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Vermicompost as fish pond manure - Effect on water quality and growth of *Catla catla* (Ham.)

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Abstract
The present study was conducted in earthen ponds measuring 0.003 ha for 150 days to study the effect of vermicompost as pond manure on growth performance of *Catla catla*. Different organic fertilizers were used at a dose of vermicompost @ 15000kg/ha/yr, vermicompost @ 10000kg/ha/yr, vermicompost @5000kg/ha/yr and cowdung @ 10000kg/ha/yr in five replicates and one pond was treated as control. One forth dose of fertilizers were applied 15 days prior to fish stocking and remaining doses were given at fortnightly intervals. Supplementary feed was used for feeding twice daily @ 2% body weight per day for entire experiment. The physiochemical characteristics of pond water remained within the favourable limits for fish culture. The range of water parameters increased significantly ($p \leq 0.05$) in the ponds. Maximal growth of *Catla catla* in terms of weight gain, length gain and growth increment was observed in the pond treated with vermicompost @10000kg/ha/yr.

Keywords: Vermicompost, Cowdung, Water quality, *Catla catla*, Growth performance, Planktons

1. Introduction
Fresh water aquaculture in India has made significant contributions towards total fish production involving different types and levels of inputs [1]. Among the various practices, depending upon the variable inputs, semi- intensive carp culture practices in rural aquaculture involve utilization of various organic manures for plankton (natural food) production. These manures are either directly utilized by the fish or they enrich the aquatic ecosystem with autotrophic (plankton) and heterotrophic microbial communities [2, 3]. Organic manures, if not decomposed completely before application in aquaculture pond may deteriorate the water quality as they utilize oxygen during decomposition. Among the decomposed manures, vermicompost is rich in all types of major and minor nutrients, vitamins, enzymes, antibiotics, growth promoters etc [4, 5]. Sulochana [6]. Have observed higher manurial value of the vermicompost as compared to raw cow dung and poultry dropping in terms of its effect on hydrobiology of water. Even if vermicompost dries up, there is no harm to its microflora, hence, it is referred to as potential biological manure or biofertilizer [7]. Moreover, vermicomposting is a farmer friendly technique, where vermicompost can be prepared from variety of locally available plant and animal wastes without much cost, labour and expertise. All- in- all the vermicastis believed to be very good organic fertilizer and soil conditioner.

2. Materials and Methods
An outdoor experiment was carried out in ponds measuring 360 sq. ft. for 150 days. The ponds were cleaned and limed @ 200 kg/ha/yr. and filled with tube well water and allowed to stabilize for 15days, the pond was fertilized with semi-digested cowdung @ 10000 kg/ha/yr, vermicompost @ 15000 kg/ha/yr, vermicompost @ 10000 kg/ha/yr, vermicompost @ 5000 kg/ha/yr [8]. Were applied at 25% initial and remaining doses were given at biweekly intervals in the ponds. The experiment was conducted on one of Indian major carp, *Catla catla*. Fry were procured from fish farm located near Hisar (29.09°N 75.43°E in western Haryana) and stocked in reinforced plastic (FRP) tanks. For 10 days the fry were acclimated under laboratory conditions and was fed on supplementary feed. Fry had the mean body weight ranging from 0.82 to 1.42g were randomly distributed @ 9 fish per pond with five replicates of each treatment.
Supplementary feed (fish meal 10%, mineral mixture 1.5%, common salt 0.5%, wheat flour 10%, soya flour 45%, mustard oil cake 17%, rice bran16%) was used for feeding Twice daily

@ 2% body weight per day for the entire experiment. For duration of 150 days the feed was adjusted According to increase the fish body weight observed after each 15 days sampling. Level of water was maintained in the experimental ponds by adding tube well water to compensate the water loss due to evaporation and seepage. Water quality parameters such as dissolved oxygen, free CO_2, alkalinity, hardness, pH and planktons were recorded at 15 days intervals by following the standard method of APHA [9]. The quantitative estimation of planktons was done at 15 days interval by using the Sedwick Rafter cell.

Table 1: Different manures used during the experiment

Serial no.	Treatments (manure)
Treatment-1	Control
Treatment-2	Vermicompost @15000kg/ha/yr (VC_{15})
Treatment-3	Vermicompost @10000kg/ha/yr (VC_{10})
Treatment-4	Vermicompost @5000kg/ha/yr (VC_5)
Treatment-5	Cowdung @10000kg/ha/yr (CD_{10})

Growth of fish was assessed by measuring body length and body weight at regular intervals. Data was analyzed using statgraphics statistical package for the following parameters. Differences among different treatments were calculated by using ANOVA ($P \leq 0.5$).

$$\text{Live weight gain(g)} = \text{Final body weight} - \text{Initial body weight}$$

$$\text{Live length gain(cm)} = \text{Final body length} - \text{Initial body length}$$

$$\text{Growth Increment (GI)} = (\text{Final body weight} - \text{Initial body weight})/(\text{culture period})$$

3. Results and Discussion

3.1 Water parameters

The water parameters like dissolved oxygen, pH, alkalinity, hardness, free CO_2 and plankton were found in optimum range in all treated ponds. The maximum value of dissolved oxygen (7.314 ± 0.060 to 7.573 ± 0.047mg/l), phytoplanktons **(**536.000 ± 5.099 to 5210.00 ± 4.45 no/l) and zooplanktons (186.000 ± 2.449 to 1782.00 ± 5.83 no/l**)** was observed under the vermicompost @ 10000kg/ha/yr. While that of pH (7.258 ± 0.54 to 8.251± 0.041mg/l), alkalinity (199.320 ± 0.524 to 326 ± 0.743mg/l), hardness **(**198.600 ± 0.872 to 252.640 ± 0.172 mg/l) and free CO_2 (0.812 ± 0.006 to 4.720 ± 0.037mg/l) were maximum in vermicompost @15000kg/ha/yr. The range of water parameters increased significantly ($P \leq 0.05$) in the ponds [Fig.1-5].

3.2 Plankton growth

The results of population density of phytoplanktons and zooplanktons under different fertilizer treatments are presented in figures 6 and 7. The pond treated with vermicompost @ of 10000 kg/ha/yr exhibited highest increase in the numbers of phytoplanktons in the pond water as compared to vermicompost @ 15000kg/ha/yr, vermicompost @ 5000kg/ha/yr, cowdung @ 10000kg/ha/yr. The mean values of number of phytoplanktons in control was found to be lowest.

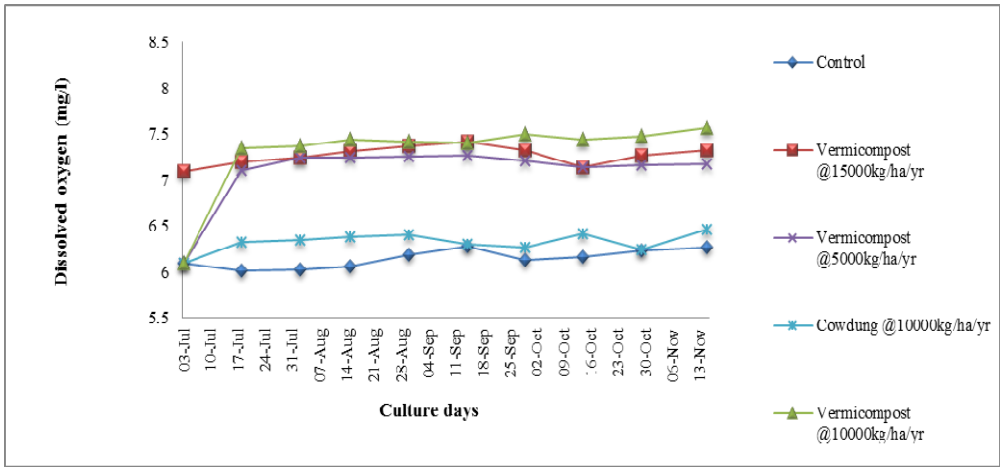

Fig 1: Measurement of dissolved oxygen (mg/l) under different treatments

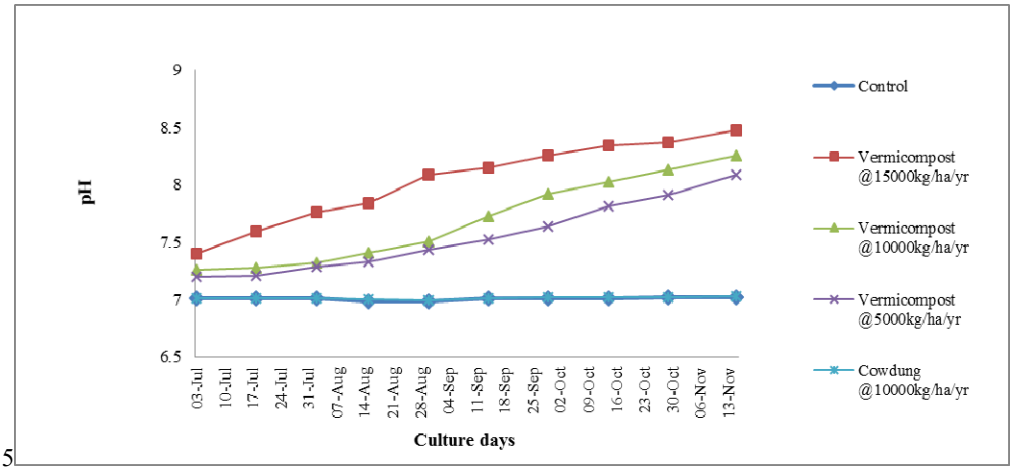

Fig 2: Measurement of pH under different treatments

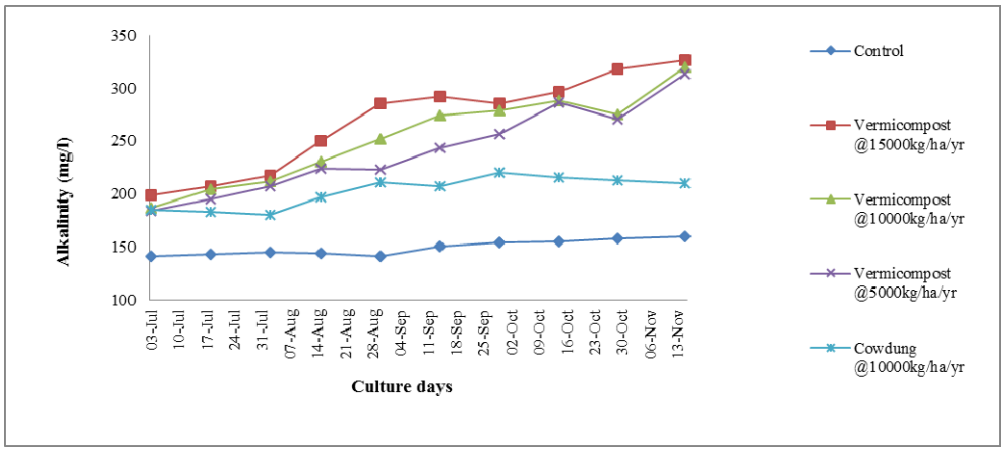

Fig 3: Measurement of alkalinity under different treatments

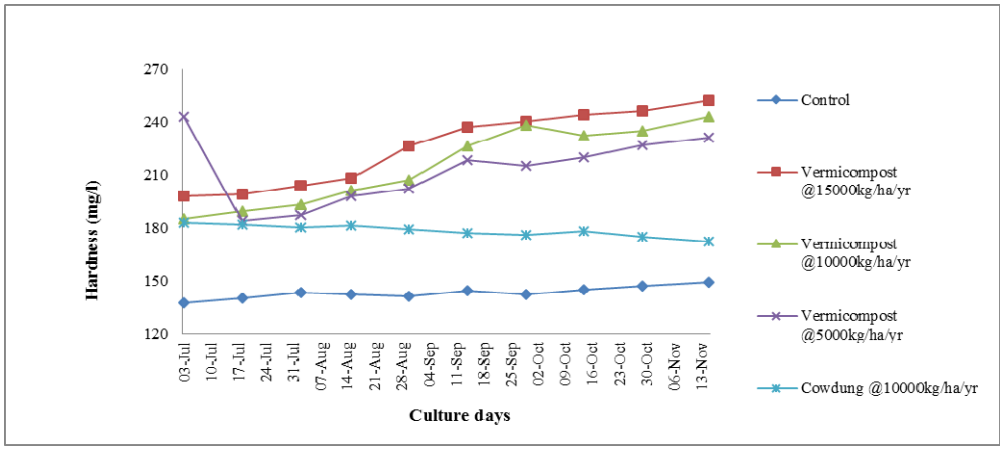

Fig 4: Measurement of hardness under different treatments

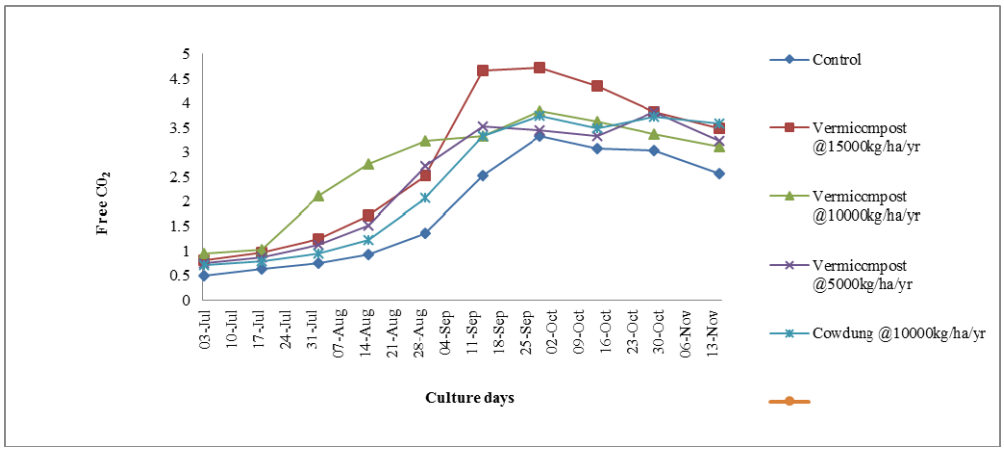

Fig 5: Measurement of free CO_2 under different treatments

The phytoplanktons population were found in the increasing order and the mean value varied between 428.000 ± 3.742 to5210.00 ± 4.45 no/l in the ponds treated with vermicompost followed by the cowdung. Whereas the mean values of number of phytoplanktons in control treatment remained in the range of 154.000 ± 2.449 to 670.000 ± 3.162 no/l. In general the observations revealed an increasing trend of phytoplanktons in during the experimental period in all the treatments [Fig. 6]**.** On the other hand similar trend was observed in the zooplanktons which were the highest number of zooplanktons was recorded in VC_{10}. The mean values in terms of the range of number of zooplanktons, varied between to 186.000 ± 2.449 to 1782.00 ± 5.83no/l and in the pond of control experiment the mean value range remained in 78.000 ± 3.742 to 124.000 ± 5.099 no/l [Fig. 7]. Chakrabarty [10, 11]. Also recorded significantly higher plankton production and fish growth (common carp) in vermicompost treated ponds as compared to traditionally used organic manures and inorganic fertilizers. The Significant difference was found in different treatment for number phytoplanktons and zooplanktons in the experiment. (C.D. $P \leq 0.05$).

3.3 Fish growth

Till now, the information regarding efficacy of vermicompost as manure in aquaculture ponds is scanty. Vermicompost has also been reported to result in higher survival and growth of aquatic organisms including fish and prawn [12]. Without adversely affecting the water quality. The present study reveals steady increase in the weight of *Catla catla* in experimental ponds treated with vermicompost as compared to control. Significantly higher growth of fish was recorded in VC_{10}. However, maximum live weight gain was 140.82 gm, length gain 13.5cm followed by VC_{15} (123.86 gm, 11.28 cm) VC_5 (111.75gm, 8.74 cm), CD_{10} (106.16 gm, 8.2cm) and the specific weight gain (3.07%) was observed in treatment VC_{10}. Ghosh [13]. Had recorded better growth in catfish, *Clarias batrachus* and higher water retention capacity in vermicompost manured ponds as compared to inorganic fertilizer treated ponds in monoculture practices. Based on the results of present study utilization of vermicompost (as manure in pond) for the growth of *Catla catla* in all the treatments also showed varied significance. ($P \leq 0.05$) [Table 2 and Figures 8 & 9].

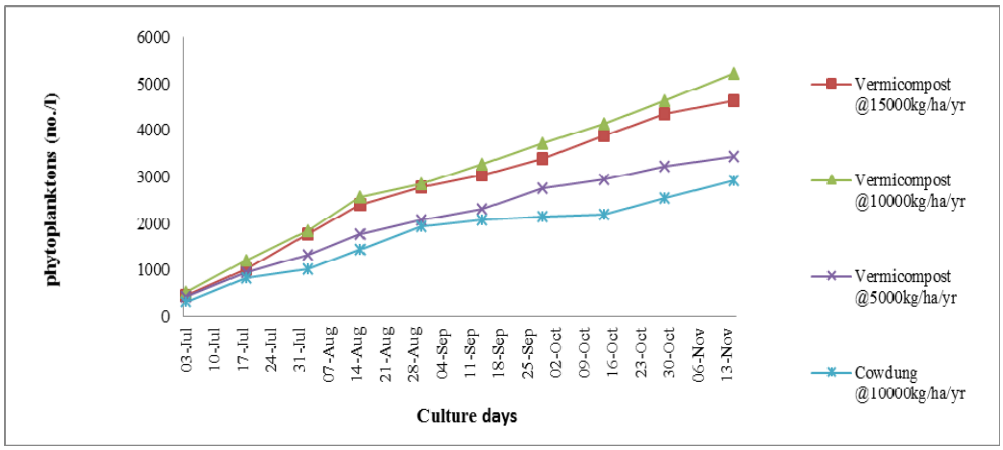

Fig 6: Measurement of phytoplanktons no's/l under different treatments

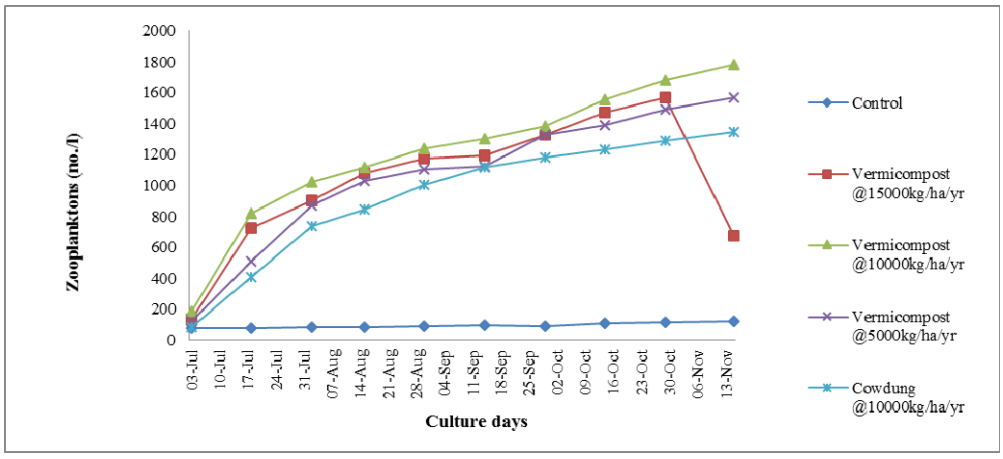

Fig 7: Measurement of zooplanktons no's/l under different treatments

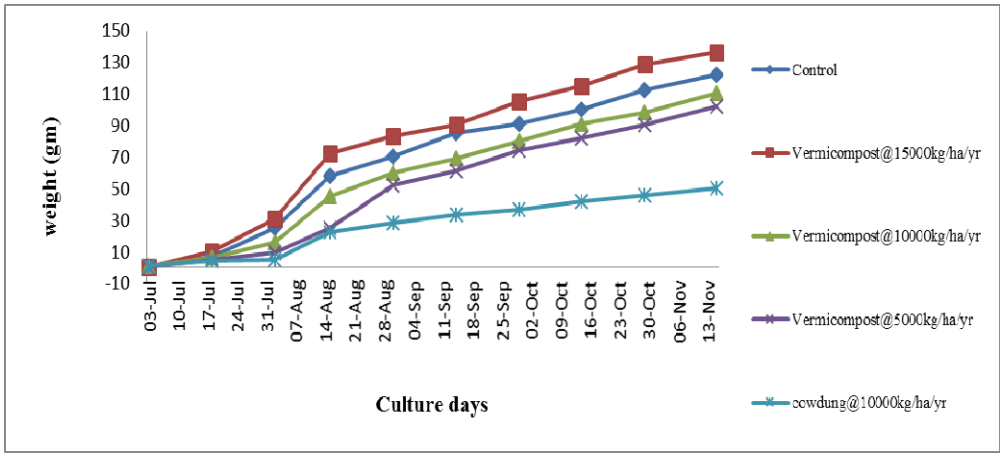

Fig 8: Measurements of body weight (gm) of *Catla catla* under different treatments.

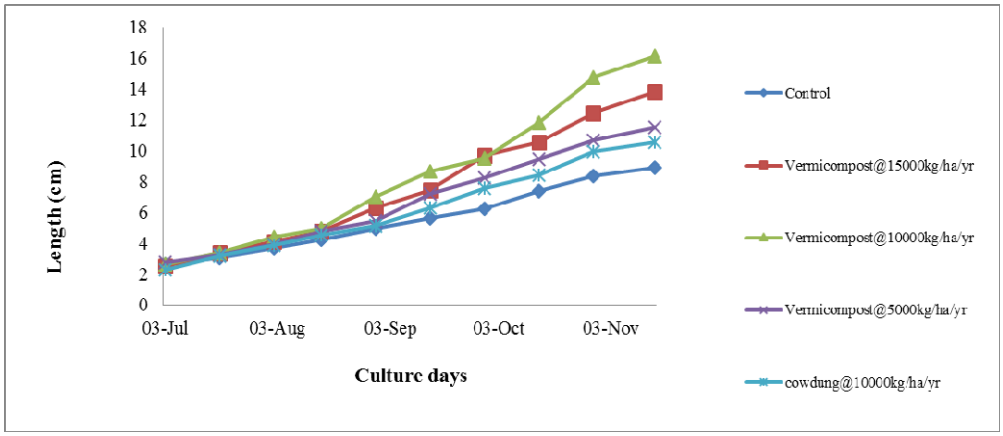

Fig 9: Measurements of body length (gm) of *Catla catla* under different treatments.

Table 2: Growth parameters of *Catla catla* under different fertilizer treatments.

Parameters	VC_{15}	VC_{10}	VC_5	CD_{10}	Control
Average initial weight (g)	1.46 ± 0.05	1.42 ± 0.05	1.490 ± 0.09	1.320 ± 0.05	1.280 ± 0.05
Average final weight (g)	125.32± 0.05	142.24 ± 0.05	113.24 ± 0.04	107.48 ± 0.03	53.460 ± 0.05
Weight gain (g)	123.86	140.82	111.75	106.16	52.18
Growth increment(GI)	0.82	0.93	0.74	0.70	0.34

Chakrabarty [9, 10]. Have recorded significantly higher plankton production and fish growth (common carp) in vermicompost treated ponds in comparison to traditionally used organic manures and inorganic fertilizers. Kaur [14] have suggested that the higher potential of utilizing vermicompost as compared to cow dung and hence can be used more effectively for manuring semi-intensive carp culture ponds without affecting the hydrobiological parameters. Hence, the findings of the present results can be helped in assessing the comparative efficiency of vermicompost with cowdung on growth performance of *Catla catla*. The results depicted significant role of vermicompost@10000kg/ha/yr in maintaining the water quality.

4. Conclusion

It is concluded that vermicompost release the nutrients (NPK) easily and at faster rate which are in ready to uptake form and initiate the algal bloom that ultimately enhances the fish growth. The present study suggests that along with the additional manorial value, the expenditure on the feed can also be reduced with use of vermicompost. Thus vermicomposting is the farmer friendly technique, hence it must be encouraged to fertilize the fish ponds at regular intervals.

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