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ORIGINAL RESEARCH ARTICLE

A Study on Effects of Fertilization and Supplementary Feed on Growth Performance of Three Indian Major Carps

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ABSTRACT

The present study was aimed to evaluate the growth performance in terms of average body weight, specific growth rate and total fish production of these fishes for one year, a polyculture experiment was carried out on the Rohu (*Labeo rohita* Ham.), Catla (*Catla catla Ham.*) and Common carp (*Cyprinus carpio Ham)*. The ponds were supplemented with 0.2 g N/100 g body weight fertilizer and supplementary feed, the sources of which were different. The treatments were cow manure, nitrophos, cow manure + nitrophos, cow manure + supplementary feed, nitrophos + supplementary feed and cow manure + nitrophos + supplementary feed. The highest gross fish production of all the fishes was recorded as 3001 kg ha^{-1} $year^{-1}$ in cow manure + nitrophos + supplementary feed amongst the treatments. Thus for getting optimal fish production the fertilization of pond with supplementary feed is recommended.

Key Words: Carps, Nitrophos, Supplementary feed and Fish production.

1. INTRODUCTION

The production of fish pond depends on the vegetation, which is dependent on the nutrients in the ponds. It is not possible to increase the production of cultivated fish by giving them the greater quantities of natural food directly. Organic manures and chemical fertilizers can be used to increase the planktonic biomass, on which fish mainly feeds. It stimulates the growth of natural food by providing essential deficient elements, which are utilized by the phyto- and zooplanktons. The fertilization in fish farming is to improve water quality and to increase the variety and quantity of phytoplankton and zooplankton, which eventually leads to high fish yield and economic returns. The ultimate goal of fertilization is to achieve suitable environmental conditions for the production of natural food for fish, but in comparison with organic manure, fertilizers increase the level of primary productivity, algae abundance, dissolved oxygen, pH and total phosphates [1,2].

Sustainable and successful freshwater fish culture on scientific basis principally depends upon the use of adequate, economically viable and environment friendly artificial feeds. Since the feed costs vary between 40 to 60% of the total managerial expenditure in fresh water fish culture system, provision of artificial feed increases the fish growth and production in the fertilized ponds and results in higher growth rates and yields than fertilization alone [3]. With a view of reducing feed input cost in aquacultural practices, it is necessary to develop better feeding strategies by incorporating plant based feed with animal protein based diets in feeding practices.

Fish is an important dietary animal protein source in human nutrition. Production of aquatic species through freshwater fisheries and aquaculture for protein supply is being encouraged throughout the world. According to nutritionists, fish is an excellent substitute of protein for red meat. Fish flesh contains all the essential amino acid and minerals *viz*., iodine, phosphorus, potassium, iron, copper and vitamin A and D in desirable concentrations [4]. It serves as valuable source of protein to a healthy diet because of its low carbohydrate and unsaturated fat, especially Omega 3 contents [5]. So the inclusion of fish in our diet can make a valuable contribution to any diet that contain mainly cereals, starchy roots and sugar for the growth [6,7,8].

The most important freshwater culturable fishes are major Indian carps like *Labeo rohita*, *Catla catla*

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and *Cirrhinus mrigala*. Some exotic species such as Common carp *Cyprinus carpio*, Grass carp (*Ctenopharyngodon idella*) and Silver carp (*Hypophthalmichthys molitix)* are also introduced. In India, suitable or common combinations of fish for composite fish culture system are Rohu, Catla and Mrigala [9]. Specific interactions among fish species are important in the sustenance of any polyculture system and much research work has been done on the culture of these three fish species under different treatments [10,11]. In the present work of polyculture system, the bottom feeder Mori is replaced with the Common carp. In this polyculture system, Rohu, Catla and Common carp are stocked. There are different opinions about the inclusion of Common carp in polyculture system. For instance Ritvo *et al.* (2004)[12] observed that Common carp has the potential to improve conditions in pond bottom soil. As a result, perturbations increase the oxygen transfer to the soil, decrease the concentration of toxic compounds, and enable more efficient food web recycling and nutrient release. According to Milstein *et al*. (2003)[13], Common carp as a bottom feeding fish produces a fertilizing effect through a food web that benefits the filter feeding fishes and reduces the application of organic and inorganic fertilizers in the aquaculture practices. It grows rapidly with high protein diet and minimum feed coefficient and is considered as a target cultured fish, and plays a key role in pond management. It stimulate efficiency of liming and nutrient availability in the bottom of the ponds, so the inclusion of Common carp in polyculture is economical to farmer as it lowers the input and management costs and it also benefits the pond water ecosystem [14,15].

Common carp and Rohu fed with fish meal, rice bran, mustard oil cake showed 1.5 and 2.1 times higher fish yield than in the treatments without supplementary feed [16]. According to Azim *et al*. (2002)[17] growth, specific growth rate of major carps were higher in fertilized pond with the provision of supplemental feed than in control (fertilization alone). Nandeesha *et al.* (2001)[18] also noted that the specific growth rates, protein efficiency ratio as well as growth rate were more pronounced in animal and plant based diet as compared to animal based diet. The objective of this experiment was to evaluate the growth performance and meat quality of Rohu, Catla and Common carp under different treatments.

2. MATERIALS AND METHODS

The Kamala basin is located in the Darbhanga district of Bihar, the reservoir is situated at latitude 260 27’ 26.81 North and longitude 860 11’ 20.98 East. It is located at an elevation of 601 m above msl. The kamala basin gets the inflows from the north east monsoon (June-September). The catchment area of the study site is about 1.6km at a stretch. The average rainfall of that area is 105 cm. The water of the reservoir is used for fisheries, and irrigation. The climate of this area is extreme ends of both warm and cool. The water of the reservoir is used for drinking, fisheries, irrigation and also for producing electricity. The climate of this area is moderately cool.

For studying the growth performance and meat quality of Rohu (*Labeo rohita)*, Catla (*Catla catla)* and Common carp (*Cyprinus carpio*) under different treatments with two replications. Earthen ponds of equal size were used to conduct the experiment. Each pond had an area of 0.02 ha, located at Biraul, Dharbhanga district, Bihar, India.

Before stocking, all the ponds were sun dried for fifteen days. For the purpose of disinfection and the stabilization of pH, liming with CaO was applied at the rate of 2.5 kg per pond with dusting method [19]. Essential precautionary measures were taken to screen the water inlets to avoid the entry of intruders or exit the fish from ponds. After one week of taking these steps, each pond was watered up to 1.5 m and this water level was maintained throughout the study. All the ponds were fertilized with organic manure (cow manure) as started dose to stimulate the productivity of the ponds. Two weeks after manuring, each pond was stocked with Rohu, Catla and Common carp in the ratio of 20:15:15. The average body weight was recorded. The amount of organic manure, fertilizer and supplementary feed was calculated on N-equivalence of 0.2 g N/100 g body weight of fish daily. In this experiment, all the experimental ponds received the same quantity of N, but the sources were different as given in (**Table 1**).

The cow manure and nitrophos was added on weekly basis, while supplementary feed was added on daily basis. The supplementary feed was formulated for treatments cow manure + supplementary feed, nitrophos + supplementary feed and 6 cow manure + nitrophos + supplementary feed, having 30% crude protein [20] by following Pearson method [21] including fish meal, rice polish, sunflower meal, maize gluten (30% C.P.), canola oil, vitamin and minerals premix [22].

After every one month, cultured fish species were

captured randomly by using drag net from each treatment and released back into their respective ponds after recording the data for wet body weight (WBW) and specific growth rate (SGR). After one month interval, on the basis of WBW, amount of organic and inorganic fertilizer and supplementary feed to be added in fish ponds were determined for each treatment. Specific growth rate (SGR) was estimated by the formula given by Dhawan and Kaur (2002)[23].

$$SGR = \frac{\text{In (Final wet body weight)} - \text{In (Initial wet body weight)}}{\text{Time duration (days)}} \times 100$$

At the end of the experiment, total harvested fishes of three fish species were counted and weighed to calculate the survival rate and total fish production.

$$\text{Survival rate} = \frac{\text{Number of fishes recovered}}{\text{Number of fishes stocked}} \times 100$$

The variation in parameters and significance and their interaction among the different treatments for these parameters were tested by using analysis of variance (ANOVA). Significant results were compared using Duncan's Multiple Range Test with repeated sampling to observe the comparison of mean values among the treatments [24].

Table 1: Composition of experimental treatments.

Treatments	Source of Nitrogen	Nitrogen %
T_1	Cow Manure	100%
T_2	Nitrophos	100%
T_3	Cow Manure	50%
	Nitrophos	50%
T_4	Cow Manure	50%
	Supplementary feed	50%
T_5	Nitrophos	50%
	Supplementary feed	50%
T_6	Cow Manure	25%
	Nitrophos	25%
	Supplementary feed	50%

3. RESULTS

The growth performance of three cultured fish species in term of average WBW, SGR revealed that Rohu had the maximum average body weight gain of 142.4 g with cow manure in May. In all treatments except cow manure and nitrophos + supplementary feed, the maximum body weight increase was observed during July, while with nitrophos + supplementary feed the maximum increase was noted in June (**Table 2**). Among different treatments, maximum increment in body weight was recorded in cow manure + nitrophos + supplementary feed. Maximum increase in average body weight of Catla was observed as 154.9 and 146.5 g in cow manure and cow manure + nitrophos during June, while in other treatments except nitrophos + supplementary feed were observed in July and in nitrophos + supplementary feed it increased maximally (143.8 g) in May. In Common carp the maximum increment in average body weight were observed with cow manure during June, while in nitrophos cow manure + nitrophos and nitrophos + supplementary feed in July and in cow manure + supplementary feed and cow manure + nitrophos + supplementary feed in April.

On the basis of comparison of mean values of average body weight in different treatments, the performance of Rohu was better with cow manure + nitrophos + supplementary feed, while the other treatments were lower than this treatment (Table 2). In Catla and Common carp, average body weight in different treatments showed that it appeared to attain maximum weight gain under the influence of cow manure + nitrophos + supplementary feed and lowest in nitrophos. While comparing the monthly growth performance on the basis of mean values, it can be concluded that Rohu showed the best performance in terms of average body weight increment from May to July; however, its poor performance was recorded in December and January (Table 2). Catla gave its highest body weight in June and July. However, the minimum increase in body weight was observed in January (Table 2). Common carp, however, showed excellent performance from March to July but poorly in December and January (Table 2). As evident from comparison of means of average body weight, Cow manure Nitrophos + Supplementary feed were the best treatment as compared to other treatments. Analysis of variance on the final average body weight of these three fish species showed a highly significant difference ($P < 0.01$) among the species, treatments as well

Mean with same subscripts in the same rows are not significantly different ($P < 0.05$) as among the interaction of species and treatments (Table 2). Comparison of mean values of average body weight showed that all the fish species under test attained maximum average body weight with organic manure, inorganic fertilization and supplementary feed. However there was a non-significant difference in all other treatments for all species (Table 2).

4. DISCUSSION

Among three fish species, Catla showed the maximum average body weight followed by Rohu and Common carp with cow manure + nitrophos + supplementary feed. Highest growth performance of Catla was due to the higher growth potential than the other two species reared under semi-

intensive culture system [25]. The results of present investigation revealed that at the end of the experiment, all the three fish species gained maximum weight with cow manure, nitrophos and supplementary feed was added as compared to other treatments. Veerina *et al*. (1999)[26], Liang *et al*. (1999)[27] and Keshavanath *et al*. (2006)[28], reported that ground nut oil cake, cotton seed meal, deoiled rice bran and sunflower meal and additives in the feed such as salt and mineral mix along with organic manure (buffalo manure & poultry droppings), contribute to high yield in carp polyculture. Azim *et al*. (2002)[29] and Islam *et al*. (2008)[30] also concluded that artificial diet comprising of rice bran, soybean meal, fish meal, vegetable oil, vitamin and mineral mixture (40:20:10:3:2) influenced the growth and survival of carp fingerlings on the basis of specific growth rate and harvested fish biomass. During this investigation, Rohu showed the maximum SGR with cow manure + nitrophos + supplementary feed than other two species (Table 1). Data for SGR revealed the significant ($P < 0.01$) difference for the months and treatments in all treatments, which corroborates with the findings of Dhawan and Kaur (2002)[31] and Sahu *et al*. (2007)[32] for these species. In the present study, it was observed that higher fish production was observed in cow manure when compared with nitrophos fertilizer was used. The results are in accordance with the findings of Mahboob and Sheri (1997)[33], who obtained the fish production of 9400 kg^{-1} ha^{-1} yr^{-1} by using broiler dropping as compared to 7400 kg/ha/yr by using NPK fertilizer with major carps.

The highest gross fish production of these three fish species was due to the role of both fertilization and supplementary feed throughout the study period. This might be due to the provision of fertilization and supplementary feed [34,35]. The highest gross fish production of the fish species under study were recorded as 3001.53 kg^{-1} ha^{-1} $year^{-1}$ in cow manure + nitrophos + supplementary feed and the lowest in cow manure (2287.00 kg^{-1} $ha^{-1}year^{-1}$), while there was no significant variation in all other treatments (Table 2) which is almost similar to that of the findings of Abbas *et al.* (2010)[36].

In conclusion, manipulation of common carp along with the major carps and the provision of supplementary feed and fertilization enhanced the growth rate as well as production in semi intensive culture system. Furthermore, it increased the effectiveness of liming application and the availability of nutrients to phytoplankton and zooplankton for the fish species in polyculture system, which is helpful in the reduction of input costs.

Table 2: Growth performance, specific growth rate and total fish production of Rohu, Catla and Common carp under different treatments in polyculture system

S. No	Treatments	Species	Body weight (g)		Production	
			*Initial	*Final	*SGR %	Gross (kg^{-1} $ha^{-1}year^{-1}$)
1	T_1	Rahu	16.8	938	1.114	2428.00
		Catla	19.1	977	1.089	
		Carpio	24.9	913	1.105	
2	T_2	Rahu	17	928	1.109	2287.00
		Catla	19.6	895	1.06	
		Carpio	25.4	926	0.994	
3	T_3	Rahu	17.6	979	1.112	2526.50
		Catla	19.2	895	1.114	
		Carpio	25.2	997	1.107	
4	T_4	Rahu	17	936	1.111	2652.50
		Catla	19.4	186	1.138	
		Carpio	25.2	111	1.048	
5	T_5	Rahu	16.6	29	1.143	2552.00
		Catla	18.8	43	1.111	
		Carpio	24.8	997	1.022	
6	T_6	Rahu	16.9	221	1.182	3001.53
		Catla	19.6	261	1.152	
		Carpio	24.8	124	1.054	

**Mean values*

REFERENCES

1. Afzal, M., A. Rub, N. Akhtar, M.F. Khan, A. Barlas and M. Qayyum, 2007.Effect of organic and inorganic fertilizers on the growth performance of bighead carp (*Aristicthys nobilis*) in polyculture system. *Int. J.Agric. Biol.*, 9: 931–933
2. Jana, B.B., P. Chakrabarty, J.K. Biswas and S. Ganguly, 2001. Biogeochemical cycling bacteria as indices of pond fertilization: Importance

of CNP ratios of input fertilizers. *J. Appl. Microbiol.*, 90: 733–740

3. Diana, J.S., C.K. Lin and K. Jaiyen, 1994. Supplemental feeding of tilapia in fertilized ponds. *J. World Aquacult. Soc.*, 25: 497–506
4. Sandhu, G.S. 2005. *A Textbook of Fish and Fisheries*, pp. 39-40. Dominant Publishers and Distributors, New Delhi, India
5. Razvi, M., 2006. *Lahore-Absolutely Fishy: Nutritional Value*, pp: 12–13.
6. Razvi, M., 2006. *Lahore-Absolutely Fishy: Nutritional Value*, pp: 12–13.
7. Salim, M., 2006. Role of fish as food to human nutrition. *International Conference on" Solving Problems of Freshwater Fish Farming in Pakistan"*, p: 20. November 27-28, 2006, UVAS, Lahore, Pakistan
8. Yildrim, O., 2008. Aquafeed industry in Turkey: its aquafeed projections towards the year 2015. *Turkish J. Fish. Aqua. Sci.*,8: 93–98
9. Chakrabarti, N.M., 1998. *Biology, Culture and Production of Indian Major Carps*, p: 175. Fisheries Scientist in Indian Council of Agricultural Research, India
10. Keshavanath, P., Shivanna and B. Gangadhara, 2006. Evaluation of sugarcane by-product pressmud as a manure in carp culture. *Bioresour. Technol.*, 97: 628–634
11. Sahu, P.K., J.K. Jena, P.C. Das, S. Mondal and R. Das, 2007. Production performance of *Labeo calbasu* (Hamilton) in polyculture with three Indian major carps *Catla catla* (Hamilton), *Labeo rohita* (Hamilton) and *Cirrhinus mrigala* (Hamilton) with provisions of fertilizers, feed and periphytic substrate as varied inputs. *Aquaculture*, 262: 333–339
12. Ritvo, G., M. Kochba and Y. Avnimelech, 2004. The effects of common carp bioturbation on fishpond bottom soil. *Aquaculture*, 242: 345–356
13. Milstein, A., A. Alkon, Y. Avnimelech, M. Kochba, G. Hulata and G. Schroeder, 2003. Effect of manuring rate on ecology and fish performance in polyculture ponds. *Aquaculture*, 96: 119–138
14. Wahab, M.A., M.M. Rahman and A. Milstein, 2002. The effect of common carp, *Cyprinus carpio* (L.) and mrigal, *Cirrhinus mrigala*(Hamilton) as bottom feeders in major Indian carp polycultures. *Aquacult. Res.*, 33: 547–556
15. Alim, M.A., M.A. Wahab and A. Milstein, 2005. Effects of increasing the stocking density of large carps by 20% on 'cash' carp–small fish polyculture of Bangladesh. *Aquacult. Res.*, 36: 317–325
16. Rahman, M.M., M.C.J. Verdegem, L.A.J. Nagelkerke, M.A. Wahab, A. Milstein and J.A.J. Verreth, 2006. Growth, production and food preference of rohu *Labeo rohita* (H.) in monoculture and in polyculture with common carp *Cyprinus carpio* (L.) under fed and non-fed ponds. *Aquaculture*, 257: 359–372
17. Azim, M.E., M.C.J. Verdegem, M.M. Rahman, M.A. Wahab, A.A. Van Dam and M.C.M. Beveridge, 2002. Evaluation of polyculture of Indian major carps in periphyton-based ponds. *Aquaculture*, 213:131–149
18. Nandeesha, M.C., B. Gangadhara, J.K. Manissery and L.V. Venkataraman, 2001. Growth performance of two Indian major carps, catla (*Catla catla*) and rohu (*Labeo rohita*) fed diets containing different levels of *Spirulina platensis*. *Bioresour. Technol.*, 80: 117–120
19. Wahab, M.A., M.M. Rahman and A. Milstein, 2002. The effect of common carp, *Cyprinus carpio* (L.) and mrigal, *Cirrhinus mrigala*(Hamilton) as bottom feeders in major Indian carp polycultures. *Aquacult. Res.*, 33: 547–556
20. Islam, M.S., 2002. Evaluation of supplementary feed for semi-intensive pond culture mahseer, *Tor putitora* (Hamilton). *Aquaculture*, 212:263–276
21. Rath, R.K., 2000. *Freshwater Aquaculture*, 2nd edition, p: 421. Scientific Publishers, Jodhpur, India
22. Rahman, M.M., M.C.J. Verdegem, L.A.J. Nagelkerke, M.A. Wahab, A. Milstein and J.A.J. Verreth, 2006. Growth, production and food preference of rohu *Labeo rohita* (H.) in monoculture and in polyculture with common carp *Cyprinus carpio* (L.) under fed and non-fed ponds. *Aquaculture*, 257: 359–372
23. Dhawan, A. and S. Kaur, 2002. Pig dung as pond manure: Effect on water quality,

pond productivity and growth of carps in polyculture system. *World Fish Cent. Quart*., 25: 11–14.

24. Steel, R.G.D., J.H. Torrie and D.A. Dickery, 1997. *Principles and Procedures of Statistics: A Biometric Approach*, 3rd edition, p: 666. WCB/McGraw Hill Book Company, New York.
25. Tahir. M.Z.I., 2008. Studies on partial replacement of fish meal with oil seed meals in the diet of major carps in semi-intensive culture system. *Ph. D. Thesis*, pp: 174–178. Department of Zoology, University of Agriculture, Faisalabad, Pakistan
26. Veerina, S.S, M.C. Nandeesha, S.S. De Silva and M. Ahmed, 1999. An analysis of production factors in carp farming in Andhra Pradesh,India. *Aquacult. Res.,* 30: 805–814
27. Liang, Y., R.Y.H. Cheung, S. Everitt and W.H. Wong, 1999. Reclaimation of wastewater for polyculture of freshwater fish: Fish culture in ponds. *Water Res.,* 33: 2099–2109
28. Keshavanath, P., Shivanna and B. Gangadhara, 2006. Evaluation of sugarcane by-product pressmud as a manure in carp culture. *Bioresour. Technol.*, 97: 628–634
29. Azim, M.E., M.C.J. Verdegem, M.M. Rahman, M.A. Wahab, A.A. Van Dam and M.C.M. Beveridge, 2002. Evaluation of polyculture of Indian major carps in periphyton-based ponds. *Aquaculture,* 213:131–149
30. Islam, M.S., K.A. Huq and M.A. Rahman, 2008. Polyculture of Thai pangus (*Pangasius hypophthalmus*, Sauvage 1878) with carp and prawn: a new approach in polyculture technology regarding growth performance and economic returns. *Aquacult. Res.,* 39: 1620–1627
31. Dhawan, A. and S. Kaur, 2002. Pig dung as pond manure: Effect on water quality, pond productivity and growth of carps in polyculture system. *World Fish Cent. Quart*., 25: 11–14
32. Sahu, P.K., J.K. Jena, P.C. Das, S. Mondal and R. Das, 2007. Production performance of *Labeo calbasu* (Hamilton) in polyculture with three Indian major carps *Catla catla* (Hamilton), *Labeo rohita* (Hamilton) and *Cirrhinus mrigala* (Hamilton) with provisions of fertilizers, feed and periphytic substrate as varied inputs. *Aquaculture*, 262: 333–339
33. Mahboob, S. and A.N. Sheri, 1997. Growth performance of major, common and some Chinese carps under composite culture system with special reference to pond fertilization. *J. Aquacult. Trop.,* 12: 201–207
34. Diana, J.S., C.K. Lin and K. Jaiyen, 1994. Supplemental feeding of tilapia in fertilized ponds. *J. World Aquacult. Soc.*, 25: 497–506
35. Veerina, S.S, M.C. Nandeesha, S.S. De Silva and M. Ahmed, 1999. An analysis of production factors in carp farming in Andhra Pradesh,India. *Aquacult. Res.,* 30: 805–814
36. Abbas, S., I. Ahmed, M. Salim and K. Rehman, 2010. Comparative effects of fertilization and supplementary feed on growth performance of three fish species. *Int. J. Agric. Biol*., 12: 276–280.