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Effects of inorganic fertilizer and a combination of cowdung and chicken manure on growth and survival of common carp (*Cyprinus carpio*)

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Abstract: The present experiment was conducted for a period of five months from July to November, 2004 to evaluate the effects of Urea and Triple Super Phosphate and a combination of the same with cowdung and with chicken manure on the growth and survival of common carp fingerlings (*Cyprinus carpio*). Three treatments namely- T_1 (Urea: 100 kg/ha. + TSP: 50 kg/ha), T_2 (Urea: 100 kg/ha. + TSP 50 kg/ha + chicken manure: 2000 kg/ha) and T_3 (Urea: 100 kg/ha. + TSP 50 kg/ha + cowdung: 4000 kg/ha) were used in three replications. The physico-chemical factors such as temperature, transparency, dissolved oxygen and pH were considered in the present study and they were found within the productive range in all the treatments. The highest growth (199.5 g) of fish was found in T_2 in the month of November and the lowest growth rate (43.10 g) of fish was found in T_1 in the month of August. On an average, the highest growth rate at the fish (199.5 g) was recorded with the treatment T_2 whereas the lowest growth rate (154.10 g) was recorded in T_1. The highest average survival rate (87.87%) and the lowest (75.75%) were also recorded in T_2 and T_1, respectively. Among different treatments, T_2 was the best one with respect to growth and survival of the fishes. Therefore, the treatment comprising Urea: 100 kg/ha. + TSP 50 kg/ha + chicken manure: 2000 kg/ha may be recommended in the field.
Key words: Inorganic fertilizer, manure, growth, survival and production.

Introduction

Fertilization is the cheapest and simplest means of increasing aquatic productivity. Both organic and inorganic fertilizers are used in fish pond. The usefulness of different kinds of manures such as poultry dropping, dung of cow, sheep and goats is established in fish culture and they are the suitable substitutes for the costly feeds and inorganic fertilizers currently in use (Alikunhi, 1957; Banerjee *et al.*, 1979). David *el al*. (1969) concluded that poultry manure is the best as it contains highly soluble inorganic salts unlike other organic manures and is required in much lower quantifies. Rappaport *et al.* (1977) observed that chicken manures were the most efficacious and profitable manure in promoting fish growth. Sometimes, organic fertilizers decay and exert an oxygen demand and excessive application may result in depletion of dissolved oxygen. Therefore, it should be applied very carefully to avoid the above situation. On the other hand, Saha (1978) reported that chemical fertilizers enhanced the more growth of phytoplankton and less growth of zooplankton. The use of inorganic fertilizers are limiting due to their high cost. Moreover, over doses of inorganic fertilizers may have adverse effect on the structure and function of the community of an aquatic habitat and also for limnological aspects of the waterbodies. In facts, fish farming is a practical application of limnology and freshwater biology. The physico-chemical properties play the most important role in governing the production of planktonic organisms or primary production in fish ponds (Baneijee, 1967). There is also a Global warning to the irrational use of inorganic fertilizer which is degrading water quality day by day with the multiple applications. So it would be feasible to apply both organic and inorganic fertilizers together in a waterbody for maximizing fish production and consequently minimizing the degradation of water quality. Jhingran and Pullin (1985) suggested different doses of combination organic and inorganic fertilizers for increasing growth and survival of fingerlings. Dinesh *et al.* (1986) reported that a combination of 100 kg/ha urea with 2000 kg/ha poultry manure is the safe and economical dose for carp culture. There is no recommended dose of organic-inorganic fertilizers or its combination to be used for fish culture in our country. Considering the above facts, the research was conducted with the view of determination of the effects of various doses of fertilizers on the physico-chemical conditions and on the growth and survival of common carp.

Materials and Methods

Study area and period: The experiment was conducted for a period of four months from August to November, 2004, which are situated at the south-west of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. All of these ponds were rectangular in shape, each having a surface area of 0.004 hectare. The ponds were made ready to turn the experiment taking all: (i) Aquatic vegetations were cleared off by repeated cutting, (ii) All the undesirable species of the ponds were eradicated through repeated use of cast and seine net, (iii) Liming was done at a rate of 247 kg/ha before seven days of fertilization.

Fertilization: Three treatments namely - T1 (Urea + TSP), T_2 (Chicken manure + Urea + TSP) and T_3 (Cowdung + Urea + TSP) were used for the present study. Inorganic fertilizers namely urea, triple super phosphate (TSP) and organic manure namely chicken manure, cowdung were used for the present study. Urea, TSP., chicken manure and cowdung were applied at the rate of 100, 50, 2000 and 4000 kg/ha, respectively into the ponds. Chicken manure and cowdung were applied into the ponds as a slury on wet weight basis. Fertilization was done fortnightly.

Stocking: After one week of the initial fertilization, the ponds were stocked with 8,000 fingerlings/ha. The weight of the fingerling was recorded at the time of stocking in the ponds.

Water quality parameters: Physico-chemical factors play an important role in the productivity of ponds. Therefore, the water quality parameters like temperature, transparency, pH and dissolved oxygen (DO) of the water were measured biweekly between 9 a.m. to 11a.m. during the study peirod. Water temperature and dissolved oxygen were recorded by DO meter (YSI, Model 58). The pH of pond water was measured by pH meter (Jenway, Model

3020), and the transparency of water was recorded by a Secchi disc.

Growth performances of fish: The growth rate of fish was recorded monthly in weight (g). For measuring the growth rate, about one third of the total fish released into pond were caught with the help of cast and seine net.

Statistical analyses: All the data these were recorded in the present experiment were statistically analysed using SPSS software and if the main effects were significant then it was separated by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Water temperature: The mean values of water temperature in different treatments are shown in Table 1. No significant variation of water temperature was observed among the treatments. During the period of investigation the water temperature of the treated ponds varied from 24.40 ^{0}C to 30.13 ^{0}C. The highest water temperature (30.13 ^{0}C) was recorded in the month of August with the treatment T_2 and the lowest water temperature (24.40 ^{0}C) was recorded in the month of November with the treatment T_3. The highest and the lowest value of water temperature might be due to bright sunshine and cold weather respectively, during the sampling time. Ganapati (1941) reported lowest temperature during November December and highest temperature during April - May. Goolish and Adelman (1984) were recorded maximum growth rate at 30 ^{0}C temperature of juvenile common carp.

Transparency: The mean value of water transparency in different experimental ponds is presented in Table 1. Water transparency of the treated ponds varied from 26.13 to 35.44 cm. The maximum and minimum values of water transparency were recorded with the treatments T_1 and T_2 in the month of August and November respectively. The average values of water transparency of all the treatments were more or less same. No significant differences were observed among the water transparency. Karim (1977) recorded the maximum and minimum water transparency in June and January respectively. Bruce *et al.* (1975) recorded the highest values of transparency in May and the lowest in September.

Table 1. Mean ±SD values of different water quality parameters observed during study period

Parameters	N	TC	TACF	TSBF
Temperature (ºC)	15	29.21 ± 2.25	30.23 ± 1.24	30.33 ± 3.24
Transparency (cm)	15	34.26 ± 6.57	28.77 ± 3.51	27.46 ± 2.41
pH range	15	7.2 - 9.5	6.7 – 8.6	6.3 – 8.8
Dissolved oxygen (mg l^{-1})	15	5.73 ± 0.07	5.81 ± 0.08	5.76 ± 0.75
Ammonia (mg l^{-1})	15	0.06 ± 0.02^b	0.15 ±0.06^a	0.17 ± 0.05^a

Different superscripts values indicate significant difference at 0.05 levels

Dissolved oxygen (DO): The average concentration of dissolved oxygen content of the water was more or less same (Table 1) throughout the study period. Dissolved oxygen concentration of the treated ponds varied from a minimum of 6.53 ppin to a maximum of 8.33 ppin. The maximum value of dissolved oxygen concentration was recorded in T_2 in the month of August whereas the minimum value of the same was recorded in T_3 in the month of October. The average concentration of DO varied significantly among the treatments. DOF (2009) reported that the range of a suitable water body for fish culture would be 5-8.0 ppm for dissolved oxygen. Alikunhi (1957) and Banerjee (1967) considered 5 to 7 ppm of dissolved oxygen content was good in respect of productivity and below 5 ppm to be unproductive. Swingle (1957) stated that the concentrations of dissolved oxygen below 5.0 ppm were undesirable in fish ponds. Therefore, it can be stated that the dissolved oxygen contents of water under different treatments were within the productive range.

Table 2. Growth parameters, production and survival of the fish in different treatments

Parameters	T_1	T_2	T_3
Individual stocking weight (g)	22.00±0.19	23.82±0.03	22.24±0.40
Individual weight at harvest (g)	154.07±0.06	198.97±0.68	174.20±0.27
Average survival (%)	75.75	87.87	78.78
SGR (% bw d^{-1})	22.00±0.19	22.00±0.19	22.00±0.19
Production (kg ha^{-1})	22.00±0.19	22.00±0.19	22.00±0.19

pH (Hydrogen-ion concentration): Monthly average pH values under different treatments are presented in (Table 1). There was no significant variation among the treatments. pH value under different treatments were found within the alkaline range during the study period. pH values of the treated ponds varied from a minimum of 7.63 to a maximum of 8.61. The maximum and minimum values of pH were recorded with the treatment T_2 in the month of August and September respectively. Swingle (1957) found a good relationship between pH of pond water and fish culture and obtained satisfactory results at pH 6.5 to 9.0. He also observed that water pH more than, 9.5 were unproductive and pH 11.0 was Lethal for fish, Banerjee (1967) stated that the pond water with almost

neutral reaction with pH values from 6.5 to 7.5 was best suited for fish production. DOF (2009) reported that the range of pH of a suitable water body for fish culture would be 6.5 - 8.5.

Growth performance and survival of fish: The growth parameters, production and survival of Carpio, *Cyprinus carpio* in different treatments are presented in Table 2. Monthly growth rate of fish under the different treatments varied from 43. 10 to 199.5 in weight. The minimum (43.10 g) and maximum (199.5 g) growth rate were found in T_1 and T_2 in the month of August and the November, respectively (Fig. 1 and Table 2).

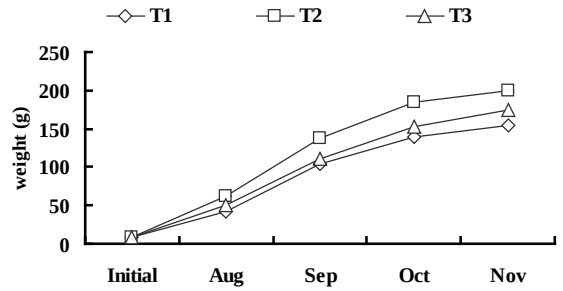

Fig. 1. Monthly growth rate of fish in different treatment during study period

The month wise growth rate by percentage of increase varied from 765.83% to 8.07% in weight. The maximum (765.83% in weight) and minimum (8.07% in weight) growth increase by percentage were found with the treatment T_2 in the month of August and November, respectively (Fig. 1).

In case of growth rate, the treatments were found to vary significantly among each other in different months. In both case significantly higher growths were found in treatment T_2 than rest of the treatments in all months. But no significant variation was observed among the treatments T_1 and T_3 in the month of November. The length –weight co-relationship were significant in all the treatment which indelicate that the fish were increasing smoothly (Fig. 2).

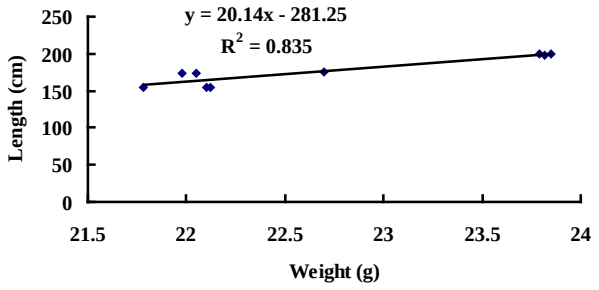

Fig.2. Length – weight co-relationship of the fish in different treatments

The maximum (199.50 g) and minimum (22.12 cm and 154. 10 gm) growth of fishes were observed with the treatments of T_2 and T_1 respectively. A significant variation in the average growth of fish was noted among the different treatments during the study period. It was also observed that the treatment T_2 showed significantly higher growth than rest of the treatments during the present study.

The highest growth rate of fish was recorded in T_2 might be due to the higher production of planktonic food, especially zooplankton. This finding more or less agrees the findings of Harish (1973) and Rabanal (1967), Mitra *et al.* (1987, and Jhingran and Pullin (1985). Saha *et al.* (1978) reported that chemical fertilizers enhanced the growth of phytoplankton and zooplankton which is turn induced the better growth of the fish. The result of the present study with combination of inorganic and inorganic fertilizers produced more plankton per unit value of water in a shorter period which is supported by Sreenivasan *et al.* (1969) who studied the effect of cowdung and a combination of cowdung and inorganic fertilizers (Urea, TSP) on the dissolved oxygen of water and on plankton production.

The average survival rate was found to be satisfactory in T_2. The average survival rate was 75.75, 87.87 and 78.78% in T_I, T_2 and T_3, respectively. The highest survival rate was recorded in T_2 and the lowest of the same was recorded in T_1 which is supported by Banerjee *et al.* (1969).

The result of the present study was good in T_2 as it was a trial of monoculture. Therefore, other feed particles were misused that's why the production per ha was higher. Therefore, it may be concluded that the fish should culture under polyculture system in lieu of monoculture for higher production and economic benefits.

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