE)	Average fork length (mm)	Average total length (mm)
<i>Catla catla</i>	2.68 ± 0.06	55.30 ± 0.07	65.29 ± 0.04
<i>Labeo rohita</i>	2.46 ± 0.03	55.00 ± 0.05	65.02 ± 0.09
<i>Cirrhina mrigala</i>	2.25 ± 0.04	59.03 ± 0.07	69.11 ± 0.08

Data on final wet weights, fork lengths, total lengths and net fish yields, from treated and control ponds, are presented in Table 1.

The application of cow-dung enhanced the growth performance of all the three fish species significantly. The interactions (treatment \times species) for all the three growth parameters were also highly significant. Better growth of fish with higher rate of manure application has been reported by Hickling (1962) and Hassan (1989). According to Hassan (1989), cow-dung was especially efficient in enhancing production of zooplankton and benthic organisms. However, Rappaport *et al.* (1977) observed higher contents of phytoplankton and chironomid larvae in organically manured fish ponds. During present investigation the maximum weight was gained by *Cirrhina mrigala*. This was significantly more than *Labeo rohita* and *Catla catla* in control and more than *Catla catla* in treated pond (Table 1). Fork and total length increases in *Cirrhina mrigala* were also significantly better than other two fish species, indicating that this species of fish responded better to cow-dung than the other two species. The findings of Javed *et al.* (1989) are in accordance with the results of the present study as they reported significantly better growth of *Cirrhina mrigala* in broiler manure fertilized pond. This could be due to inherent potential of *Cirrhina mrigala* to attain larger fork and total lengths in earthen ponds (Javed, 1988).

Significantly higher growth of all the three fish species recorded under cow-dung treatment was the result of higher plank-

Table 1. Treatment values for final average weights, fork lengths and total lengths of three fish species in polyculture. Values are mean \pm SE of two replicates. Treatment means with the same letters in a single column are statistically similar at 5% level of significance

	Weight (g)		Fork length (mm)		Total length (mm)	
	Treated	Control	Treated	Control	Treated	Control
<i>Catla catla</i>	527.36 b \pm 3.66	128. b \pm 3.34	280.96 b \pm 1.02	180.63 b \pm 2.03	334.01 b \pm 0.08	224.08 b \pm 1.63
<i>Labeo rohita</i>	571.58 a \pm 4.09	140.85 b \pm 3.60	292.26 b \pm 1.44	191.45 b \pm 2.20	346.51 b \pm 1.75	221.05 b \pm 2.83
<i>Cirrhina mrigala</i>	588.40 a \pm 4.47	216.96 a \pm 4.24	335.62 a \pm 1.13	243.73 a \pm 1.60	383.13 a \pm 1.16	279.33 a \pm 1.42

tonic productivity (79.33 g/m^3) under this treatment (Table 2). This high growth of fish can be correlated with better assimilation of diet in the form of phytoplankton and zooplankton which were with the mean annual densities of 66.79 and 37.88 individuals per 5 ml of water, respectively, present in the pond, and conversion efficiency associated with the existing planktonic biota as reflected from the data presented in Table 2. Better synthesis of planktonic biota stimulated the growth rate of fish significantly which correlated positively with water temperature (Table 3). The present findings corroborated the fact that nitrogen incorporation efficiency of fish (NIE), being the variable, determined the growth rate of fish at an annual average water temperature of 21.94°C as reported by Nayak and Mandal (1990). A quantity of 1160.89 kg sun-dried cow-dung was added (which contained 1718 g nitrogen) to get 140.13 kg of fish with an overall NIE of 12.26%. The present findings are in accordance with the results of Javed *et al.* (1990) who reported 12.20% incorporation of nitrogen from broiler manure into fish.

Increase in fish yield, planktonic biomass, phytoplanktonic and zooplanktonic densities were significantly better in treated than in the control pond (Table 2). In both treated and control ponds the increase in fish yield was positively and significantly correlated with water temperature and existing dry weights of the planktonic biomass. However, planktonic biomass was also significantly and positively correlated with water temperature (Table 3). This showed the dependance of fish yield on planktonic productivity and both planktonic productivity and fish yield, in turn, were dependent on water temperature (McCauley and Casselman, 1981). Incorporation of nitrogen from manure into fish was significantly and positively correlated with water temperature and

Table 2. Treatment values for increase in fish yield, planktonic biomass conversion efficiency, planktonic productivity and net yields. Treatment means with the same letters in a single column are statistically similar at 5% level of significance

	Increase in fish yield (g/m ³)	Planktonic biomass (g/m ³)	Biomass conversion efficiency (%)	Zooplankton Ind./5 ml	Phytoplankton Ind./5 ml water	Phyto-/Zoo. ratio	Net yields kg ha ⁻¹
Treated	8.11 a	79.33 a	13.00 b	37.88 a	66.79 a	1.76 b	2928.54 a
Control	2.29 b	10.52 b	26.00 a	6.63 b	14.58 b	2.20 a	767.29 b

Table 3. Correlation coefficients among different parameters under study

Variable	Water temperature	Planktonic biomass	Water temperature	Planktonic biomass
Increase in fish yield	0.921	0.832	0.633	0.512
Planktonic biomass dry weight	0.887		0.350	
Nitrogen incorporation efficiency (NIE)	0.910	0.420	0.451	0.512

Critical value (1-tail, 0.05) = + or -0.334

planktonic biomass in both the ponds. The present results indicated that cow-dung may serve as a direct source of food for fish food organisms, or they may get decomposed for the release of inorganic nutrients (Boyd, 1981) that stimulated planktonic growth as evident from relative abundance of zooplankton (79.33 g/m³ of water) in pond treated with cow-dung (Table 2).

At the end of one year experimental period all the three fish species, from both the ponds, were harvested. Net fish yields of all the three fish species, together from treated and control ponds, were 140.57 (2928.54 kg/ha) and 36.83 kg (767.29 kg/ha), respectively. These results could be compared with the findings of Bajwa (1981) who reported a net fish (*Cyprinus carpio*)

yield of 1555.25 kg/ha under the influence of cow-dung treatment.

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