A STUDY ON EARTHWORM TREATED *AZOLLA* COMPOST IN RELATION TO N, P, K AND MICROBIAL LOAD

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Abstract

Azolla is heterosporous free-floating freshwater ferns that live symbiotically with Anabaena - Azolla, nitrogen-fixing blue - green algae and can grow on moist soils as long as the moisture persists in the soil. Azolla is commonly used as a biofertilizer that's promoting the plant growth. The present study was focused on quantitative estimation of microorganisms in Vermicompost and Biocompost prepared from Azolla and if earthworm Eudrilus eugeniae has any impact on microbial growth was studied. Nitrogen (N), Phosphorous (P), Potassium (K) was also analyzed to determine the effect of microbial activity. There is extensive evidence in the literature that earthworms and other soil invertebrates feeding on microorganisms boost microbial activity in the first instance. As an outcome of it, earthworms diminish the accessibility of these resources for the microbial communities and consequently their activity, in later stage.

Keywords: *Azolla, Eudrilus eugeniae, Vermicompost, Biocompost, Microbial Load.*

1. Introduction

Increasing public awareness of the negative environmental impacts, growing consumer demand for healthier products and criticism of higher input production systems lead to more emphasis on organic crop production under integrated management systems (Guarda *et al.*, 2004). Excessive use of chemical fertilizers decline soil and food quality due to loss of soil organic matter is the main characteristics of the conventional farming systems which are more pronounced in arid and semi-arid areas (Singh *et al.*, 2007). Entry of pesticides into the food chain coupled with their bioaccumulation and biomagnifications can

trigger the effects of unforeseen consequences. In addition, fertilizer contamination of ground water has led to eutrophication of lake and river waters, causing depletion of oxygen that further leads to the death of aquatic life. Other related problems include nitrate pollution, increased emissions of gaseous nitrogen and metal toxicities (Atiyeh *et al.*, 2002, Malley *et al.*, 2006).

Vermicomposting is a mesophilic bio-oxidative process in which detritivorous earthworms interact intensively with microorganisms and soil invertebrates within the decomposer community, strongly affecting decomposition processes, accelerating the stabilization of organic matter and greatly modifying its physical and biochemical properties. Vermicomposting systems sustain a complex microbial and invertebrate food web that results in the recycling of organic matter and release of nutrients. Biotic interactions between decomposers (i.e. bacteria and fungi) and the soil fauna include competition, mutualism, predation and facilitation and the rapid changes that occur in both functional diversity and substrate quality are the main properties of these systems (Sampedro and Dominguez 2008). The most numerous and diverse members of this food web are microorganisms, although there are also abundant protozoa and many invertebrates of varying sizes, including nematodes, microarthropods and large populations of earthworms (Aira 2006; 2008).

The word *Azolla* is the combination of two Greek word azo (to dry) and allyo (to kill), reflecting the inability of plants to survive dry conditions. *Azolla* is abundant in paddy fields, and also referred as 'paddy organisms'. *Azolla* found in both temperate and tropical regions. It grows luxuriantly in ditches, fresh water ponds and paddy fields. The *Azolla* plants are delicate, small and triangular or polygonal in shape. *Azolla* contains 4-5 % N on dry weight basis and 0.2-0.4% on fresh weight basis and can be the potential source of organic manure and nitrogen in rice production. The important factor in using *Azolla* as biofertilizer for rice crop is, its quick decomposition in the soil and efficient availability of its nitrogen to rice plant (Singh A.L and Singh P.K 1989). Besides nitrogen fixation, these biofertilizers or biomanures also contribute significant amount of P, K, S, Zn, Fe, Mo and other micronutrients.

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2. Materials and Methods

2.1. Collection of Compost Materials

Azolla was collected from the local ponds around periyakulam. The fresh *Azolla* biomass was washed with tap water and chopped into small pieces. The chopped biomasses were mixed with equal amount of fresh cow dung. Moisture was maintained up to 60% by spraying water regularly to get the predigested substrate. The substrate mixtures were turned up 7 days gap to accelerate decomposition.

2.2. Vermicompost and Biocompost Bed

The pre composted *Azolla* biomass was mixed with cow dung at the ratio of 3:1 and filled in the plastic trough. Two plastic bins were taken and covered with nylon mesh for proper aeration. The contents in both the bins were same except the worms. 20 numbers of adult earth worms (*Eudrilus euginae*) of around 7 to 10 cm size were added in vemicompost bin. Watering was done daily to maintain moisture content.

2.3. N, P, K analysis

The N, P, K parameters of Vermicompost and Biocompost prepared from the biofertilizer of *Azolla* bins were also analyzed after 15 days time intermission. Table 1 shows the methods used for N, P, and K analysis.

Table 1: Methods used for the analysis of N, P, and K

S. No.	Parameter analyzed	Methods used
1.	Nitrogen (N)	Microkjeldhal method (Trivedi R.K & Goel 1986).
2.	Phosphorus (p)	Olsens method (Trivedi R.K & Goel 1986).
3.	Potassium (k)	Flame photometry (Trivedi R.K & Goel 1986).

2.4. Microbial analysis

First Sample was collected for analysis 15 days after the set up of Vermicompost and Biocompost. Second and third samples were also taken by keeping 15 days gap between them, to complete 60 days study (i.e. initial setup to

3rd sample). For observing microbial growth Sterile Nutrient agar plates were used. 1 gm of sample was dissolved in 9 ml of sterile saline. The Serial dilution (10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} and 10^{-8}) up to 10^{-8} was carried out. Then 0.1 ml of sample from the 10^{-5}, 10^{-6} and 10^{-7} was taken and spread by Spread plate method over the sterile Nutrient Agar plate and incubated at R.T. for 24 hours and microbial count was done. The viable count was determined by the following formula,

$$\text{No. of cells/ml} = \frac{\text{No. of colonies} \times \text{Dilution factor}}{\text{Volume of Sample}} \text{ s}$$

3. Results and Discussion

The sterile nutrient agar plates after an incubation period of 24 hours at room temperature showed a crowded plate on first sampling i.e. during initial stages of formation of Vermicompost and Biocompost. Table 3 shows the total count of Colony Forming Unit (CFU) per gram of Vermicompost samples for 10^{-5}, 10^{-6}, 10^{-7} dilutions. The CFU count was higher at initial stages while it was getting decreased further. Thus the microbial population was found higher at initial stages, which may be because after digestion of organic material the vermicasts formed; Providing large quantity of material to decompose and large surface area for microbes to adhere to the substrate; microbes from earthworm's gut i.e. enteric microflora also get added to the microbial population. After the formation of Vermicompost and degradation of organic matter, the food chain in Vermicompost and Biocompost starts working i.e. the microbes and other soil invertebrates compete for available resources (i.e. N, P, K) to sustain their lives, thus the microbial population starts decreasing. The total CFU counts of Biocompost were determined.

The comparative study showed that microbial population in Biocompost was much lower as compared to Vermicompost. Fig 1 represents the comparative account of microbial populations in Vermicompost and Biocompost. The N content in both Vermicompost and Biocompost was found to be increased from initial concentration of 0.51% to 1.25% in Vermicompost and 0.32% to 0.68% in

Biocompost. Table 2 shows the concentration of N, P and K at 15 days time interval. It has followed an increasing trend for all the phases in development of Vermicompost and Biocompost. In Vermicompost the NPK content was found higher as compared to Biocompost. Higher 'N' content may be due to the presence of earthworms, as, the Nephridial secretions of earthworms produce Nitrogenous compounds in their digestive tract which finally get mixed up with Vermicomposting material, increasing the 'N' content. P and K content also followed a rising trend in all phases. Again it is found higher in Vermicompost compared to Biocompost. Fig 2 represents the comparison of N, P, K contents in % of Vermicompost and Biocompost.

Table 2: N, P, K Concentration of Biocompost and Vermicompost.

Analysis	1		2		3	
	VC	BC	VC	BC	VC	BC
N%	0.51	0.32	0.75	0.43	1.25	0.68
P%	0.91	0.67	1.24	0.83	1.63	1.3
K%	0.15	0.1	0.27	0.12	0.39	0.21

Table 3: Total CFU/g Count for Vermicompost and Biocompost

Dilution Used	10^{-5}		10^{-6}		10^{-7}		Average	
	VC	BC	VC	BC	VC	BC	VC	BC
Sample1	2.64×10^{-6}	2.8×10^{-6}	11×10^{-6}	5.4×10^{-6}	80.2×10^{-6}	24.4×10^{-6}	31.28×10^{-6}	10.86×10^{-6}
Sample2	1.57×10^{-6}	2.5×10^{-6}	9.5×10^{-6}	4.2×10^{-6}	70×10^{-6}	20.6×10^{-6}	27×10^{-6}	9.1×10^{-6}
Sample3	1.37×10^{-6}	1.7×10^{-6}	7.7×10^{-6}	3.4×10^{-6}	62×10^{-6}	19×10^{-6}	23.69×10^{-6}	8.03×10^{-6}

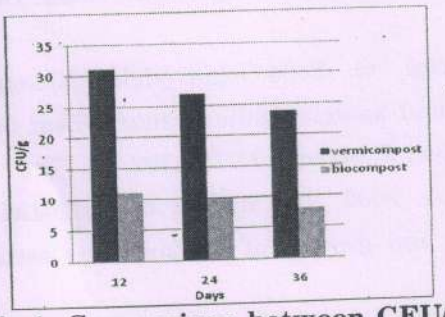

Fig.1: Comparison between CFU/g Counts of Vermicompost and Biocompost

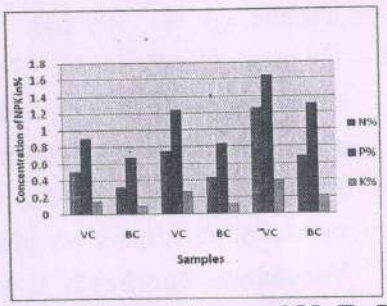

Fig.2: Comparison of N, P, K Contents in % of Vermicompost and Biocompost

4. Conclusion

The soil enriched with Vermicompost provides additional substances that are not found in chemical fertilizer (Lalitha *et al.*, 2000). Nowadays, it is difficult to manage the aquatic weeds in lotic and lentic types of water bodies. So the present investigation proves that the conversion of aquatic weed biomass into Vermicompost is an effective eco-friendly technology for not only managing the rapid growth of aquatic weeds but also can fertilize the crops for sustainable production, particularly vegetable crops. Nitrogen increased from first to forth fortnight as the earthworms mediate nitrogen mineralization of weed. It is also suggested that the earthworms also enhance the nitrogen levels of the substrate by adding their excretory products, mucus, body fluids, enzymes to the Vermicompost (Suthar, 2007).

5. References

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