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Effect of Different Organic Manures on Growth and Survival of Carps Rearing from Fry to Fingerlings

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ABSTRACT

An experiment was conducted in cement ponds to determine the effect of different organic manures on growth and survival of carps (*Catla catla*, *Labeo rohita* and *Cyprinus carpio*) during fry to fingerling stage when they are reared together. Ponds were prepared with three types of organic manures viz., cowdung (T_1 : CD), poultry manure (T_2 : PM) and cowdung + poultry manure (T_3 : CD + PM) applied @ 10,000 kg/ha, 5000 kg/ha and 5,000 + 5,000/ ha respectively. Fry were stocked @ 30/m^2 in the ratio of 4 : 3 : 3 (Catla : Rohu : Common Carp) to all treatment and replication tanks and fed twice a day with a mixture of fine groundnut oil cake and rice bran at the ratio of 1 : 1. The highest combined survival of all the three species was observed in PM with 89.5% followed by CD+PM treatments with 87.23% and 74.94% in CD treatment. The catla seed showed better growth in treatment T_2 with 80.67± 2.80 mm, followed by T_3 (60.27±4.24 mm) and T_1 (44.93±5.42 mm) where, rohu also performed better in T_2 (67.50±2.52 mm) followed by T_3 (61.8±4.25 mm) and T_1 (44.3±0.87 mm) and common carps growth was better in T_3 (65.0±7.30 mm) followed by T_2 (60.23±8.87 mm) and T_1 (42.87±4.07 mm) in 60 days of rearing period. Physico-chemical and biological parameters were found within the productive range for all the treatments. The mean values for temperature were 27.4ºC for PM, 27.1ºC for CD and 27.3ºC for the CD+PM. pH was optimum in all the treatments with 8.0 in CD treatment, 8.38 in PM treatment, 8.16 in CD+PM. Dissolved oxygen was > 6.0 mg/l throughout the culture systems in all the treatments. Ammonia recorded 1.31 mg/l for poultry manure, 1.63 mg/l for cowdung and 0.74 mg/l was recorded in cowdung + poultry manure. Poultry manure produced the highest number of phytoplankton species as a result of the high Nitrate and Phosphate 0.05 mg/l in cowdung, 271.69 mg/l in poultry manure and 135.62 mg/l in cowdung+ poultry manure content which is a mineral stimulates phytoplankton production. ANOVA results showed significant differences ($p < 0.05$) in phytoplankton production between poultry manure, cowdung and cowdung + poultry manure.

Keywords Organic manures, Carp farming, Primary production, Fry to fingerlings, Poultry manure.

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INTRODUCTION

Scarcity of major carp seeds is as one of the major

constraints for aquaculture development in Karnataka and in India as well. Though, carps hatcheries producing plentiful of spawns, their survival per cent from spawn to fingerling is lesser than 30%. This calls for better nursery management practices with suitable manuring dosages. Predominantly, the raw cowdung is used in many of the fish nurseries owing to its low cost and availability. There are many other organic manures available in the country which can substitute or complement the existing manures. Proper management, care and understanding about the biotic and abiotic conditions of particular water body is important, when a undesirable conditions may lead to mass mortality of fingerlings (Khan *et al.* 2015). Application of organic manure in nursery and rearing ponds can play vital role to ensure the production of planktonic feed for fingerlings. Among the organic manure poultry manure and cowdung + poultry manures are the best for most of the fish species because it contain more nitrogen and phosphorus which play a vital role for primary production (Sharmin Akther *et al.* 2015) and promoting fish growth with high profit (Priyadarshini *et al.* 2011). Earlier workers have worked on the influence of the manures on carps seed rearing; but most of them on a mono species rearing. Therefore, the present study was undertaken to understand the effect of different organic manures on the growth and survival of carp species when they are reared together.

MATERIALS AND METHODS

The experiment was undertaken in cement ponds of the Zonal Agricultural and Horticultural Research Station Brahmavara Udupi District Karnataka. The size of ponds was equal having 8.57 m^2 each. The average depths of the ponds were 2.5 ft. Three types of fertilizer, like cow-dung, poultry manure and cowdung + poultry manure (10,000 kg, 5000 kg and 5,000+ 5,000/ha were tried in treatments T_1 , T_2 and T_3 respectively. Treatments with three replicates were applied. The ponds were prepared by cleaning them properly and added one inch thickness of red soil was added each pond, lime ($CaCO_3$) was applied at a dose of 0.170 g per m^2 and then after 3 days, the ponds were fertilized properly by organic fertilizers using proper dose in the respective three treatment groups. After 7 days of fertilization, the ponds were stocked with carp fry (Catla : Rohu : Common Carp) at a density of 30 No/m^2 in the ratio of 4 : 3 : 3 to the ponds of all the treatments and replications. From the second day of stocking, fry were fed twice daily with a mixture of finely powdered dried groundnut oil cake and rice bran at the ratio of 1 : 1. Supplemental feed was applied on the following days maintaining 3 times of the initial stock of the fry and was continued up to 5 days. On the consequent 5 days, the amounts of feed were increased 5 times, 7 times and 9 times respectively. Sampling was done every 10 days interval by dragging a in the pond to check the growth. Survival rate was calculated after the final harvest. Weight and length of 30 fry/pond were recorded randomly during each sampling. Water quality parameters such as temperature, dissolved oxygen and pH were recorded at an interval of 5 days throughout the experimental period. Plankton samples were collected by filtering 15 l of water through No. 55 bolting silk value of plankton net with a mesh size of 100. Collected samples were preserved in 5% formalin. The Sedgwick Rafter (S-R) cell was used to calculate the plankton population. The procedure was repeated 5 times for each sample and the average number of organisms was determined for one liter of water by applying the following formula :

$$N = \frac{A \times 1000 \times c}{V \times L \times F}$$

Where, N = No. of plankton cells or units per liter of original water,

A= Total No. of plankton counted C =Vol of final cone of the sample in ml,

L =Volume of original water expressed in liter F =No. of field counted,

V =Volume of a field= 1 cu mm.

RESULTS

Chemical composition of poultry manure and cowdung used in the experiment:

Parameters	1st dose	2nd dose	3rd dose	1st dose	2nd dose	3rd dose
	Poultry manure			Cowdung		
Total ash (%)	25.14	28.71	23.68	40.11	38.46	39.28
Acid in soluble ash (%)	10.95	9.75	11.20	28.83	27.89	28.36
Organic matter (%)	74.86	71.29	76.32	59.89	61.54	60.71
Total nitrogen (%)	2.46	2.34	2.82	2.09	2.04	2.06
P_2O_5 (%)	5.91	5.51	5.63	1.20	0.98	1.09

After 65 days of rearing fry were harvested, first by repeated netting, finally by complete draining of ponds.

Water quality

The mean values for temperature were 27.4ºC for PM, 27.1ºC for CD and 27.3ºC for the CD+PM. pH 8.0 in CD treatment, 8.38 in PM treatment, 8.16 in CD+PM. Dissolved oxygen was 6.0 mg/l throughout the culture systems. Ammonia recorded 1.31 mg/l for poultry manure, 63.63 mg/l for cowdung and 0.74 mg/l was recorded in cowdung + poultry manure. Poultry manure produced the highest number of phytoplankton species as a result of the high Nitrate and Phosphate 0.05 mg/l in cowdung, 271.69 mg/l in poultry manure and 135.62 mg/l in cowdung + poultry manure content which is a mineral stimulates phytoplankton production. ANOVA result showed significant differences ($p<0.05$) in phytoplankton production between poultry manure, cowdung and cowdung + poultry manure respectively (Tables 1, 2).

Phytoplankton density and identification

Density (number)

Following initial fertilization, the average total phytoplankton density increased sharply in all the treatments up to the 21th day, but less so in PM treatment (Table 3). However, after the 7th day, phytoplankton density increased considerably in PM treatment, while in the other treatments the increase is smaller. Subsequent to refertilization on the 42nd day, a marked increase in phytoplankton was observed only in PM treatment, while CD+PM treatment showed a slight increase. But CD treatment showed a decline in the phytoplankton density ; in the case of CD treatment, the decrease was marked. In the week following CD and PM treatments, the increase occurred gradually. On the other hand, in the case of PM treatment, no such clear increase in phytoplankton density was discernible. Differences in phytoplankton density between treatments were not well defined until the 35th day, after which, PM treatment can be said to have had the highest density, followed by CD + PM and CD treatments in that order. There were less fluctuations in phytoplankton

Table 1. Mean values for physico-chemical parameters of water measured for various treatments.

Parameters	Cowdung	Poultry manure	Cowdung+ poultry manure
Temperature (ºC)	27.1	27.4	27.3
Hydrogen ion conc	8.0	8.38	8.16
Dissolved organic matter (ppm)	8.06	8.44	7.91
Dissolved oxygen (mg/l)	6.16	6.38	5.93
Ammonia (µg at N/L)	63.63	1.31	0.74
P_2O_5 (mg/l)	0.05	271.69	135.62

Table 2. Total phytoplankton density (No./L) in different treatments.

Treatments	Initial	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	9th week
Cowdung	20.0	320.0	80591.0	3823.0	852.0	433.0	4125.0	2251.0	473.0	3731.0
Poultry manure	22.0	61.0	150.0	202.0	1477.0	3729.0	2820.0	3183.0	4174.0	1568.0
Cowdung+ poultry manure	21.0	176.0	1986.0	974.0	1860.0	3925.0	1835.0	2713.0	3831.0	1211.0

population in both PM and CD+PM treatments as compared to CD treatment.

Qualitative composition

The data on the qualitative occurrence and density of phytoplankton in the different treatments during the study are tabulated (Tables 3–10). The phytoplankton in the different treatments belonged mainly to the groups Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenineae. The former two groups were encountered commonly in large, while the latter two groups were represented in small numbers and only occasionally.

Zooplankton density and identification

Density (numbers)

After initial fertilization total zooplankton density increased conspicuously in all the treatments up to the 21st day, but thereafter decreased slightly in cowdung treatment up to the 42nd day. Fallowing refertilization the zooplankton density was increased in PM treatment on the 28th day, zooplankton numbers increased markedly in PM and CD + PM treatments up to the 63rd day, whereas they declined slightly in CD treatment with each subsequent dose of manure, zooplankton increase noticeably in CD and CD+PM treatments in the following week. The difference in the density of zooplankton between treatments became more noticeable and prominent after the 28th day, when the density was more in PM treatment, followed by CD+PM and CD treatments in that order. The fluctuations in total zooplankton density were low in CD and CD+PM treatments and high in PM treatment.

Qualitative composition

The data on the diversity and density of the zooplankton in the three treatments during the study are presented in table. The important zooplankton encountered in the various treatment during the experimental period belonged to the groups rotifer, Cladocera, Copepod, Ostracoda, Crustacean eggs and larval forms. The rotifer were found to be the most dominant group in all the treatments. The group next in abundance was Cladocera, followed by copepods and larval forms. The group Ostracoda were en-

Table 3. Total zooplankton density (No./L) in different treatments.

Treatments	Initial	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	9th week
Cowdung	10.0	140.0	45.0	119.0	45.0	98.0	59.0	110.0	40.0	41.0
Poultry manure	16.0	20.0	24.0	37.0	248.0	283.0	48.0	126.0	194.0	217.0
Cowdung + poultry manure	13.0	80.0	84.0	78.0	146.0	190.0	88.0	118.0	117.0	121.0

Table 4. Specific growth rate of *Catla catla* in different treatments.

Treatments	Cisterns	0–10	Oct–20	20–30	30–40	40–50	50–60
Cowdung	R_1	2.02	1.87	1.13	0.76	0.77	0.3
	R_2	2.63	1.44	1.2	0.76	0.59	0.44
	R_3	2.56	1.93	1.01	0.73	0.39	0.34
	Average	2.40	1.75	1.11	0.75	0.58	0.36
	SD	0.33	0.27	0.10	0.02	0.19	0.07
	% CV	13.9	15.3	8.6	2.3	32.6	20.0
Poultry manure	R_1	2.71	2.25	1.88	1.42	0.71	0.33
	R_2	3.3	1.95	2.04	1.16	1.05	0.67
	R_3	3.77	2.78	1.47	1.11	0.53	0.55
	Average	3.26	2.33	1.80	1.23	0.76	0.52
	SD	0.53	0.42	0.29	0.17	0.26	0.17
	% CV	16.3	18.1	16.4	13.5	34.6	33.4
Cowdung + poultry manure	R_1	3.21	3.21	1.43	1.21	0.28	0.57
	R_2	4.38	2.26	1.48	1.08	0.69	0.62
	R_3	3.72	2.86	1.49	1.04	0.61	0.47
	Average	3.77	2.78	1.47	1.11	0.53	0.55
	SD	0.59	0.48	0.03	0.09	0.22	0.08
	% CV	3.7	2.9	1.5	1.0	0.6	0.5

countered to a lesser extent. Generally, the Rotifers, Copepods and Cladocerans were more abundant in CD treatment.

Specific growth rate (SGR) of fish

The growth rate of fishes under different treatments was found to vary from 0.014 to 3.33 g in weight. In case of average gain weight significant variation was observed among different treatments and within the sampling. Significantly higher growth was found in treatment T_2 when compared with other treatments. However, no significant variation was observed between treatments T_2 and T_3 in the samplings. The

Table 5. Specific growth rate of rohu (*Labeo rohita*) in different treatments.

Treatments	Cisterns	0–10	Oct–20	20–30	30–40	40–50	50–60
Cowdung	R_1	2.25	1.51	1.03	0.37	0.33	0.3
	R_2	2.38	1.69	0.93	0.39	0.32	0.27
	R_3	2.4	1.43	0.93	0.33	0.36	0.31
	Average	2.34	1.54	0.96	0.36	0.34	0.29
	SD	0.08	0.13	0.06	0.03	0.02	0.02
	% CV	3.5	8.6	6.0	8.4	6.2	7.1
Poultry manure	R_1	3.11	2.87	1.66	0.5	0.48	0.44
	R_2	3.8	1.85	1.49	0.52	0.47	0.32
	R_3	3.85	1.98	1.6	0.4	0.57	0.44
	Average	3.59	2.23	1.58	0.47	0.51	0.40
	SD	0.41	0.56	0.09	0.06	0.06	0.07
	% CV	3.9	2.0	1.6	0.4	0.6	0.4
Cowdung + poultry manure	R_1	3.47	1.56	1.35	0.51	0.5	0.45
	R_2	3.17	3.08	1.25	0.63	0.49	0.37
	R_3	2.63	2.22	1.14	0.58	0.49	0.47
	Average	3.09	2.29	1.25	0.57	0.49	0.43
	SD	0.43	0.76	0.11	0.06	0.01	0.05
	% CV	13.8	33.3	8.4	10.5	1.2	12.3

Table 6. Specific growth rate of common carp in different treatments.

Treatments	Cisterns	0–10	Oct–20	20–30	30–40	40–50	50–60
Cowdung	R_1	4.6	2.27	1.23	0.76	0.49	0.25
	R_2	5.54	1.94	1.07	0.76	0.45	0.2
	R_3	4.93	2.24	1.31	0.83	0.48	0.26
	Average	5.02	2.15	1.20	0.78	0.47	0.24
	SD	0.48	0.18	0.12	0.04	0.02	0.03
	% CV	9.5	8.5	10.2	5.2	4.4	13.6
Poultry manure	R_1	6.73	3.4	2.1	0.94	0.5	0.33
	R_2	8.63	2.87	1.75	1.03	0.55	0.44
	R_3	7.63	3.16	2.19	1.09	0.52	0.43
	Average	7.66	3.14	2.01	1.02	0.52	0.40
	SD	0.95	0.27	0.23	0.08	0.03	0.06
	% CV	12.4	8.4	11.5	7.4	4.8	15.2
Cowdung + poultry manure	R_1	6.71	3.23	1.5	1.28	0.93	0.42
	R_2	7.54	2.8	1.39	1.2	0.78	0.15
	R_3	6.78	3.39	1.66	1.34	0.9	0.35
	Average	7.01	3.14	1.52	1.27	0.87	0.31
	SD	0.46	0.31	0.14	0.07	0.08	0.14
	% CV	6.6	9.7	9.0	5.5	9.1	45.7

final average maximum (38.88 g) and minimum (24.99 g) growth were observed in treatments T_2 and T_1 respectively. The highest average survival rate was recorded for treatment T_2 (85.6%) followed by treatment T_3 (85.5%) and treatment T_1 (74.3%).

DISCUSSION

Table 7. Survival percentage of different species in different treatments.

Treatments	Species	Catla	Rohu	Common carp	Total
Cowdung	R_1	66.66	77.70	88.80	77.74
	R_2	50.00	88.80	88.80	75.86
	R_3	58.33	77.70	77.70	71.24
	Average	58.33	81.40	85.10	74.94
Poultry manure	R_1	91.66	77.77	88.88	88.0
	R_2	75.00	100.00	100.00	88.0
	R_3	83.33	88.88	100.00	81.0
	Average	83.33	88.88	96.29	89.5
Cowdung + Poultry Manure	R_1	75.00	77.77	100.00	88.0
	R_2	83.33	88.88	96.29	88.0
	R_3	75.00	88.88	100.00	81.0
	Average	77.77	85.17	98.76	87.23

In the present experiment mean values for temperature were 27.4ºC for PM, 27.1ºC for CD and 27.3ºC for the CD+PM. pH 8.0 in CD treatment, 8.38 in PM treatment, 8.16 in CD + PM. Dissolved oxygen was 6.0 mg/l throughout the culture systems. Ammonia recorded 1.31 mg/l for poultry manure, 63.63 mg/l for cowdung and 0.74 mg/l was recorded in cowdung + poultry manure. Poultry manure produced the highest number of phytoplankton species as a result of the high nitrate and phosfate 0.05 mg/l in cowdung, 271.69 mg/l in poultry manure and 135.62 mg/l in cowdung + poultry manure content which is a mineral stimulates phytoplankton production. Which is within the required rate as stated by Shaid Mahboob, Lyiola *et al.* (2015) that the optimum Water temperature recorded was 27.4ºC in poultry droppings, 27.1ºC in cow dung and 27.3 ºC in the control was recorded by Lyiola *et al.* (2015). Mean hydrogen ion concentration ranged between 7.7 – 8.6 which is conducive for zooplankton and fish species production, as discussed by Kamal Shanker Shukla *et al.* (2019), Bhatnagar *et al.* (2004) stated that the ideal pH range for culture of fresh water organisms is between 6.5 – 9.0. Mean dissolved oxygen is 5.0 mg/l and it is conducive for phytoplankton production as discussed by Chakrabati (2017) which recommended that the range for oxygen in fresh- water culture system must

Table 8. Growth in length (mm) of *Catla catla* in the different treatments.

Treatments	Replications/ days	Initial	10	20	30	40	50	60
Cowdung	R1	14.6	26.5	31.5	36.6	39.5	44..1	46.5
	R2	16.1	25.8	27.6	35	41.1	44	38.9
	R3	15.7	27.8	34.2	39.6	40	46.7	49.4
	Average	15.47	26.70	31.10	37.07	40.20	45.35	44.93
	SD	0.78	1.01	3.32	2.34	0.82	26.22	5.42
Poultry manure	R1	19.6	34.2	43.1	55.1	61	72.6	78.9
	R2	20	33.5	47.3	58.5	69.2	76.4	83.9
	R3	19	35.1	46.3	56.8	68.9	74.3	79.2
	Average	19.53	34.27	45.57	56.80	66.37	74.43	80.67
	SD	0.50	0.80	2.19	1.70	4.65	1.90	2.80
Cowdung+ poultry manure	R1	23.1	43.2	48.8	51.7	54.4	56.3	56.8
	R2	27.2	41.9	43.3	43.7	50.8	52.2	59.0
	R3	27.6	46.2	53.7	58.8	59.6	62	65.0
	Average	25.97	43.77	48.60	51.40	54.93	56.83	60.27
	SD	2.49	2.21	5.20	7.55	4.42	4.92	4.24

not be less than 5.0 mg/l. Ammonia ranges between 0.0– 0.9 mg/l. As discussed by Lyiola *et al.* (2015), the permissible ammonia level in freshwater ponds is 0.1 mg/l average total ammonia concentrations varied from 0.786 to 1.670 mg at N/l in PM treatment, 0.742 to 1.299 mg at N/L in CD treatment, 0.764 to 1.260 mg at N/L in CD+PM treatment. Nitrate is a major macro nutrient used by zooplankton to grow and levels above 100 mg/l will encourage the growth of dangerous algae which affects pond plants. Levels recorded during the experiment ranged between from traces to 0.220 mg at N/L in CD treatment, traces, to 1.210 g at N/L in PM treatment, traces to 0.605 ml g at N/L in CD+PM treatment during the study period. During the period of observation, the maximum total ammonia concentration recorded in the present study was 1.962 mg at N/L in CD/ R^3 cistern. Ammonia level in culture systems must be reduced to <0.5 mg/l at all times by increased aeration and addition of fresh water. Ammonia level was highest in treatment (cowdung manure) than the other treatments and reduced gradually by

Table 9. Growth in length (mm) of rohu in different treatments.

Treatments	Replication/ days	Initial	10	20	30	40	50	60
Cowdung	R_1	13.8	20.8	26.4	32.2	37.8	41.9	44.8
	R_2	13.6	20.7	27.2	32.6	37.4	43.1	44.8
	R_3	13.9	20.6	24.9	30.1	36.4	40	43.3
	Average	13.77	20.70	26.17	31.63	37.20	41.67	44.30
	SD	0.15	0.10	1.17	1.34	0.72	1.56	0.87
Poultry manure	R_1	20.7	33.4	40.7	51.6	58.4	63.8	69.1
	R_2	20.3	30.5	39.7	48.7	54.2	61.7	64.6
	R_3	20.9	33	39.8	48.8	55.6	61.7	68.8
	Average	20.63	32.30	40.07	49.70	56.07	62.40	67.50
	SD	0.31	1.57	0.55	1.65	2.14	1.21	2.52
Cowdung + Poultry manure	R_1	19.8	27.5	36.4	42.5	52.1	58.6	61.7
	R_2	19.6	30.1	39.9	46.6	55.1	64.3	66.1
	R_3	19.8	27.1	32.9	39.5	50.8	55.1	57.6
	Average	19.73	28.23	36.40	42.87	52.67	59.33	61.80
	SD	0.12	1.63	3.50	3.56	2.21	4.64	4.25

Table 10. Growth in length (mm) of common carp in different treatments.

Treatments	Replications/ days	Initial	10	20	30	40	50	60
Cowdung	R_1	8.84	13.7	21.3	26	31	37.1	42
	R_2	8.22	12.9	20.6	21.8	30	35.3	39.3
	R_3	8.63	13.3	22.4	29.9	36.3	43	47.3
	Average	8.56	13.30	21.43	25.90	32.43	38.47	42.87
	SD	0.32	0.40	0.91	4.05	3.39	4.03	4.07
Poultry manure	R_1	13	20	30.6	37	45.6	56.9	65
	R_2	12	19.7	28.7	33.1	39.6	45.4	50
	R_3	12.6	18.3	30.5	39.1	48.1	59.2	65.7
	Average	12.53	19.33	29.93	36.40	44.43	53.83	60.23
	SD	0.50	0.91	1.07	3.04	4.37	7.39	8.87
Cowdung + poultry manure	R_1	12.8	20	31.8	39.1	44.9	51.5	57.8
	R_2	12	18.2	31.5	30.6	48	57.6	64.8
	R_3	12.6	20.5	34.9	48.3	57.8	66.3	72.4
	Average	12.47	19.57	32.73	39.33	50.23	58.47	65.00
	SD	0.42	1.21	1.88	8.85	6.73	7.44	7.30

constant addition of fresh water. During the experiment, nitrite levels were high and reduced daily as fresh water was added, but level above 4.0 mg/l is very toxic and must be reduced immediately by addition of fresh water. Dhawan and Toor (1989) also discussed the role of poultry droppings alone and in combination with cow-dung for higher production of zooplankton compare to application of cow-dung alone. The growth pattern of the fish shows rapid increase at the initial part of the e × periment with a significant variation in the average gain in weight and treatments T_2 showed significantly higher growth compare to other treatments. The role of poultry droppings for production of plankton food in a water body and promoting fish growth was also reported by several authors (Mitra *et al.* 1987, Varghese *et al.* 1981, Rappaport *et al.* 1977). In the present study, the average survival rate was 61.95%, 72.3% and 52.5% in the treatments T_3, T_2 and T_1 respectively. This might be due to the better ability of organic manures to enhance the production of plankton as the natural fish food organisms.

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