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Effects of Vermicompost on Growth of Cyprinid Fish and Water Quality of Warm Water Earthen Ponds

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Abstract

Experiment was conducted in 0.0-ha earthen ponds to promote growth performance of silver carp and *Cyprinus carpio* and big head (cyprinid) plus phytoplankton and zooplankton and were estimated in a pond receiving mixed fertilizer with vermicomposting, with 6000 and 12000 kg per/ha/year mixed with fertilizer (VC_6 and VC_{12}) and 6000, 12000 kg per/ha/year without vermicomposting ($CO_6$and CO_{12}). All treatments were compared finally. Significant differences were found in diversity and abundance of plankton in the pond exposed to fertilizer having CO_6, CO_{12} *and VC6, VC12* The used fertilizer and manure could be graded in the following descending order VC_{12}, VC6, CO_{12}, and CO6. The least concentration was accounted in control sets with 6000 kg manure. The highest production of fish was found in vats treated with VC_{12} (12000kg/ha/year) followed by VC_6 (6000 kg / ha/year), CO_{12} (12000 kg/ha/year), CO_6 (6000 kg/ha/year). The highest yield of fish in vats applied with VC_{12} may be related to its highest manorial value.

Keywords: fertilizer, vermicompost, cyprinid, yield, primary production

Introduction

The purpose of applying pond manure was primarily to provide adequate amounts of essentials Nutrients for phytoplankton production (Steinberg et al., 2006). Fertilizing or manuring is widely practiced in fishponds for natural fish production as it is important for sustainable aquaculture and to reduce expenditure on costly feeds and fertilizers which form more than 50% of the total input cost (Edwards, 1980). A wide variety of organic manures such as grass, leaves, sewage water, livestock manure, industrial wastes, night soil and dried blood meal have been used in aquaculture (Hickling, 1962) to improve fish production, organic fertilizer can be utilized as food for invertebrate fish-food organisms and fish (Tang, 1970). There is growing interest in locally produced food that is Sold directly to consumers,and aquaponics is a growing from of aquaculture that easily first into a local and regional food system model in part because it can be practiced in or near large population centers.(Love d.c and et;al 2015)

They are intended primarily to release inorganic nutrients for phytoplankton and zooplankton Growth. (Bhakta 2004)The purpose of pond manuring is primarily to provide adequate amounts of essentials nutrients for phytoplankton production (Steinberg et al 2006,wang 2000)

Fertilization or manuring is widely practiced in fishponds for natural fish production as it is important for sustainable aquaculture and to reduce expenditure on costly feeds and fertilizers this from more than 50% of the total input cost (Edwards, 1980, oribhabor and ansa 2006) wide variety of organic manures such as grass, leaves, sewage water, livestock manure.

Among the decomposed manures, vermicomposting is rich in all types of major and minor nutrients, vitamins antibiotics and growth promoters (Mitra, 1997; Bhusand, 2003). It is organic manure, which is produced by earthworms from a variety of organic wastes (e.g. Cow dung, poultry waste, piggery waste, agricultural waste) and is, in fact, the worm castings (Fecal excretion) and other organic materials (Bhakta 2004). Moreover, vermicomposting is a farmer-friendly technique because vermicomposting can be prepared from a variety of locally-available plant and animal wastes without much cost, labor and expertise.

The output of this research is how to fertilize, initial production, final production and finally culturing warm water fish Identifies in Iran and provides valuable information on the optimal management of aquaculture development.

In addition, it determines the optimal composition of fertilizers and predicts the size of fish stocks by designing a suitable model, and according to the estimate of nutrient consumption in the whole breeding period, the burden of pool pollution is reduced.

Materials and methods

An outdoor experiment was conducted in 150 m^2 (0.015 ha) earthen ponds for 120 days. Earthen Ponds were prepared Before stocking of fish and filled with well water. Manuring was done with mixed fertilize including vermicomposting, cow manure, poultry, urea and superphosphate. C: N: P was 88.6: 7.5:1, respectively, at the dose of 6000 and 12000 kg/ha/year. The control treatments were mixed fertilizer without vermicompost at the dose of 6000 and 12000 kg/ha/year. One hundred and six larvae of carp with an average weight of 1g, including silver carp (50%), big head (10%) and common carp (25%) and grass carp (15%), were stocked in each earthen pond.

At the time of stocking, water quality including temperature, dissolved oxygen, pH, soluble phosphate and ammoniac nitrogen were measured fortnightly using the standard methods (APHA, 1991).

Phytoplankton and zooplankton were sampled and fixed in formalin. Phytoplankton, density was Estimated and identified using a compound microscope and identification keys fortnightly. Zooplankton density was estimated using a Sedgwick-Rafter cell.GPP (gross primary production) and NPP (net primary production) were measured using the dark and light bottle method as described by Vollenweider (1978). Fish growth was estimated by measuring the body length and weight at regular monthly intervals. The following parameters were also calculated:

Weight gain = final body weight –initial body weight.

$$\text{Specific growth rate (\%weight in/day)} = \frac{\text{Ln(Final body weigth)} - \text{Ln(initial body weight)}}{\text{culture period days}} \times 100$$

Data was analyzed using Stat graphics statistical package. A significant difference among the treatments was examined using a one-way ANOVA ($\alpha = 0.05$). A Redundancy analysis (RDA) was used to depict the relationship between planktonic species and water chemical parameters.

Results

Water quality

The average water temperature of various treatments was almost similar (27±3). There were some fluctuations in pH (7.8 ± %2) and dissolved oxygen (7.8 ± %6) across the treatments. The concentration of organic phosphate was the highest (0.552 mg/L) in the VC_{12} treat and the lowest in the control CO_6 (0.3463 mg/L). The concentration of total P in VC_{12} was higher (0.552) than those of VC_6 and CO_{12} and CO_6 treatment (i.e. 0.41 mg/L, 0.38 mg/L, 0.34 mg/L).

There was significant difference in concentration of total P and total nitrogen concentration among the treatments. The treatments CO_6, CO_{12} had no significant difference in their available N concentration. In addition, VC_6 and VC_{12} had significant differences in the concentration of N in water.

Initially the plankton count was nil up to 5 days in every experimental units. Phytoplankton started appearing on day 6 and zooplankton on day in each experimental units. The factors affecting the abundance of plankton were:

Temperature, pH, O_2, NO_2, NO_3, NH_4, PO_4

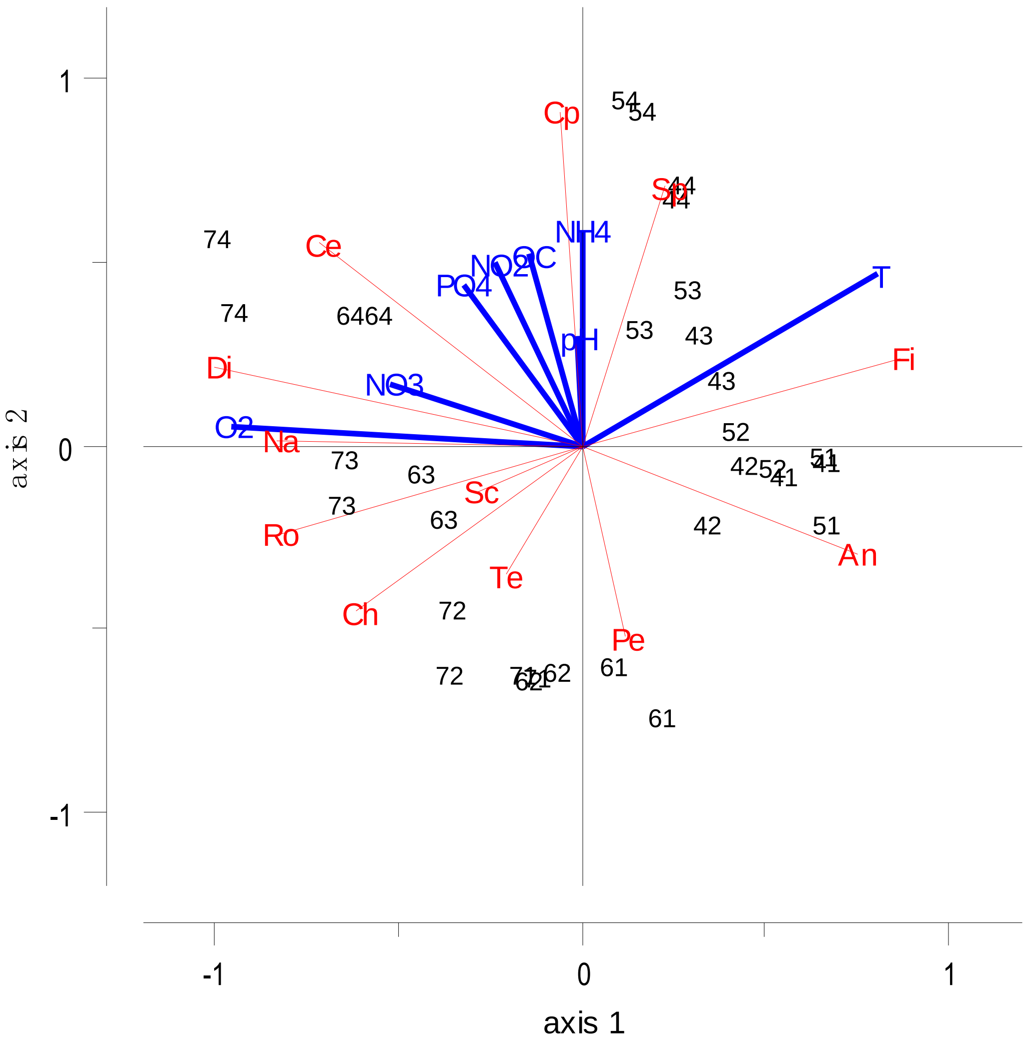

Figure 1. A RDA bipod indicating the relationship of the planktonic species and water chemical factors.

Primary production

In all the treatments, the primary production and density of both phytoplankton and zooplankton were significantly ($P < 0.001$) higher than that of the control. Phytoplankton composition was represented by nine groups Chlorella, Ankyra, filamentous algae, Pediastrom, Spirogyra, Diatoms, Navicula, Scendesmus, and Tetrastrum. Among those phytoplankton groups, filamentous algae exhibited the highest percentage (72.8 – 79.5 %) in all treatments on various sampling days, however, *Naviculahas the lowest percentage (2-4%) in all treatments. The* phytoplankton density had an increasing trend in vats treated with VC_{12} (12000 kg/ha) followed by VC_6 (6000 kg/ha), CO_{12} (6000kg/ha), CO_6 (6000 kg/ha).

Table 1. The average (± SD) plankton abundance in four treatments and four times

Time				Treatment
OCTOBER	SEPTEMBER	AUGUST	JULY	
C** ±7071/06 115000	C** 215000±7071/06	D** 475000±7071/06	420000±0/00B**	1
180000±0/00B	C 7071±235000/06	7071±505000/06C	0±480000/00AB	2
AB 195000±7071/06	B 7071±275000/06	7071±535000/06B	7071±515000/06A	3
A 215000±7071/06	0±420000/00 A	7071±575000/06A	7071±545000/06A	4

** The same english letters above the numbers in each column indicate a significant difference between the means at the confidence level of 0.01.
* the same english letters above the numbers in each column indicate a significant difference between the means at the confidence level of 0.05.

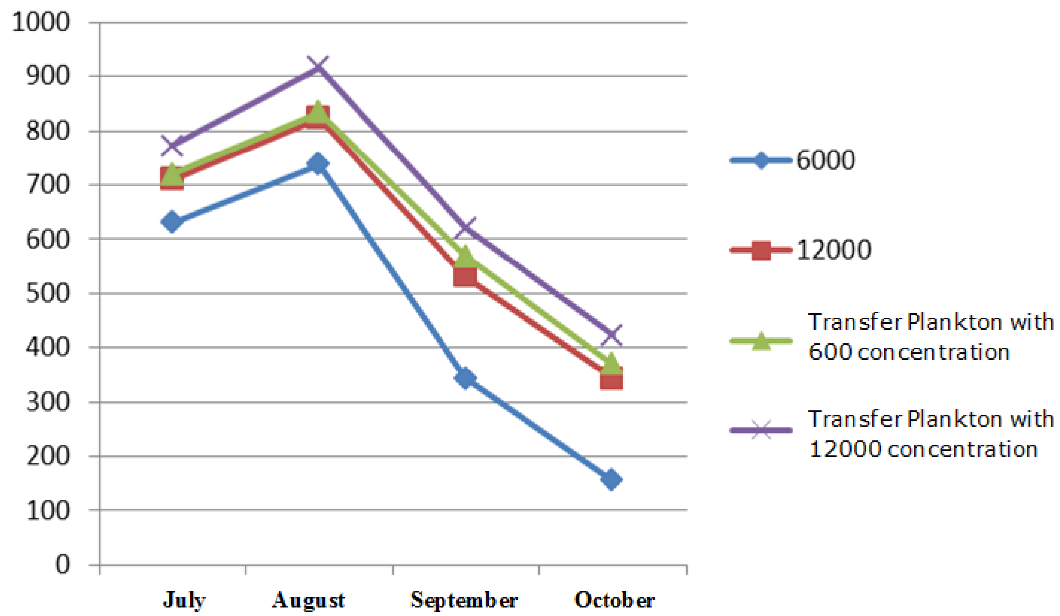

Figure 2. The main effect of the treatments over time on primary gross production.

Fish growth

There was a steady increase in weight of fish in all treatments, however, the growth was much greater in the treated ponds than the control. The maximal growth increment and total gain were recorded in VC_{12} followed by VC_6, CO_{12} and CO_6. The minimal growth rate was recorded in CO_6. The total yield of fish was higher in the system with high plankton count as indicated from the vats treated with VC_{12} (12000 kg/ha/year), with vermicomposting, compared to low plankton count in CO_6 (6000 kg/ha/year) without vermicomposting.

There was a significant difference among of treatments. Results indicated that fourth, third, second and first treatments were the most effective on the weight change of carp.

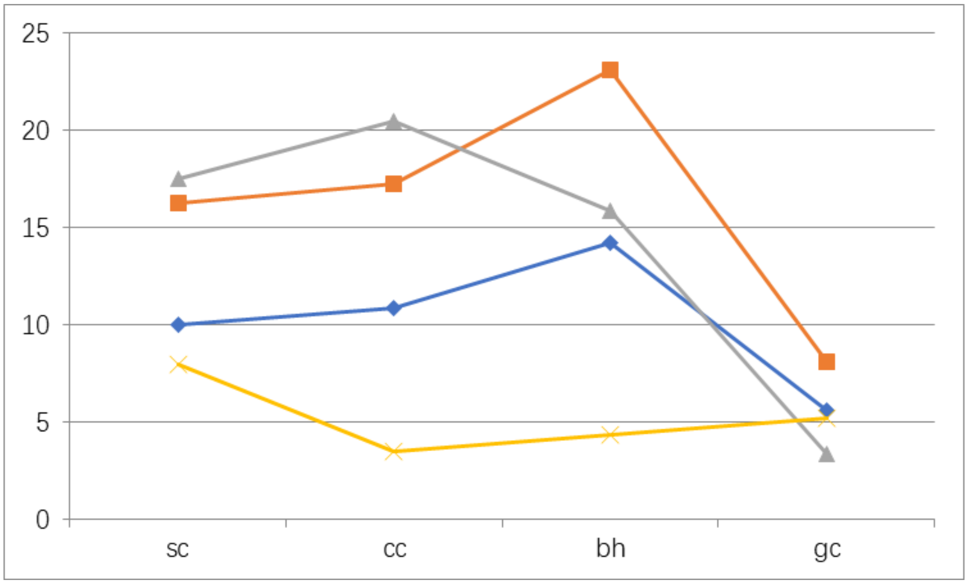

Figure 3. Changes of fish species biomass at the time of study.

Discussion

High rates of fish yield and excellent growth in the experiment can be attributed to high availability of natural food with high nutritional value in the treatments. Swingle (1961) found a direct relationship between average plankton and fish production. Similar results were found in the present experiment where the absolute growth of fish in all the treatments exhibited a highly-positive correlation with the primary production of water.

Because the average of total fish yield achieved in any treatment boosted with VC_{12} was essentially higher than that of those received CO_{12} it is apparent that VC_{12} might be a cost effective fertilizer in carp culture.

It seems that the recovery of mixed fertilizer with a concentration of 12000 kg / ha is sufficient and is more suitable for the proper production of the fingerprint stage of fish in the north of the country. Studies (Azim, 2001) that tested the four different ratios of fertilizer to find the highest biosynthesis of phytonutrients confirmed the above study.

The present study, however, made it clear that there was a direct link between algae growth and nutrient recovery to a concentration of 12,000 kg / ha, but that algae growth decreased with increasing fertilizer concentration due to reduced nutrient recovery. According to studies (Wehch Lindeu in 1992).

Therefore, increasing the concentration of fertilizer above 12000 kg / ha per year is not only unnecessary, but also expensive and also causes algae bloom, fish mortality and water quality spoilage (Data,1988).

These results were consistent with the results obtained by (Uddin 1987) that better production of planktonic organisms and fish combined with increased nitrogen and phosphorus at different levels were shown to be successful. Organic fertilizers, if not completely decomposed, may degrade water quality before being used in aquaculture ponds, and they also use oxygen during decomposition. (Bhakta,2004) Therefore, the amount of each organic fertilizer to be added to the pool basically depends on the BOD (Biological oxygen demand), and their excessive use may cause the soil to dissolve the dissolved Oxygen in the pool and can increase parasitic diseases. Give. (Charls, 2003) Among the decomposed fertilizers, vermicompost is rich in all major nutrients, and vitamins, Enzymes, antibiotics, growth enhancers, etc. (mitra 1997, Bhusan 2003) Chalrabtry (2008), like this study, confirmed higher plankton and growth production compared to pools with vermicompost treatment and traditional organic fertilizers. Ansal (2006) also significantly reported higher soluble oxygen in fertilizers composted by ferry compost compared to cow manure, as observed in the present study. The maximum fish product can be created at a concentration of 12,000 kg / ha in the form of plankton transfer to produce higher zooplankton and better water quality with high dissolved Oxygen content. The present study also confirmed the direct use of vermicompost as food for common carp, as carp growth has increased significantly, confirming the results (Vanect ider naur T 2010).

In total, three experimental studies have shown that the CNP ratio of 88/6:7/5:1with a concentration of 12000kg/ha in the form of plankton transfer is the best method that can be trusted according to the planktonic data of primary production and final production. However, in future studies, purely algae-fed aliens and further monitoring of plankton can be considered as a new idea. It is suggested that more serious studies be done in this regard so that it can be recommended in a general way.

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