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Effect of Dry Poultry Waste on the Physico-chemical and Fish Growth Parameters of Exotic carp, *Cyprinus carpio* at Carp Fish Hatchery (District Badin), Sindh, Pakistan

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Abstract: To test the effectiveness of introducing dry poultry waste and to study its effect on water quality, growth and survival of exotic carp, *Cyprinus carpio*, a six month study was conducted from March to August 2010 at carp fish hatchery, district, Badin, Sindh. The poultry manure was maintained in four management regimes: 500, 1000, 1500 g and control were designated as treatment I, II, III and IV respectively, all treatments were replicated thrice. The physico-chemical parameters like temperature, pH, salinity, total dissolved solids, conductivity and dissolved oxygen of the cisterns were recorded fortnightly with the help of digital portable water quality multiparameter. The significantly (P>0.05) lowest ph and temperature ranges were found (7.9-8.87 and 30.0-34.2 ®C respectively) from treatment I followed by treatment II (8.1-8.97 and 31.8-35.2 ®C respectively) and highest values of pH and temperature were recorded from treatment III (8.2-9.1 31.5-35.7 ®C respectively). Salinity and TDS values in different treatments showed slight variations. The significantly lowest conductivity was noted from treatment I (1220-1786 µS/cm) followed by treatment II (1300-1890 µS/cm) while highest values were obtained from treatment III (1520-2100 µS/cm). The dissolved oxygen values were recorded highest from low dose of waste (4.5-4.9 mg/L) while recorded low with the increasing dose of poultry waste. The results of the growth parameters of the experimental fish showed better growth in terms of mean weight gain, percentage weight gain, specific growth rate, survival rate and production from treatment I followed by treatment II and lowest was from treatment III. It was concluded that the treatment I with 500 g poultry waste was found to be suitable for both water quality and fish growth parameters of the exotic carp, *Cyprinus carpio* from fish hatchery, district, Badin, Sindh.

Keywords: Poultry waste, *Cyprinus carpio*, Fish growth, Physico-chemical parameters

1. INTRODUCTION

The dry poultry waste (manure) is recognized as one of the most suitable organic fertilizer due to its high nitrogen content. The manures applied to produce some necessary plant nutrient which serves as soil fertilizer by putting organic matter (Sloan *et al*., 2003). Among manure used, chicken is preferred because of its ready solubility and high level of phosphorus concentrations (Knud- Hansen *et al*., 1991). Moreover it increases biomass of zooplankton-phytoplankton and benthic organism (Atay and Demir, 1998). It is therefore necessary to have knowledge regarding suitable dose of manures that help to improve water quality factors of fish pond water in a suitable range for modern fish culture. The present knowledge on the use of poultry waste (manure) for optimum production of zooplankton and phytoplankton in the nursery as well as in the grow-out ponds are meager. The objectives of the present investigations to calculate the effect of dry poultry wats (manure) on various water quality parameters (physico-chemical factors) of the cemented cisterns, and to recommended the suitable dose for maximum fish production.

2. MATERIALS AND METHODS

a) Experimental design

The present study was conducted for a period of six months starting from March to August 2010. Twelve cemented cisterns size 145×145 cm (5×5 feet) were selected randomly for the study. These cemented cisterns were located at carp fish hatchery at district Badin Sindh. The water depth 45 cm was maintained throughout the study. The experimental ponds were dried and washed with detergent again dried for three days before starting the experiment. The experiment was conducted in a Randomized Block Design (RBD). There were four treatments with three replications for each treatment. The dry poultry waste/manure was applied once at three doses 500, 1000 and 1500g per cistern. There was also a control where no poultry waste/manure was added. The water samples for determination

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of the physico-chemical parameters of the nursery ponds were taken at every fortnight. Water samples were taken in plastic bottles and chemical analysis was performed according to the methods outlined by (Boyd, 1982).

b) Monitoring of physico-chemical parameters

Various water quality parameters like temperature, pH, conductivity, salinity, TDS, dissolved oxygen were monitored at the field fortnightly with the help of portable digital water quality meter JENCO model # 6231 N and model 3010 made in Taiwan.

c) Fish growth parameters

The experimental fish *Cyprinus carpio* of same size 5.0 g body weight was collected from carp fish hatchery Badin and stocked at the rate of10 fish/pond. The experiment was conducted for period of six months from March to August 2010. Various fish growth parameters like mean weight gain, percentage weight gain, specific growth rate, survival rate and production were recorded monthly with the help of digital electronic balance. For the computation of the data, ANOVA test was applied as suggested by (Steel and Torrie 1981).

3. RESULTS

a) Effect of poultry waste on physico-chemical parameters

Various physico-chemical parameters were studied at the field fortnightly during the month of March to August 2010 like temperature, pH, conductivity, salinity, TDS, dissolved oxygen.

The range and mean values of the all physico-chemical parameters in different treatments and control as recorded from the cemented cisterns of Badin fish hatchery are shown in (Table 1). The significantly highest values of pH were recorded in the month of April in treatment III (9.10) while significantly lowest values were recorded in the month of August in treatment I (7.9). The temperature values were significantly highest recorded in the month of June in treatment III (35.7 ^{o}C) while significantly lowest values were recorded in the month of March in treatment I (30.0 ^{o}C**).** The TDS values were found highest in the month of June in treatment III (1.86mg/L) while lowest values were recorded in the month of March in treatment I (0.65). The values of conductivity were found to be highest in the month of June in treatment III (2100 µS/cm) while lowest values were recorded in the month of August in treatment I (1220 µS/cm). The salinity values were range between (0.8 – 1.60 mg/L) throughout the study period. The dissolved oxygen were recorded highest in the month of April in treatment I (4.50 mg/L) and lowest were obtained in the month of August in treatment III (3.00mg/L) (**Table 1).**

b) Effect of poultry waste on fish growth Growth performance of *C. carpio* in terms of mean initial weight, mean final weight, mean weight gain, percentage weight gain, specific growth rate (% per day) survival rate and production (kg/m^2) are shown in table 2. The significantly ($p<0.05$) highest weight gain of fish (37.2 g) was obtained in treatment I followed by treatment II (27.5 g) and the significantly ($p<0.05$) lowest (20 g) was recorded in treatment III. The significantly ($p<0.05$) highest percentage weight gain (844%) was recorded in treatment I followed by treatment II (550%) and the significantly ($p<0.05$) lowest (500%) was noted in treatment III. The specific growth rate (SGR % per day) of fish was found to be highest (0.5175) in treatment I followed by II (0.4136) and lowest was (0.3904) in treatment III. The significantly ($p<0.05$) highest (100%) survival of fish was observed in treatment I followed by II (85%) while lowest (65%) survival of fish was recorded in treatment III. The significantly highest ($p<0.05$) production rate (0.767 kg/m^2/180 days) was obtained in treatment I followed by II (0.425 kg/m^2/ 180 days) while lowest (0.295 kg/m^2/180 days) in treatment III. The mean initial weight 5.0 g was reached to a final weight 42.20 g, 27.50 g, 25.0 g and 19.70 g in treatment I, II, III and control respectively **(Table 2)**.

Table 1. Showing variation in water quality parameters in different treatments over a period of six months at Carp Fish Hatchery District Badin Sindh.

PARAMETERS	TREATMENT I		TREATMENT II		TREATMENT III		CONTROL	
	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN
pH	7.9-8.8	8.35 ± 0.05	8.1-8.9	8.5 ± 0.58	8.2-9.1	8.65 ± 0.41	8.0-8.5	8.25± 0.70
TEMPERATUR ^{0}C	30.0-34.2	32.1 ± 0.05	31.82-35.2	33.5 ± 0.09	31.5-35.7	33.6 ± 0.79	30.12-32.7	31.45 ± 0.69
Conductivity µS/cm	1220-1572	1396 ± 10.0	1300-1711	1505.5 ± 14.5	1520-1944	1732 ± 18.0	1200-1365	1282.51 ± 5.5
SALINITY mg/L	0.9-1.0	0.95 ± 0.05	1.0-1.45	1.22 ± 0.10	1.1—1.6	1.35 ± 0.13	0.8-1.0	0.90 ± 0.10
DISSOLVED OXYGEN mg/L	3.6-4.5	4.05 ± 0.05	3.0-3.9	3.45 ± 0.1	2.9-3.8	3.35 ± 0.45	4.0-4.60	4.30 ± 0.70
TOTAL DISSOLVED SOLIDS mg/L	0.65-1.0	0.825± 0.05	0.65-1.55	1.1± 0.08	0.65-1.86	1.255± 0.02	0.65-0.67	0.66 ± 0.03

± SD = Standard Deviation

Table 2. Showing the fluctuation in fish growth in different treatments over a period of six months at Carp Fish Hatchery District Badin Sindh.

Parameters	Treatment I	Treatment II	Treatment III	Control
Mean Initial weight (g)	5.00 ± 0.49	5.00 ± 0.50	5.00 ± 0.80	5.00 ± 0.50
Mean Final weight (g)	42.20 ± 2.80	27.50 ± 2.50	25.00 ± 1.0	19.70 ± 1.30
Mean weight gain (g)	37.20 ± 2.80	22.50 ± 1.50	20.00 ± 1.0	14.70 ± 1.30
% weight gain	844	550	500	394
Survival %	100 ± 0.0	85 ± 1.5	65 ± 3.5	60 ± 4.0
SGR % per day	0.5175 ± 0.025	0.4136 ± 0.03	0.3904 ± 0.016	0.3326 ± 0.014
Production kg/m^2	0.767 ± 0.23	0.425 ± 0.20	0.295 ± 0.15	0.214 ± 0.16

± SD = Standard Deviation

4. DISCUSSIONS

Physico-chemical parameters of water play a significant role in the biology and physiology of fish. During the present investigation it was observed that water quality parameters of the cemented cisterns were found to be within the suitable ranges in treated as well as control condition Jhingran (1991) recorded similar observation. The biological productivity of any aquatic body is generally judged through the qualitative and quantitative estimation of plankton, which form the natural food of fish (Ahmed and Singh 1989), animal wastes lead to increase biological productivity of ponds through various path ways which result in an increase in fish production. In present study, the biological parameters of water total planktonic growth showed significantly higher in the treated pond as compared to control. This may be due to high level of water-soluble phosphates in the poultry manure. The different type of animal waste resulted in different structure of phyto and zooplanktons. There was autochthonous production of plankton in all treatments. High application rates of poultry manure in treatment III significantly ($p<0.05$) increased salinity, pH, conductivity, TDS, temperature, values of the water incorporated from organic manure application as well as metabolism of the water body, might be considered an index of environmental stress (Jana and Chakrabarti, 1993). In our experiment, lower DO values were recorded in the treatment II and III difference of the relative abundance of some plankton may contribute to the differential growth of the *C. carpio.* Lower weight gain, SGR and survival in the control treatment may be attributed to the insufficient quantity of zooplanktons and phytoplankton in the system (Szlaminska and Przybye, 1986). Zoobenthos form essential food items of many cultivated fishes in Indian ponds (Jhingran, 1991). It is well known that

high fish yield of fish can be achieved by higher abundance of plankton in culture system However, it is not possible to increase the application rate of organic manures after a certain limit because this may reduce water quality, which cause stress for production of essential plankton thereby causing adverse effect on fish growth. Studies on life history parameters of *Daphnia* sp. and *Moina* sp. (Jana and Chakrabarti, 1993) reported that the reproductive potentials and longevity of each species are affected by the nutrient conditions of the culture media. (Dhawan and Kaur 2002) reported a decrease in cladoceran population with increased organic manure application in ponds. The presence of relatively higher density of plankton in treatment I compared to treatment II and III could be consequence of relatively suitable environment in terms of water quality and food abundance (Jana and Chakrabarti, 1993). As a result, the weight gain of *C. carpio* was significantly higher ($p<0.05$) in the treatment I compared to the treatment II and III respectively. Similar decline in plankton biomass due to undesirable water quality with very high amounts of fertilizers have been reported by many authors (Lin *et al.*, 1997; Garg and Bhatnagar, 1999; Azim *et al*, 2001; Cheikyula *et al*, 2001). The significantly higher level of nutrients in the treatment II and III, perhaps lowered the grazing activity by carp in these two treatments compared to the treatment I. In the present investigation, an application of 500g/m^3 appeared to be the most suitable for *C. carpio*. Higher application rates reduce water quality, deplete the plankton population and cause adverse impact on the growth of the *C. carpio*. Further research on husbandry management of *C. carpio* needs to be conducted. The water quality parameter and their fluctuation during the study period as shown in table 1 were found in the suitable range. Temperature recorded 30.0 to 32.7 ^{o}C during the study period which was similar to that reported by Mumtazuddin *et al*., (1982) and Rehman *et al*. (1982) in selected ponds. The dissolved oxygen values during the experimental period were found between 3.3 to 4.5 mg/L, which accords with findings of Rehman *et al*., (1982) in ponds. The pH and salinity ranged from 7.9 to 9.1 and from 0.8 to 1.6 mg/L respectively which was similar as reported by Swingle (1967). In the present study conductivity showed high value ranges from 1200µS/cm to 2100µS/cm which might be due to high poultry manure. Rehman (1992) has reported the similar observation.

The present study on the growth and survival or *C. carpio* under different poultry manure reared in cemented cistern. The results indicated that the growth rate of *C. carpio* varied in different treatment. Treatment I showed the best result in terms of growth production. Many authors (Chaitiamvong, 1977; Ahmed *et al.,* 1983; Hoque *et al*., 1984; Azimuddin *et al*., 1999) have reported the highest growth in different fish species with lower dose of poultry manure and lowest growth in high dose of poultry manure but in case of *C. carpio* during the present study the highest growth rate was observed in treatment I with low dose of poultry manure Usui (1974) and Nasar (1997) have reported similar observation in *Anguilla anguilla* and *Monopterus cuchia* and suggested to use higher density of 1000 and more per square meter. It might be due to the habit of the eels, which like to live in groups and in confined place and it is an air breathing fishes. NO mortality was recorded in treatment I (with low dose) and mortality was increased when increase in the dose the high mortality was recorded in treatment III during the present investigation. The highest survival and production rate was observed in treatment I followed by II and the lowest was in treatment III which is be due to high dose of poultry manure. Narejo *et al.,* (2002) reported 100%survival rate in *P. boro* fed with different food items, the present study findings in accordance with the above findings.

6. CONCLUSION

On the basis of the above study it is concluded that the lower dose (500g) of poultry manure was found to be suitable for both physico-chemical parameters of the cemented cisterns and fish growth parameters.

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