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Effect of di-ammonium phosphate and ammonium nitrate on the growth and flesh quality of chinese carps

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Abstract

To draw lesson that inorganic fertilizers are important for increasing the availability of phytoplankton in water body that resulted in better growth and body composition of fish species, that are easily available and cheap for farmers, an experiment was conducted in ponds stocked with Common carp (*Cyprinus carpio*), Grass carp (*Ctenopharyngodon idella*) and Silver carp (*Hypophthalmichthys molitrix*) at the proportion of 1:2:1 to mounted growth and flesh quality of carps. Pond I was treated with Di-Ammonium Phosphate (DAP) (P_1),pond II with Ammonium Nitrate (P_2) @ 0.3g N/100 gm of fish body weight per day and pond III without fertilizers (P_0/control pond) as treatments. Total net fish production shown by pond I and pond II was 608.975 and 618.335 kg/ha/year respectively and 599.023 Kg/ha/year in control pond. The fish production is more in pond with ammonium nitrate than di-ammonium phosphate by 1.01 times. The water quality parameters were found within optimum range for the fish species throughout the experiment. At the end of the experiment the flesh quality of three said Chinese carps was observed. Maximum protein and fat content observed in *C. idella* (18.02% and 5.44% respectively) in DAP treated pond. *H. molitrix* showed maximum carbohydrate and ash contents (2.43% and 26.12% respectively) while the moisture content was maximum in *C. carpio* of 71.29% with treatment of ammonium nitrate. Proximate composition showed statistically non-significant ($P>0.05$) results. The result showed that the fish growth and carcass properties increased with the use of fertilizers.

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Introduction

Nutrition of high quality has a pronounced effect on the animal production with good and healthy product. In fish production the feed represents of 40-50% of the production cost. In recent year there is advance development of supplementary feed for fish which help to promote the optimal fish health and growth (Yaqoob *et al.*, 2010). Supplementary diet increases natural feed in the pond (Stickney, 1979), it helps to the production of planktons; because the fertilization of ponds enhances autotrophic as well as heterotrophic level which increases fish production (Grag and Bhatnagar, 2000). There is a big role of fertilization in intensive and semi-intensive fish culture. It helps to increase the fish production in shortest time period, by increasing the carrying capacity (Hepher, 1975; Devaraj *et al.*, 1986).

In term of fertilization of ponds farmers sometime used three or four time higher dose then standard dose, for getting more production. So far, a big amount is utilized to fulfill the demand of fertilizers which results in financial loss. There is not enough work for the dosage of fertilizers in ponds (Syeed *et al.*, 2007). The present study was conducted to find out the proper dose of inorganic fertilizer in carp polyculture which help the workers to get more benefit within an economic range and enhances the fish production to manifolds.

In body composition of fish the main constituents are fat, protein, carbohydrate, water and ash. Mostly in fish the percentage of water is 70-80%, protein 20-30% and lipid of 2-3% (Love 1980). These values are variable depending on the species, size, sex, feeding time of the year and physical activity (Buchtova *et al.*, 2010). Protein and moisture contents of fish are not affected by supplementary feed (Cho *et al.*, 2001). The water content is good indicator of lipid, energy and proteins, by measuring the water content in fish a worker can estimate the percentage of lipid and proteins in fish (Jonsson and Jonsson, 1998). The present study was conducted to evaluate the changes in major constituents of fish body *viz.*, carbohydrates, proteins, fats, moisture and ash in relation to body size and condition factor for better and healthy fish production.

Materials and methods

Fertilization of ponds

Ponds were selected, each with extents of 25 ×8 × 1.5 m (length × width × depth) located at Fisheries Research Farms, University of Agriculture, Faisalabad. There were 40 fishes in each pond. Each pond was provided with 10 *Hypophthalmicthys molitrix* 20 *Ctenopharyngodon idella* and 10 *Cyprinus carpio*. Pond I was treated with Di-Ammonium Phosphate (DAP), Pond II with Ammonium Nitrate at the rate of 0.3g N/100g and pond III was control pond without fertilizer. Fertilizers were added on weekly basis.

Physico-chemical parameters and proximate composition

The most significant water quality factors *viz.* temperature, dissolved oxygen, penetration of light, pH and planktonic biomass were considered (Boyd, 1981). At the conclusive stages of the research, meat samples of stocked three fish species *viz.*, *Hypophthalmicthys molitrix, Ctenopharyngodon idella* and *Cyprinus carpio* were nominated from experimental ponds to examine the effect of inorganic fertilizer on the meat quality for its contiguous composition parameters (vapors, crude protein contents, fats, ash and carbohydrates contents) (A.O.A.C., 1995).

Statistical analysis

The assessments of weekly based mean values for different factors were investigated by using Analysis of Variance (ANOVA) and comparison of means by Duncan's Multiple Range Test with repeated sampling using by using minitab software version 16.1. Water quality parameters of ponds were given in table-2 (Steel *et al.*, 1997).

Results

The gain in body weights and lengths observed maximum in fertilized ponds than unfertilized pond. Pond treated with DAP might have abundant

phytoplankton which result in high growth rates than control group. The growth and length showed highly significant (P<0.05) in treated ponds as compared to untreated pond, maximum gain in weight observed in *H. molitrix* with DAP fertilizer while *C. carpio* showed maximum gain in length in ammonium nitrate treated pond (Table 1).

Table 1. Body weight and body length of fish species in different treatments.

Treatments	Species	Initial weight (g)	Final weight (g)	Total gain weight (g)	Total gain length (cm)	Gross fish productionkg/ha/year	Net fish production kg/ha/year
	H. molitrix	8.54	240.24	255±24.99 a	15.50±4.23 a		
Control(Po)	*C. idella*	3.55	45.34	43.88±04.83 c	8.45±2.54 b	628.55	599.023
	C. carpio	2.54	133.20	131.40±21.03 b	17.32±5.33 a		
Di-Ammonium phosphate (PI)							
	H. molitrix	10.76	279.46	268.62±26.40 a	16.50±4.73 a		
	C. idella	3.33	54.00	50.71±05.83 c	10.23±2.64 b		
	C. carpio	2.66	169.86	167.20±22.22 b	17.40±5.63 a		
Ammonium Nitrate(PII)	*H. molitrix*	7.38	273.58	266.20±27.94 a	16.90±4.82 a	631.25	608.975
	C. idella	3.65	45.38	44.70±04.93 c	9.50±2.35 b	638.05	618.335
	C. carpio	2.72	192.62	189.90±20.04 b	17.80±5.70 a		

The physico-chemical parameters showed no significant (P>0.05) differences in treated and untreated ponds (Table 2). Results showed that the mean values of body components i.e. fat, protein, ash, moisture and carbohydrate contents (wet body weight) fluctuated non-significantly (P>0.05) in the three selected fish species (Table 3).

Discussion

The results indicated that the pond treated with DAP and ammonium nitrate observed maximum growth in terms of weight gain and length as compared to untreated pond. Similar results were shown by Hassan *et al.*, 2008 and Kumar *et al.*, 2014.

Table 2. Water quality factors of tentative ponds (means ± SE).

Parameters	Treatments		
	Control	PI	PII
Planktonic biomass(mg/L)	73.13±6.63	79.61±73	77.65±7.95
Temperature (°C)	17.50±0.89	19.14±0.96	18.95±0.60
pH	8.26±0.078	8.37±0.067	8.23±0.098
Dissolved oxygen(mg/L)	5.81±0.065	5.83±0.079	5.79±0.083
Light penetration(cm)	18.08±0.54	19.75±0.46	22.31±0.42

The maximum growth with inorganic fertilizers is due to presence of nutrients like nitrogenous compounds that are easily available to the water. Boyd and Massaut (1999) showed the same findings in their experiment with inorganic fertilizers. In another experiment Saad *et al.*, 2014 reported that the fertilizers containing phosphorus and nitrogenous compound enhance the production of zooplanktons and phytoplankton which in turn improve the fish growth and production.

The temperature values of the fertilized ponds were similar to the results of Jha *et al.*, 2007. The value of the pH throughout the experiment remained slightly alkaline that were the findings of the Mosha *et al.*, 2016. These are the optimum conditions for the fish production in fertilized ponds. During the experiment there was difference in transparency from 19.75 to 22.3. The value of planktonic biomass was greater in the fertilized ponds as compared to unfertilized.

With the increase planktonic biomass, the penetration of light decreased. The value of dissolved oxygen is higher in the pond treated with DAP this might be due to presence of high plankton in the water as compared to the other two ponds. The physicochemical parameters increased in the treated ponds than untreated pond this was observed by Saad *et al*., 2014 who showed that the use of organic or inorganic fertilizers to the water increased the pH value than only feed containing water. It indicated that use of fertilizers increased some of the physicochemical parameters of the water.

Table 3. Comparison of mean on the proximate analysis of three fish species under three treatments.

Treatments	Po (Control)			PI (Di-ammonium phosphate)			PII (Ammonium nitrate)		
Fish species	*C. molitrix*	*C. idella*	*C. crpio*	*C. molitrix*	*C. idella*	*C. carpio*	*C. molitrix*	*C. idella*	*C.carpio*
Protein (%)	15.00	16.75	7.77	17.04	18.02	8.79	16.21	17.45	9.02
Fat (%)	3.71	3.25	2.65	4.21	5.44	3.28	5.43	5.29	2.75
Carbohydrate (%)	1.11	0.20	1.25	1.54	0.45	1.63	2.43	1.03	1.29
Ash (%)	18.44	18.20	12.01	25.97	17.72	14.54	26.12	19.84	14.06
Moisture (%)	40.00	51.73	62.89	49.00	54.89	69.55	49.22	54.69	71.29

The body composition is an important indicator to check the status and health of the fish. Results from the recent study indicated that body composition varied non-significantly ($P<0.05$) among the three fish species in pond water. Protein and fat contents recorded maximum in *Ctenopharyngodon idella* and minimum in *Cyprinus carpio*.

Hypophthalmichthys molitrix remained prominent in ash and carbohydrates content than other two fish species (Table-3). Similar results were observed by Miroslav *et al*., 2012 that the use of organic fertilizers is cheap tool to increase the nutrient contents of fish muscle.

So it may be concluded that as fish is rich source of protein so different values of protein contents help the farmers to choose best species for economic profit by producing protein rich fish.

This represent that the fertilized ponds improve the quality and growth of the fish species as compared to untreated pond.

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