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Comparative efficacy of *Azolla* in combination with certain organic manures for production of zooplankton

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Abstract
The study has been carried out to investigate the effect of *Azolla* in combination of certain organic manures (OM) for production of live fish food organisms. Experiment was carried out with nine treatments by mixing single super phosphate (0.7 g) with different doses of OM/*Azolla*/OM+*Azolla viz.* T1(control) – only single super phosphate (SSP), T2 – Cow dung, T3 – cow dung + *Azolla*, T4 – *Azolla* (100%), T5 – *Azolla* (50%), T6 – poultry manure, T7- poultry manure + *Azolla*, T8 – vermicompost, T9 – vermicompost + *Azolla*. The effect of manuring on water quality parameters has also been studied. The maximum average zooplankton population (805 Nos/l); and maximum zooplankton biomass (36.86 g/250L) were observed in T7 i.e. *Azolla* and poultry manure. The trend of best organic manure based on the zooplankton productivity (population and biomass) in descending order as observed in the present study is – Poultry manure + *Azolla* (T7) > poultry manure (T6) > cow dung + *Azolla* (T3) > vermicompost + *Azolla* (T9) > vermicompost (T8) > cowdung (T2) > *Azolla* (100%) (T4) > *Azolla* (50%) (T5) > Single super phosphate SSP control (T1). The trend of dominance of zooplankton categories observed by per cent contribution in all treatment was- Nauplii (35.63%) > Cladocerans (24.98%) > Copepods (21.01%) > Rotifers (18.47 %). The study concludes that *Azolla* in combination of organic manures particularly with poultry manure proposition is most suitable for mass production of live fish food organisms. It is followed by cowdung and vermicompost in combination of *Azolla*.

Keywords: Zooplankton, Organic manure, Biofertilizer, *Azolla*

1. Introduction
The Application of various organic and inorganic fertilizers in fish pond have positive effect on the production of live fish food organisms. The application of manures in fish pond causes a surge of nutrient in water. This abrupt increase in nutrient combined with favourable physical condition increases most heterogeneous group of photo-autotrophs. Primary producers particularly green algae have great importance in the aquatic ecosystem. These algal forms constitutes the main food of zooplankton which are preferred food item of fishes in aquaculture. In recent years biofertilizer play a significant role in maintaining soil fertility, water quality and enhancing pond productivity. They are inexpensive, eco-friendly and can supplement chemical fertilizer which are rather costly. *Azolla* is globally distributed small aquatic fern found in symbiotic association with cyanobacterium, *Anabaena Azollae* in its leaves which is known to fix atmospheric nitrogen (Gupta *et al*., 2011) [1].
Reports on the effects of biofertilizer on zooplankton production in aquaculture are scanty [2-4]. Therefore, in the present research work an attempt has been made to study the utilization of *Azolla* as a biofertilizer and to study its efficacy for replacing some traditionally used organic manures in aquaculture.

2. Materials and Methods
The experiment was conducted to evaluate effect of *Azolla* in combination of organic manures for producing fish food organisms. In all, nine treatments were prepared using organic bio-fertilizer *'Azolla'* as a base with combination of three organic manures *viz.* cow dung, poultry manures and vermicompost including control which was devoid of any organic manure or *Azolla*. All the treatments were added with 0.7 g of single super phosphate per tank to supply 0.25 mg/l of orthophosphate. The doses were designed to provide 1.00 mg/l of nitrate nitrogen through either of organic manure and *Azolla* alone or in the combinations of organic manure with *Azolla*. As such the nine treatment were T1(control) – only single super phosphate (SSP), T2 – Cow dung(83.33 g), T3 – cow dung(41.66 g) + *Azolla*(56.00 g), T4 – *Azolla* 100% (111.0 g), T5 – *Azolla* 50(56.00 g), T6 – poultry manure(33.33 g), T7- poultry manure(16.60 g) +

Azolla(56.00 g), T8 – vermicompost(50.00 g), T9 – vermicompost (25.00 g) + + *Azolla* (56.00 g). The experiment was conducted in rectangular FRP tanks containing 500 l ground water, kept indoor. There were three replication for each treatment including control. The duration of experiment was six weeks. The evaluation of different water quality parameters and zooplankton analysis were carried out following Trivedi *et al.* (1987) [5].

3. Results and Discussion

3.1 Water Quality

The minimum and maximum values of water quality parameters in different treatments were: air temperature: 28.50 – 34.40 °C; water temperature: 24.50 – 31.00 °C; pH: 8.00 – 8.80; EC: 710 - 1180 µS/cm; dissolved oxygen: 3.80 – 6.80 mg/l; nitrate nitrogen: 0.60–1.10 mg/l and orthophosphate concentration was 0.05 – 0.13 mg/l. The electrical conductivity (EC), dissolved oxygen, nitrate nitrogen and orthophosphate were found significantly favourable for zooplankton production.

3.2 Zooplankton

The total zooplankton population (Nos/l) produced during the experimental period in different treatments are shown in Figure 1. The minimum zooplankton population was observed in T1 (control) i.e. 90 Nos/l in 1st week. Whereas, the maximum zooplankton population was observed in T7 i.e. 1350 Nos/l during the 6th week. The trend of zooplankton population from maximum to minimum with their average Nos/l can be written as T7 (805) > T6 (769) > T3 (594) > T9 (578) > T8 (531.50) > T2 (522) > T4 (475) >T5 (387) >T1 (255) indicating that the poultry manure in combination of *Azolla* resulted as best organic manure to produce maximum total number of zooplankton. The statistical analysis of zooplankton population indicate significant results ($P < 0.05$) with a critical difference (CD = 54.210) between control and other treatments. However, a non-significant difference was also noted between T2, T4 and T8. Similarly a non-significant difference was seen between T3 and T9. Interestingly the treatment T6 and T7 produced maximum number of zooplankton with a non-significant difference between the two ($P<0.05$).

3.3 Zooplankton Biomass

The total zooplankton biomass in 250 l, produced during the experimental period in different treatments are shown in Table 1. The minimum zooplankton biomass was observed in T1 (control) i.e. 4.122 g (week 1st) whereas, the maximum zooplankton biomass was observed in T7 i.e. 61.83 g after 6th week. The maximum total biomass of zooplankton harvested in 6 weeks was 221.18g in T7 i.e. *Azolla* + Poultry manure. However, the minimum of total zooplankton biomass was 70.00g harvested in T1 i.e. control. The trend of zooplankton biomass from maximum to minimum with their average weekly biomass g/250 l can be written as T7 (36.86) > T6 (35.21) > T3 (27.20) > T9 (26.46) > T8 (24.34) > T2 (23.90) > T4 (21.75) > T5 (17.72) > T1 (11.67). The statistical analysis of average zooplankton biomass indicates significant result ($P<0.05$) and a significant critical difference (CD = 2.076) between treatments and their respective control.

3.4 Qualitative analysis of plankton and relative dominance

The qualitative analysis of zooplankton was carried out for the four categories of zooplankton *viz.* rotifers, cladoceran, copepods and their nauplii. The average values of four categories of zooplankton and their per cent distribution values are summarized and shown in Table 2. The result shows that the minimum and maximum numbers (Nos/l) of the four zooplankton groups were –rotifers 41.66 & 160.00, cladoceran 65.33 & 198.50, copepods 52.16 & 175.50 and nauplii 95.83 & 270.83 in T1 and T7 respectively. The results also indicate that over all there was maximum number of nauplii (35.63%) followed by cladocerans (24.98%), copepods (21.01%) and rotifers (18.47%).

In the present study combination of poultry manure and *Azolla* has emerged as the best organic manures in the production of zooplankton. Anon (1998) [6] stated nutrient content- N, P, K% in goat droppings which is higher than the NPK in cow dung, poultry manure, vermicompost. The rich nutrient content of poultry manure in combination of *Azolla* has obvious reasons for better result of plankton production in experimental water. These nutrient contents may enhance the survival and reproductive capability for the increased production of zooplankton in water.

Sharma (2010) [7] reported higher zooplankton production (822.66 No/l) with poultry dropping compared to vermicompost and cowdung (755.16) in combination with Nualgai a commercial trace nutrient supplement.

Jana and Pal (1983) [8] revealed higher values of abundance of *Daphnia carinata* in mass culture experiment with the use of cow dung compared with other manures. Dhawan and Toor (1989) [9] recorded significantly better phytoplankton and zooplankton population in ponds receiving poultry droppings alone and in combination with cow dung. Balasubramanian and Kasturi bai (1994) [10] observed that concentrations of 0.1 – 0.3% biogas slurry is suitable for longer maintenance of algae and *Daphnia similis* in plankton culture system.

Use of vermicompost as organic manure in aquaculture is relatively new. In the present study it has been found that vermicompost has resulted in a better nutrient source as compared to cow dung, poultry manure and *Azolla* itself. Kaur and Ansal (2010) [11] and Sharma (2010) [7] referred vermicompost as potential biological manure and found it to be more nutritious then farm yard manure and cow dung in terms of more carbon and phosphorus, less potassium and comparable nitrogen.

The pond fertilization and water quality parameters equally affect the plankton diversity and their production. In the present study the qualitative analysis of zooplankton was carried out for the four categories of zooplankton *viz* rotifers, cladoceran, copepods and their nauplii. The average values of the four categories of zooplankton and their per cent distribution values indicate that there was maximum number of Nauplii (34.76%) followed by rotifers (26.56 %), copepods (24.15%) and cladocerans (14.53%). Palsaniya (2005) [12] observed cladocera (*Moina* sp.) as a dominating plankton group followed by nauplii and copepods (*Cyclops*) in plankton culture experiment using vermicompost and farm yard manure. In contrast to this Rahman and Hussain (2008) [13] found *Cyclops* (68.25% and 60.28% of total copepods) as the most dominant zooplankton among the four groups in plankton culture ponds. However, Similar to the research of present study Sharma (2010) found grate population and nauplii followed by three other plankton categories *viz*. rotifers, copepod and cladocerans.

Gupta *et al*, (2011) [1] found a zooplankton population of 1609

no/l and 1250 no/l with 3·0 and 1.0 ml/l of *Azolla* supplementation application fortnight intervals during 28 days culture period. This has reveled significance *Azolla* in plankton production particularly Cyclops with a greater number in a mixed culture.

Thus, it is revealed from the present study that *Azolla* given better zooplankton production then SSP alone (control). However, it was further revealed that *Azolla* in combination of organic manure was more effective to produce zooplankton than the single dose of organic manure indicating release of greater amount of nitrogen favorable result with *Azolla* in weekly phased application. The manuring also suggests that the *Azolla* meal also serve as direct food for the plankton produced. Therefore the finding of present research work also suggest further line of research to evaluate the acceptability of finely powdered *Azolla* meal as direct food for the zooplankton in culture systems.

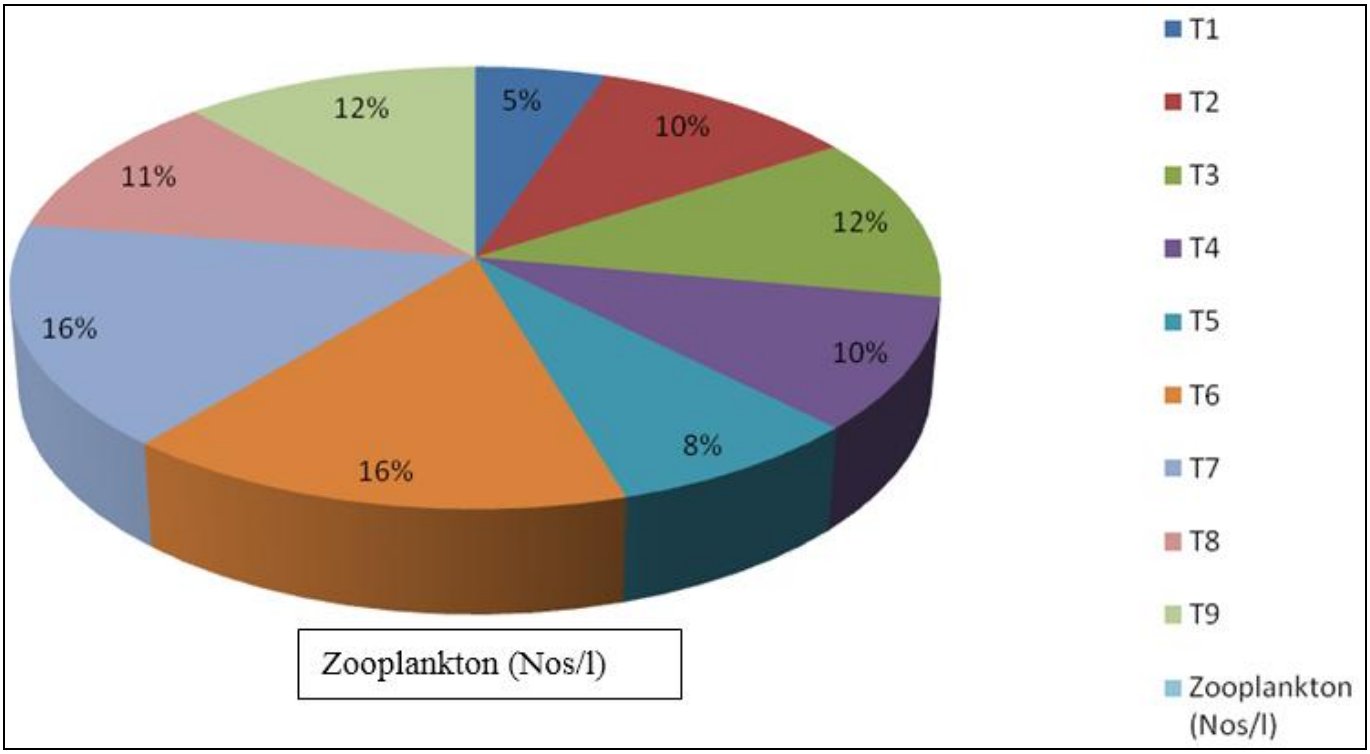

Fig 1: Total zooplankton nos/l produced in different treatments

Table 1: Total zooplankton biomass (g/250 l) produced in different treatments

Treatments	Weeks						Total biomass harvested (g/tank)	Average bio mass (g/tank)
	I	II	III	IV	V	VI		
T_1	4.12	6.87	10.30	13.74	17.17	17.86	70.00	11.64
T_2	6.87	8.65	19.69	31.60	37.78	38.83	143.43	23.90
T_3	7.55	12.36	21.30	33.66	42.55	45.75	163.18	27.2
T_4	6.18	8.93	14.42	22.67	38.47	39.84	130.51	21.75
T_5	5.49	7.14	12.64	20.19	29.54	31.32	106.33	17.72
T_6	10.30	15.80	27.20	42.59	55.78	59.63	211.30	35.21
T_7	11.26	17.58	29.95	42.86	57.70	61.83	221.18	36.86
T_8	6.87	11.68	17.86	27.48	39.84	41.32	146.05	24.34
T_9	8.65	13.05	18.55	28.16	44.38	46.02	158.81	26.46
CD	0.589	0.907	1.470	2.253	3.175	3.342	11.739	2.076
CV%	4.59	4.66	4.49	4.49	4.59	4.58	4.56	4.84
SEm±	0.198	0.305	0.495	0.758	1.069	1.125	3.951	0.699

Table 2: Average values (Nos/l) of different zooplankton categories and their percent contribution in total zooplankton

Treatments	Zooplankton categories and their per cent distribution								Total Zooplankton (Nos/l)
	Rotifers	% Dist.	Cladocera	% Dist.	Copipoda	% Dist.	Nauplii	% Dist.	
T_1	41.66	16.33	65.33	25.62	52.16	20.46	95.83	37.58	254.98
T_2	95.67	18.33	130.00	24.90	107.50	21.59	188.83	36.17	522.00
T_3	112.33	18.88	146.66	24.65	125.33	21.06	210.66	35.40	594.98
T_4	86.00	18.10	118.33	24.91	97.00	20.42	173.66	36.56	474.99
T_5	70.16	18.12	100.00	25.83	79.66	20.57	137.33	35.47	387.15

T_6	152.83	19.84	189.33	24.58	169.50	22.00	258.50	33.56	770.16
T_7	160.00	19.87	198.50	24.66	175.50	21.80	270.83	33.65	804.83
T_8	97.16	18.28	132.66	24.96	110.00	20.69	191.66	36.06	531.48
T_9	106.83	18.48	142.83	24.71	118.83	20.56	209.50	36.24	577.99
Average dominance	-	18.47	-	24.98	-	21.01	-	35.63	-

4. Conclusion

From the results of the present study it can be concluded that *Azolla* in combination with organic manures particularly poultry manure followed by cow dung and vermicompost are the best three proposition for mass production of live fish food organisms. These combinations are also important for greater resource utilization in aquaculture involving recycling of organic waste and at the same time facilitates the dependency lesser uses on chemical fertilizers. However, *Azolla* alone did not show encouraging results. The proposed doses of organic manures also favoured congenial water quality parameters. Thus, after this study it is recommended that *Azolla* can be utilized preferably in combination with poultry manure, wherever it is available or otherwise it can be mixed with poultry manure + *Azolla*, poultry manure and cow dung + *Azolla* for better results of zooplankton culture. The study opens avenues for further research using these combinations of manures under varied field conditions.

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6. References

1. Gupta AK, Nigam D, Prakash MM. Efficacy of *Azolla* as a biofertilizer for zooplankton production. Research Environment Life Science 2011; (1):21-24.
2. Garg SK, Bhatnagar, A. Effect of varying doss of organic and inorganic fertilizer on plankton production and fish biomass of brackish water fish ponds. Aquaculture Research. 1996; 27:157-166.
3. Shirgur GA. Observation on rapid production of zooplankton in fish nurseries by phased manuring. J. Ind. Fish Assoc. 1971; 1(2):25-35.
4. Sharma OP, Saini VP. Evaluation of pig manure fertilization in relation to zooplankton production and water quality. J. Ecobiol. 1992; 4:27-31.
5. Trivedi RK, Goel PK, Trisal CL. Practical Methods in Ecology and Environmental Science. Environmental Publishers, Karad (India). 1987, 340.
6. Anon. Fertilizer values of some manures. *Countryside & Small Stock Journal*. 5, http://goatconnection.com/articles/publish article_84. html. May 2016.
7. Sharma M. A study of relative efficacy a commercial fertilizer 'Nualgi' and organic manures for mass culture of fish food organisms M.F.Sc. Thesis, College of Fisheries, Maharana Pratap University of Agriculture and Technology, Udaipur. 2010, 79.
8. Jana, BB, Pal GP. Some life history parameters and production of *Daphnia carinata* (King) grown in different culturing media. Water Research 1983; 17:735-741.
9. Dhawan A, Toor HH. Impact of organic manures or supplementary diet on plankton production, growth and fecundity of an Indian major carp, *Cirrhinus mrigala* (Ham.) in fish ponds. Biological wastes. 1989; 29:289-297.
10. Balasubramanian PR, Kasturi bai R. Utilization of anaerobically digested cattle dung slurry for the culture of zooplankton, *Daphnia similis* claus (*Crustacea :* Cladocera). Asian Fisheries Science. 1994; 7:67-194.
11. Kaur VI, Ansal MD. Efficacy of vermicompost as fish pond manure – Effect on water quality and growth of *Cyprinus carpio* (Linn.). Bioresource Technology. 2010; 101:6215-6218.
12. Palsaniya MD. Relative efficiency of FYM and vermicompost for the better production of zooplankton. M.Sc. (Ag.), Thesis, Department of Limnology and Fisheries, Maharana Pratap University of Agriculture and Technology, Udaipur, 2005.
13. Rahman S, Hussain MA. A study on the abundance of zooplankton of a culture and a non-culture pond of the Rajshahi University Campus. Rajshahi University Zoological Society. 2008; 27:1023-6104.