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Biotransformation potentiality of *Eisenia foetida* for beneficial eco-friendly technology for improving soil fertility

Dr. Sanjib Ghoshal

Assistant Professor of Zoology, Bangabasi College, Kolkata-700009, West Bengal, India.

E-mail: ghoshalsanjib@gmail.com

Abstract

The improvement of soil quality with the incorporation of Vermicompost prepared from four different waste materials like cow dung (V1), leaf litter (V2), home garbage (V3) and sugarcane husk (V4). Vermicompost improved electrical conductivity and cation exchange capacity of the applied soil. The content of organic carbon, total nitrogen, total phosphorus, available potassium and micronutrients were increased significantly. The most common earthworm used in vermicomposting is *Eisenia foetida*. The rate of decomposition of different types of Vermicompost in soil was not uniform. The rate of decomposition of V1 was most rapid followed by V2, V3 and V4 in decreasing order. However, V1 retained maximum amount of organic carbon. V1 resulted in the highest increased followed by V3, V2 and V4 respectively. V2 and V3 exerted almost similar effect in this regard while V1 was superior in this respect. All of the Vermicompost caused a significant increase in the content of available micronutrients status of the soil. Addition of V1 released maximum amount of available Fe, Zn, and Mg in soil on the other hand, V4 released minimum amount of the same. V3 liberated maximum amount of available copper while V2 and V4 liberated almost similar amount of copper in the soil. V4 is minimal in this respect. In respect to zinc, V3 liberated minimum and V1 liberated maximum amount in the soil.

Key words: Vermicompost, fertility, NPK, Eco-friendly.

Introduction

Agricultural crops in India remove about 4.27x 10^6 tons of nitrogen, 2.13x 10^6 tons of phosphoric acid and 7.42x 10^6 tons of lime per year (Panda, 1995). Besides continuous use of chemical fertilizers exert a harmful effect on the soil micro-fauna and flora, polluting soil system and ground water and ultimately turning the soil from a dynamic living medium into an inert unproductive sterile mass of sands and silts. This compels an eco friendly technology to exploit the soil resource on sustainable basis. Vermicomposting is a technique of composting of biodegradable wastes using earthworms.

They exclusively multiply and carry out organic matter transformation into quality compost in a very short period and in a simple way which is designated as vermicompost. Previous investigations (Teotia et al., 1950; Kale et al., 1992) revealed that application of vermicompost at recommended fields does improve the microbial population. Considering the diversity of facts, it has been felt that an intensive study regarding the effect of vermicompost on soil physico-chemical change, micro and macronutrient status and microbial population in soil system will be of importance especially at 50% water holding capacity of soil. In this present study, different vermicomposts prepared on four different waste materials were used to find out their relative efficiency.

Materials and methods

Four different types of compost were produced using *Eisenia foetida* from four different waste materials namely, cow dung (V1), leaf litter (V2), home garbage (V3) and sugarcane husk (V4). The said vermicomposts were mixed separately with 200 gm of silt clay soil in earthen vat at the rate of 0.5% on soil weight basis. There were altogether five treatments including a control where Vermicompost was not mixed. The treatments were replicated twice. The moisture content of the treated and untreated solid was maintained at 50% of the water holding capacity of the soil throughout the experimental period. Soil samples were drawn after 0 and 30 days of incubation and were analyzed for organic carbon, total nitrogen, total phosphorus, and micronutrients (Fe, Mn, Zn and Cu) following standard methods as described by Black (1965).

Result and Discussion

Results are presented in table 1 and 2. The rate of decomposition of different types of Vermicompost in soil was not uniform. The rate of decomposition of V1 was most rapid followed by V2, V3, and V4 in decreasing order. However, V1 retained maximum amount of organic carbon. The increase in the total nitrogen content of soil by the addition of different types of Vermicompost supported the report of Jambhekar (1992). V1 resulted in the highest increased followed by V3, V2 and V4 respectively. However, the sequential influence of different Vermicompost on total nitrogen in soil was concurrent with the total nitrogen content of the said vermicomposts.

Fig 1. Preparation of vermicomposting bed using different materials.

The significant increase in the content of total phosphorus by the addition of different types of Vermicompost supported the previous observations of Mackay et al., (1962). V2 and V3 exerted almost similar effect in this regard while V1 was superior in this respect (table 1).

All of the Vermicompost caused a significant increase in the content of available micronutrients status of the soil. (Table 2) the results, supported the information of Bhawalkar (1992). Addition of V1 released maximum amount of available Fe, Zn, and Mg in soil on the other hand, V4 released minimum amount of the same. V3 liberated maximum amount of

Table 1. Effect of different vermicomposts on physicochemical and chemical properties of soil.

Treatments	Organic carbon (%)		Total nitrogen (%)		Total phosphorus (%)		Potassium mg/kg	
	0 day	30th day	0 day	30th day	0 day	30th day	0 day	30th day
Control (C)	0.65	0.66	0.05	0.05	0.66	0.66	125.34	125.34
C+ V1	0.735	3.56	0.09	2.87	0.97	2.58	170.06	200.32
C+ V2	0.72	2.58	0.081	1.58	0.90	2.14	162.86	172.22
C+ V3	0.71	2.99	0.085	2.02	0.98	2.02	160.71	170.59
C+ V4	0.70	1.58	0.07	1.55	0.01	1.25	96.67	99.57

Table 2. Effect of different vermicomposts on micronutrients of soil.

Treatments	Iron (mg/kg)		Zinc (mg/kg)		Manganese (mg/kg)		Copper (mg/kg)	
	0 day	30th day	0 day	30th day	0 day	30th day	0 day	30th day
Control (C)	3.45	3.45	1.50	1.50	0.61	0.61	1.99	1.99
C+ V1	5.78	6.99	2.04	3.69	2.70	3.99	2.13	3.01
C+ V2	4.79	5.10	1.97	2.01	1.97	2.45	2.10	2.50
C+ V3	4.57	4.60	1.93	1.99	1.84	2.02	2.20	3.63
C+ V4	4.46	4.49	1.90	2.00	1.72	1.79	2.14	2.15

available copper while V2 and V4 liberated almost similar amount of copper in the soil. V4 is minimal in this respect (Table 2). In respect to zinc, V3 liberated minimum and V1 liberated maximum amount in the soil.

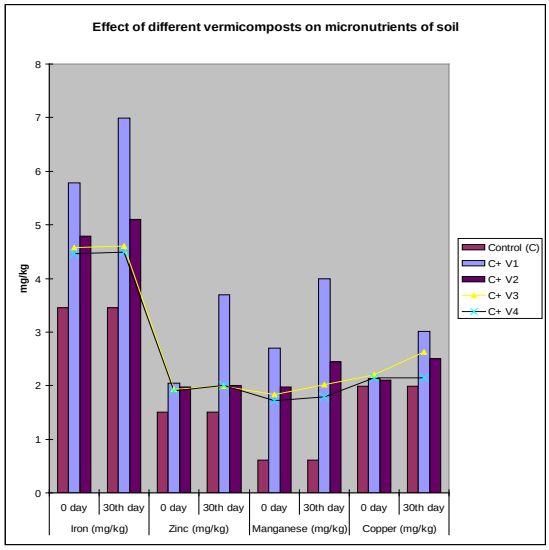

Fig.2. Effect of different vermicomposts on micronutrients of soil.

Therefore, the incorporation of different vermicomposts prepared from different waste materials in soil system exerted excellent micronutrients and improves physicochemical quality of the soil. The vermicomposts prepared using cow dung and home garbage is best while sugarcane husk can exert minimum effect in this regard.

Vermicomposting with aforesaid materials have a great promise in the improvement of soil fertility. It may have stimulatory influence on the proliferation of soil micro-faunal status. They cause the release of more micronutrients in the soil to maintain an ecofriendly soil system.

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