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Impact Of Indiscriminate Use Of Cow-Dung On The Physico-Chemical Parameters Of Nursery Ponds Of Chilya Fish Hatchery District Thatta, Sindh

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Abstract: The present study was planned to study the effects of the application of cow dung on the physico-chemical parameters and growth performance of major carp, *Cirrhinus mrigala* of the nursery ponds of Chilya fish hatchery, district Thatta, Sindh. The experiment was conducted for six months from March to August 2008, using ten nursery ponds size about 450 × 1500 cm (15 × 50 feet). Cow dung was applied once to the experimental nursery ponds at the rate of 5, 10 and 15 kg per nursery pond and one control without manure. The results of the study effect of cow dung on physico-chemical parameters indicated that cow dung treatments had significant effect on the water transparency, dissolved oxygen (DO) and biochemical oxygen demand (BOD) of the treated ponds. The pH and total hardness of the water were not affected by the cow-dung treatment. For the study of growth performance of major carp, *Cirrhinus mrigala* each nursery pond was stocked with 20 Morakhi, of mean initial weight of 6.40 ± 1.60 g. The results indicated that the significantly ($p>0.05$) highest growth and survival of experimental fish was obtained from treatment II (10 kg cow dung/pond) followed by treatment III. While significantly ($p<0.05$) lowest growth was recorded from control and treatment I. The above findings indicated that the proper manuring with organic fertilizers have considerable importance in environment and fish culture. Therefore it is concluded that the dose of cow dung (10 kg/pond) was suitable for the physico-chemical parameters and the growth of major carp *Cirrhinus mrigala* in nursery pond.

Keywords: Cow-dung, Physico-chemical parameters, Fish Hatchery, Chilya

1. INTRODUCTION

The physic-chemical parameters (water chemistry) of any water body are termed as essential pre-requisite before starting any fish culture operation. The limnological characterization of water used for aquaculture system is essential, because these parameters have direct relationship with fish growth parameters such as feed conversion ratio (FCR), specific growth rate (SGR) and weight gain (Mahboob and Sheri, 2002). The change in the physico-chemical parameters may effect production of aquatic biota (phyto-zooplankton) and their diversity in different seasons (Odum, 1971). The aquatic biota (biomass) phyto-zooplankton relationship of fish pond is governed by few limnological parameters that help to maintain pond productivity (producers) and growth of microphytes in a desirable quantity (Mahboob *et al*., 1988a and Hasssan, 1998). Manuring is one of the most important steps in management and fertilizations of fishponds for the culture and propagation of fries and fingerlings of carps. The organic fertilizers (manures), dry poultry waste and cow dung manure is cheap and available. These manures are frequently used for the growth of aquatic microphytes (phyto-zooplankton) which in tern used as food for the fish and also help to regulate water quality characters of fishponds (Mirza *et al*., 1990). But cow dung upon addition to fishponds starts decomposition and reduction of dissolved oxygen (suffocation) in fishponds and responsible for the mass mortality of microorganisms and produces unpleasant smell which resulted into heavy fish mortality. The use of cow dung manure as fertilizer for the optimum growth of phyto-zooplankton (producers) in fishpond and nursery ponds is insufficient. The pond production is directly proportionate upon the growth of aquatic biota and microorganisms present (suspended) in the water body. Changes in the planktonic biomass depend upon physico-chemical environment of the water body (Boyd, 1982; Mahboob *et al*., 1988a; 1993a; 1993b). The production of planktons in the water body is directly related with few variables of water quality (Visisht and Jindal, 1980; Forsyth *et al*., 1983). The fish culture operations solely dependent upon the mass production of primary producers (phyto-zooplanktons) that not only served as natural food for the fish but help to maintain ecosystem of the fishpond (Manjunatha and Shetty, 1991). The nutrient content of the water body that helps to increase primary productivity varies with the seasons and sudden climatic changes. The pond fertilization techniques through the application of organic manure (cow dung) helps to overcome nutrient deficiencies that in turns helps to get maximum fish production from the manure treated fish ponds with desirable doses (Yamada, 1986; Alam *et al*., 1996). In

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fish ponds the cow dung manure has been used for centuries to increase fertility and primary productivity, still no work on the optimum or standard dose of organic manure (cow dung) has yet been studied (Zhu *et al*., 1990). (Moav *et al*., 1977) suggested that the fish production may be increased many times in fishponds under poly culture system treated with cow dung manure. However very little information is available regarding the use of organic fertilizer and manures for the maximum production of microorganisms and fish, but still the suitability of manures could not available and its quantity (dose) for the optimum fish production (Wahid *et al*., 1997). Due to the lack of scientific knowledge on these lines, the indiscriminate use of cow dung creates environmental degradation in most of the fishponds, which would result in heavy fish mortalities. Keeping in mind the proposed study has been planned to supply scientific knowledge to the fish farmers on the proper use of cow dung to increase primary pond productivity. The objectives of the proposed study were to evaluate the effect of cow dung on the water quality (Limnological parameters) of the nursery ponds. To recommend suitable dose of cow dung for the maximum production of phyto-zooplanktons to study the impact of cow dung on the various fish growth parameters.

2. MATERIALS AND METHODS

The present investigations on the effect of cow-dung on physico-chemical parameters and fish growth were carried out for a period of six months starting from March to August 2008 at Chilya Fish Hatchery, District Thatta, Sindh. Ten nursery ponds 15 × 50 feet were selected randomly for this study. The nursery ponds were rectangular in shape with an average depth of 60 cm. The experimental nursery ponds were dried, limed (250kg/ha), fertilized with inorganic (75kg T.S. P/ha) and organic fertilizer 10,000 cow dung/ha) well ahead of time. Under ground water from a deep tube –well was introduced to the ponds 7 days before initiation of the experiment. There were three treatments each had three replications and one control with out cow dung was applied once at three doses 5, 10 and 15 kg/pond. The water samples to determine various physico-chemical parameters such as Water temperature b) Water transparency c) Color of water d) pH of water e) Dissolved oxygen f) Free carbon dioxide g) Biochemical oxygen demand h) Total hardness i) Ammonia nitrogen j) Nitrate nitrogen and k) Phosphate phosphorus from the experimental nursery ponds were collected after fifteen days interval and the chemical analysis were performed by using sensitive portable electronic multiparamter meter (model Jenco 340, made in Taiwan) was used in the field and laboratory (Fig. 3.3). Computation of data and ANOVA test were carried out as suggested by Steel and Torrie (1981). The experimental fish (*Cirrhinus mrigala*) of same size (6.40±1.60g) was collected from the Chilya fish hatchery district Thatta, Sindh. The experimental fish were stocked at the rate of twenty fish per nursery pond, various growth parameters like mean initial weight, mean final weight, mean weight gain, percentage weight gain, SGR (specific growth rate% per day), survival rate and production was determined from the fish samples collected on monthly basis for a period of 6th months. For the comparison of various treatment means Duncan's new multiple range test (DNMRT) was performed.

3. RESULTS

a) Physico-chemical parameters

The result of the studies on the physico-chemical properties such as water temperature, transparency, water color, dissolved oxygen, bio-chemical oxygen demand, free carbon dioxide, pH and total hardness are described as follows.

Water temperature

During the period of investigation, the water temperature of the treated and control ponds varied between 23.1to31.0°C from March to August **(Table 1).** The fluctuation of water temperature was found to have no relationship with cow dung treatments **(Fig. 1).**

Table.1 Mean values of the physico-chemical parameters of the nursery ponds of Chilya fish hatchery District Thatta, Sindh during the study period March to August 2008.

Parameter	Treatment I	Treatment II	Treatment III	Control
Temperature °C	32.5 ± 0.50	33.0 ± 0.50	34.0 ± 0.50	32.0 ± 0.50
Water Transparency (cm)	55.0 ± 1.50	32.0 ± 1.33	31.0 ± 1.20	68.0 ± 1.50
Color of water	Light brown	Greenish brown	Greenish brown	Green
pH	7.4 ± 0.6	7.6 ± 0.40	7.3 ± 0.70	7.8 ± 0.20
Dissolved Oxygen (ppm)	5.5 ± 0.10	5.9 ± 0.50	5.0 ± 0.15	5.4 ± 0.60
CO2 (ppm)	8.1 ± 1.90	7.5 ± 1.50	9.5 ± 2.50	3.1 ± 2.50
B.O. D. (mg/l)	2.2 ± 0.80	2.5 ± 0.50	3.70 ± 0.30	1.1 ± 0.90
Total hardness (ppm)	32.0 ± 0.50	30.5 ± 0.50	31.5 ± 0.50	30.5 ± 0.50

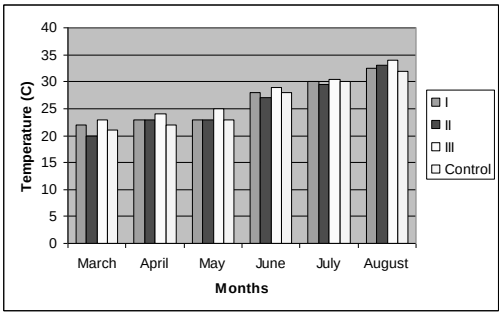


Fig.1. Month-wise variation of temperature in different treatments from the fish hatchery District Thatta, Sindh.

Water transparency

The water transparency of the treated ponds was in the range of 30.0 to 70.0 cm. The highest transparency of 70 cm was recorded in the control ponds where no cow dung was applied. The cow dung treatments appeared to have affected the water transparency of the treated ponds to a significant extent ($p<0.05$). A marked reduction in the values of transparency was observed in the treated ponds **(Fig. 2).**

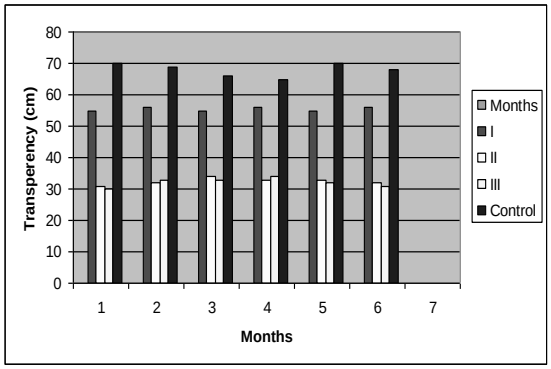


Fig. 2. Month-wise variation of transparency in different treatments from the fish hatchery District Thatta, Sindh.

Color of water

The color of water in the treated ponds was found to vary from light brown to greenish brown and vice versa. The change in water color was related to the amount of cow dung added to the experimental ponds. The control ponds much clearer than the treated ones. The color of the water of the treated ponds appeared to have been largely influenced by the presence of dense population of the planktons.

pH of pond water

The mean values of pH in the control ponds was 7.5 which was not significantly different ($P<0.05$) from those in treatment I and II. But the values of pH in treatment III was significantly lower than that of control and in treatment I and II **(Fig. 3).**

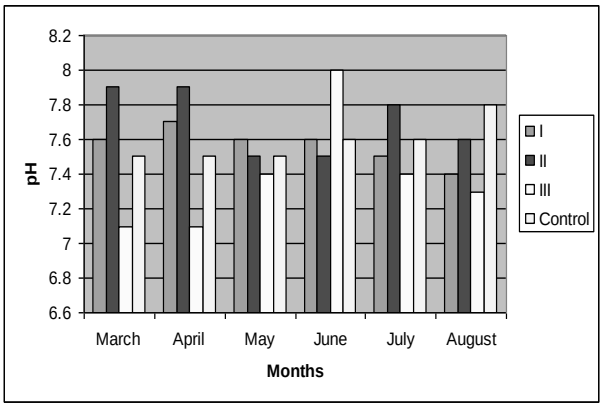


Fig. 3. Month-wise variation of pH in different treatments from the fish hatchery District Thatta, Sindh.

Dissolved oxygen

The concentration of dissolved oxygen was comparatively higher in treatment I and II. Though dissolved oxygen was lower in treatment III but it was not statistically different from that in control treatment **(Fig. 4).**

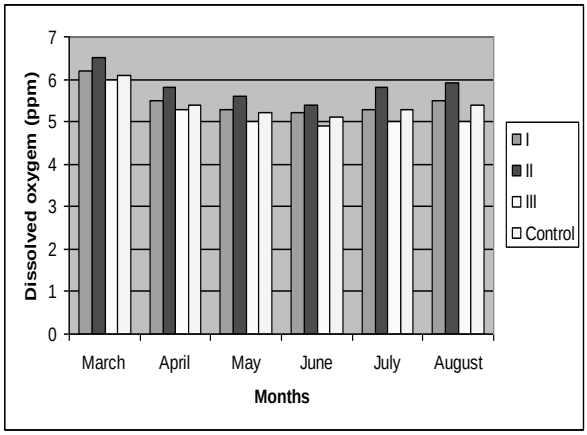


Fig.4. Month-wise variation of dissolved oxygen in different treatments from the fish hatchery District Thatta, Sindh

Biochemical oxygen demand (BOD)

The BOD values of the nursery ponds charged with cow dung at 5, 10 and 15 kg/pond ranged between 2.08 to 3.87 ppm. The value of BOD in control treatment was ranged between 0.80 to 1.20 ppm. It is evident from the present study that cow dung treatment had significant effect on the BOD level of the treated ponds **(Fig. 5).**

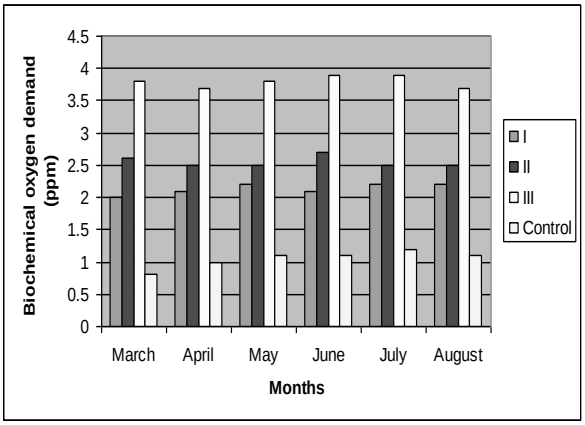


Fig. 5. Month-wise variation of biochemical oxygen demand (BOD) in different treatments from the fish hatchery District Thatta, Sindh

Free carbon dioxide

It is evident from the tables that carbon dioxide was always higher in treated ponds. The cow dung manure had significant ($P<0.05$) effects on the carbon dioxide content of the treated ponds. The values of the free carbon dioxide in the present study ranged between 2.90-10.80 ppm **(Fig. 6).**

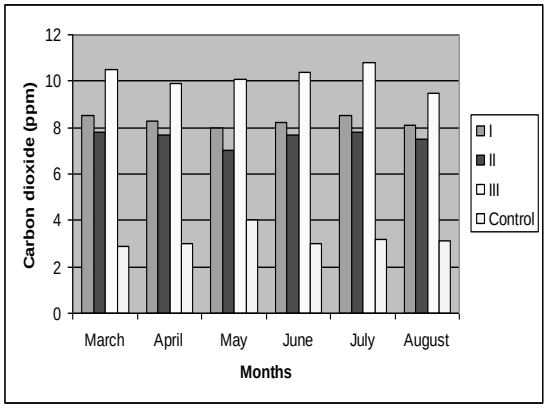


Fig. 6. Month-wise variation of free carbon dioxide in different treatments from the fish hatchery District Thatta, Sindh

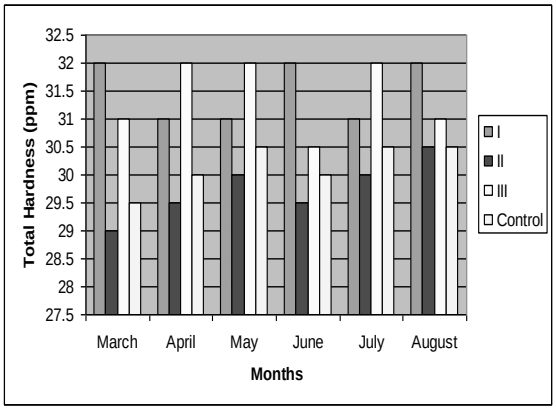


Fig.7Month-wise variation of free total hardness in different treatments from the fish hatchery District Thatta, Sindh

Total hardness

Total hardness content of the control and treated ponds through out the study period was with in the range of 29.5 to 33.0 ppm. Cow dung manure seems to have no significant ($P<0.05$) effect on the total hardness content of the treated ponds **(Fig. 7).** The comparison of various physico-chemical parameters of cow dung treated ponds of Chilya fish hatchery district Thatta, Sindh were tested with ANOVA are shown in **(Table 2).**

b) Fish growth parameters

The growth and production data of experimental fish *Cirrhinus mrigala*, in terms of mean initial weight, mean final weight, mean weight gain, percentage weight gain, SGR (specific growth rate % per day), survival and production reared in different treatments of cow dung is shown in **(Table 3)**. The mean initial weight of 6.40 ± 1.60 g of the experimental fish reached to mean final weight of 76.84, 120.5 and 95.43 g in treatment I, II and III respectively. It was observed that the treatment II with (10 kg/cow dung/pond) yielded significantly ($P<0.05$) highest growth, survival and production followed by treatment II, while significantly ($P<0.05$) lowest growth, survival and production was recorded from control and treatment I (Table 3). It is therefore concluded that the cow dung (10 kg/cow dung/pond) found to be suitable dose for both physico-chemical parameters and fish growth parameters in nursery ponds of Chilya fish hatchery district Thatta, Sindh

Table 2. ANOVA for determination of the effects of cow dung treatment on the physico-chemical parameters of the nursery ponds at Chilya fish hatchery district Thatta, Sindh.

Source of variation	D.F	Water Ttransparency		pH		D.O		CO_2		BOD		Hardness	
		MS	F	MS	F	MS	F	MS	F	MS	F	MS	F
Treatments	3	272.0	12.9*	0.21	4.20	1.82	15.1*	6.4	40*	4.52	41*	71.6	4.70
Replications	3	2.4	0.08	0.01	0.20	0.10	0.83	0.10	0.62	0.04	1.27	8.91	0.58
Error	6	28.7		0.05		0.12		0.16		0.11		15.2	
Total	12												

* = Significant at 5% level Tabulated F (3.6) 0.05 = 4.76

Table 3. Data of growth and production of *Cirrhinus mrigala* reared in different treatment of cow dung at nursery ponds of Chilya fish hatchery district Thatta, Sindh. (Through out the study period).

Parameters	Treatment I (5 kg cow dung/pond)	Treatment II (10 kg cow dung/pond)	Treatment III (15 kg cow dung/pond)	Control With out cow dung
Mean initial weight (g)	6.40 ± 1.60	6.40 ± 1.60	6.40 ± 1.60	6.40 ± 1.60
Mean final weight (g)	76.84 ± 1.80	120.5 ±2.10	95.43 ±1.10	33.55 ±1.66
Weight gain (g)	70.44	114.10	89.03	27.15
% weight gain	1200	1882	1491	524
SGR (% per day)	1.38	1.63	1.50	0.92
Survival rate (5)	80	100	90	60
Production Kg/pond/180 days	5.122	8.033	6.36	2.236

3. DISCUSSIONS

The water quality parameters of any water body are the pre requisite for the subsequent studies on the biology of a particular fish. In the present study the physico-chemical parameters of water in different manure treatments and control pond remain within the favorable limits as required for the carps culture practices (Jhingran 1991). Water temperature, pH, dissolved oxygen, biochemical oxygen demand, free carbon dioxide, transparency and total hardness of the nursery ponds of Chilya fish hatchery did not differ significantly between different treatments. In the present study a marked reduction in values of transparency was observed in the treated ponds might be due to the presence of large number of phyto- and zooplankton. The color of the water of the treated ponds appeared to have been largely influenced by the presence of dense population of the plankton. The present results agree well with the findings of Bamforth (1958, Banerjee *et al*., (1979) and Mirza *et al*., (1990). The low values of pH in treatment III in the present study might be due to the periodic release of carbon dioxide (CO_2) from decomposition of cow dung manure. During decomposition of organic manure carbon dioxide is released which then reacts with water and produces carbonic acid. The carbonic acid dissociates into H^+ and HCO_3 as a result of which a marked reduction in pH values takes place (Ruttner, 1955; Boyd, 1979; Mirza *et al*., 1990; Mahboob and Sheri 2002). The higher concentration of dissolved oxygen in some of the treated ponds in the present study were found to be associated with the maximum abundance of phytoplankton which suggest that it was due to the photosynthetic activities of the algae. The present findings are in agreement with those reported by Laskshminarayana (1965), Schroeder (1978), Boyd, (1979), Mirza *et al*., (1990), Alam *et al*., (1996) and Wahid *et al*., (1997). The persistent high values of carbon dioxide as encountered in the treated ponds during the present investigations seemed to be related with the decomposition rate of cow dung manure and high respiratory activities of the zooplankton. Michael (1969), Schroeder (1974), Mirza *et al*., (1990) and Alam *et al*., (1996) also arrived to a similar conclusion. It is evident from the present study that cow dung treatment had significant effects on the BOD level of the treated pond. It deserves of special mention here that BOD values were high (3.90 ppm) in the months of June and July in treatment III with (15kg cow dung/pond) which is indicative of the rapid rate of decomposition suggesting possible water pollution. Though BOD values were fairly high in the present study but such values were not too high as reported by other workers. Banerjee, *et al*., (1979) reported to have recorded BOD values of 8.1mg/l in ponds treated with 10 kg cow dung/ha. Mirza *et al*., (1990) observed the BOD values of 3.87 ppm from nursery ponds treated with 10 kg cow dung/ha. Schroeder (1974) suggested that BOD of any decomposable organic matter should judge based on their percent dry matter content. The apparent deviation of BOD values of the cow dung from that of Banerjee *et al*., (1979) seemed to be due to the difference in the ambient temperature and dry matter content of the cow dung manure. The data in the present study indicated that the application of cow dung at the rate of 10 kg/pond was found to be with in the acceptable range as far as BOD is concerned. Cow dung manure seems to have no significant ($P<0.05$) effect on the total harness content of the treated ponds in the present findings. This might probably be due to insufficient calcium content of the cow dung use in the present study. Similar observations have been reported by various authors Mirza *et al*., (1990), Alam *et al*., (1996), Mahboob and Sherry (2002), Jha *et al*., (2004) and Sayeed *et al*., (2007). The growth performance of *Cirrhinus mrigala* in the present investigations on the effect of cow dung on the physico-chemical parameters and fish growth at carp fish hatchery district Thatta, Sindh, showed that the significantly ($P<0.05$) highest weight gain (114.10 g), percentage weight gain (1882), SGR (% per day) (1.63), survival rate (100%) and production (8.033 kg/pond/180 days) was obtained from treatment II with (10 kg cow dung/pond), followed by Treatment II (15 kg cow dung/pond) while significantly lowest weight gain (70.44 and 27.15), percentage weight gain (1200 and 524), SGR (1.38 and 0.92) survival (80 and 60) and production (5.122 and 2.236 for treatment I and control respectively) was recorded from Treatment I (5 kg cow dung/pond) and control with out cow dung. Wahid *et al*., (1997) found significantly high growth of benthophagus fish *Cirrhinus mrigala* reared under poly culture system with other major carps in cow dung manure treated ponds. These results are in accordance with the present findings. The significantly highest survival rate of *C. mrigala* in the present study was obtained in treatment II (with 10 kg/cow dung/pond. Vohra (2011) found similar survival rate of *C. carpio* in treatment I and II (with 500 g poultry manure/pond) from carp fish hatchery district Badin, Sindh. The mean weight gain during the present course of studies was found to be high from treatment II. Jha, *et al*., (2004) used low dose (10 kg/pond) of cow dung manure and poultry excreta to study effect of manures on water quality and fish growth of *C. carpio*. They found a dose of 10 kg/pond for the optimum for both water quality and fish growth parameters. The present study findings agreed with the findings of Jha *et al*., (2004).

It is therefore, concluded that the dose of 10 kg cow dung/pond found to be acceptable for the better water quality management and fish growth parameters at Chilya fish hatchery district Thatta, Sindh.

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