INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

STUDIES ON EFFECT OF ORGANIC SUBSTRATES ON QUALITY AND QUANTITY OF VERMICOMPOST

M. V. Durai[1]*, N. Ravi[1], R. Raja Rishi[2]
[1]Division of Silviculture and Forest Management, Institute of Wood Science and Technology, 18th cross, Malleswaram, Bangalore – 560 003.
[2]Division of Forest Protection, Institute of Wood Science and Technology, 18th cross, Malleswaram, Bangalore – 560 003
*Corresponding Author email: duraimv@gmail.com

ABSTRACT
The present study was conducted to investigate the effect of organic substrates on quality and quantity of vermicompost (VC). Two kinds of organic biomass such as agricultural wastes and forest litter were used for VC production as substrate. The experiment includes *viz*., T_1 = Cow dung (control), T_2 = Rice straw+ Cow dung (1:1), T_3 = Sal + Cow dung (1:1), T_4 = Bamboo + Cow dung (1:1), T_5 = Vitex + Cow dung (1:1), T_6 = Tendu + Cow dung (1:1), T_7 = Lantana camera + Cow dung (1:1) and T_8 = Grass + Cow dung (1:1). The earthworm, *Eisenia foetida* was used for vermicomposting. Substrate play vital role in quality VC production. The agricultural wastes based VC production takes minimum period whereas forest foliage based VC requires long production period. However, the quality of forest foliage based VC is superior than that of cow-dung and paddy-straw based VC.

KEY WORDS: organic, substrate, vermicompost, forest, quality.

INTRODUCTION

Vermicomposting is an eco-friendly and economically viable practice. Earthworms decompose organic wastes at a shorter duration. The castings and excreta of earthworms can be used as an organic fertilizers (Ismail, 1997). Vermicompost (VC) is not supply nutrients and growth hormones but also improves physico-chemical and biological properties of soil. VC contains high levels of nitrogen, phosphorous, potassium and micro nutrients along with growth hormones (Parthasarathi and Ranganathan, 1999; Chaouli *et al.*, 2003). Sustainable use of VC with adequate quantity can increase organic carbon, soil water retention and improves other physical properties of soil *viz*., bulk density, penetration resistance and aggregation (Zebarth *et al.*, 1999) as well as beneficial effect on the growth of a variety of plants (Atiyeh *et al.*, 2002). The various organic substrates are used for vermicomposting in combination with easily biodegradable substrate, cow dung (Munnoli and Bhosle, 2009). The *E. eugeniae* was mass cultured on the feed prepared using different combinations of cow dung, sheep and horse dung, rice polish, wheat bran, and green gram bran, vegetable waste and egg shell powder. All worm casts of this study were slightly acidic to neutral pH and N content remained the same in all casts. The EC, organic C, P_2O_5 and K_2O contents of the same varied greatly (Bano *et al.* 1987). However, very few studies were done on effect plant biomass on quality of vermicompost. Hence, the present study was attempted to document the effect of agricultural and forest biomass on quantity and quality of VC.

MATERIALS AND METHODS

The present study was conducted at Vermicomposting Unit, Forest Research Centre (Institute of Forest Productivity), Mandar, Ranchi (23° 27’ 41.3” N and 085° 05’ 57.0” E) at an altitude of 703m above mean sea level, having an annual average rainfall of 1400mm; humid to sub humid tropical type of climate. Annual temperature ranges from maximum 42°C to 20°C during summer and 25 to 4°C during winter season. Soil of study site is lateritic in nature. In this study, two kinds of organic biomass *viz*., agricultural wastes and forest litter were used for vermicompost production as substrate to investigate its effect on quality of vermicopost production. Agricultural wastes includes cabbage leaves, paddy stray and garden grasses and forest biomass such as *Bambusa bambos* (bamboo) litter, green foliage of *Shorea robusta* (sal), *Diospyros melanoxylon* (tendu), *Vitex negundo* and *Lanatana camera* and weeds (lantana and grasses) were used in the study for vermicompost production as substrate. The chopped organic biomass and cow dung were put into decomposition tank. Materials were turned up and down for every 15 days to speed up decomposition rate. Water was sprayed over decomposing materials to maintain sufficient moisture, whenever required. Decomposed organic materials were transferred from decomposition tank to vermin-composting beds and spread uniformly. Each type of organic biomass was mixed with cow-dung in equal proportion to study its effect on VC quality. The experiment includes viz., T_1 = Cow dung (control), T_2 = Rice straw+ Cow dung (1:1), T_3 = Sal + Cow dung (1:1), T_4 = Bamboo + Cow dung (1:1), T_5 = Vitex + Cow dung (1:1), T_6 = Tendu + Cow dung (1:1), T_7 = Lantana camera + Cow dung (1:1) and T_8 = Grass + Cow dung (1:1). Watering was done to maintain sufficient

moisture. Then, about 1kg weight of earthworms (*Eisenia foetida)* was introduced into each bed. Regular turning up and down of bedding materials was done to facilitate uniform decomposing. From each bead, three soil samples were collected randomly by making a pit from surface to bottom in zig-zag manner. The collected samples were shade dried and sieved with 2mm sieve. The processed samples were subjected to laboratory analysis for determination of chemical properties of the same following methods described by Black (1965).

RESULTS AND DISCUSSION

Effect of organic biomass on vermicompost yield

The data on decomposition rate revealed that the decomposition rate of organic wastes depends upon quality parameters of foliage viz., texture, thickness and water content (Table 1). Among the agricultural wastes, the decomposition rate and worm introduction time of cow dung and cabbage were done at shorter period than others. The worms were introduced 2, 7 and 15- days after initiation (DAI) into cabbage + cow dung, cow-dung and paddy + cow dung, respectively. In case of VC production period, vermicompost production period was short recorded in cow dung alone and cabbage + cow dung and highest period was recorded in sal, tendu and grass amended beds. The lowest yield per bed was recorded in cow dung alone bed with about 75kg and highest was in sal + cow dung bed (Table 1). This difference was mainly due to difference in texture and water content of organic residues.

TABLE 1: Influences of organic wastes on worm introduction, production period and yield (n=3)

Sl No	Name of Organic Wastes	Nature of materials	Time of Worm introduction (DAI)	Mean VC production period (Day)	Mean Yield/Bed (kg)
A. Agricultural wastes					
1	Cow-dung	Semi-solid state	07	75 -90	75
2	Cabbage leaves	Fresh succulent leaves	02	75-90	140
3	Paddy straw	Air dried fully	15	80-90	86
B. Forest biomass					
1	*Bambusa bambos*	Dried litter fall with thin smooth paper like	20	90-95	115
2	*Shorea robusta*	Fresh foliage with leathery rough texture	20	95-100	145
3	*Diospyros melanoxylon*	Do	20	95-100	94
4	*Vitex negundo*	Fresh foliage with soft and smooth texture	15	95-97	115
5	*Lantana camera*	fresh with soft and less vein	15	75-80	106
6	Grasses	fresh and smooth texture	18	95-100	86

TABLE 2 Mean nutrient content of vermicompost derived from different organic residues (n=3)

Sample	M/C (%)	pH (1:5)	EC (mS/cm^2) 1:5	OC (%)	Nutrient content (%)		
					T N	TP	TK
T_1 = Cow dung	30.00	7.10	0.551	13.50	1.02	0.253	1.03
T_2 = Rice straw+ Cow dung (1:1)	26.00	7.30	0.276	11.75	1.13	0.096	0.94
T_3 = Sal + Cow dung (1:1)	28.6	6.72	0.663	10.06	0.86	0.178	0.78
T_4 = Bamboo + Cow dung (1:1)	25.7	6.48	0.674	19.02	1.4	0.147	0.76
T_5 = Vitex + Cow dung (1:1)	27.5	6.82	0.287	18.74	2.03	0.138	0.95
T_6 = Tendu + Cow dung (1:1)	28.2	6.80	0.426	10.23	0.76	0.169	0.72
T_7 = Lantana + Cow dung (1:1)	30.00	7.40	0.137	35.30	1.79	0.078	2.28
T_8 = Gahato (wild weed) + Cow dung (1:1)	33.54	7.60	0.273	19.79	1.17	0.106	0.46

Where, MC – Moister content of VC @ harvesting time
EC – Electrical conductivity
OC – Organic Carbon
TN - Total Nitrogen
TP – Total Phosphorus
TK – Total Potassium

Effect of biomass on quality of vermicompost

The Table 2 revealed that quality of VC varied significantly with type of organic wastes used. The pH of vermicompost produced from plant biomass was ranged from 6.5 – 7.6. The highest pH was 7.6 observed in T_8 and lowest in bamboo VC (T4). The soluble salt content was high in T_4 followed by T_3. The highest OC content was about 35% in lantana VC (T_7) and lowest was in T_3. The total N was high T_5 and low in T_6, where as total P was maximum in T_1 and lowest in T_7 recorded. The highest

total K was 2.28% in T_7 and lowest in T_8. Thus, the quality of vermicompost produced was varied with nutritive content of biomass.

CONCLUSION

The quality and quantity of VC depend up on the quality and nature of biomass used. The agricultural wastes based VC production takes minimum period where as forest foliage based VC requires long production period. Forest foliage based VC is comparatively superior quality than cow-dung and paddy-straw based VC. From these results, it is concluded that quantity, quality and production period of vermicompost depends upon the type of substrate used.

REFERENCES

Atiyeh, R.M., Lee, S., Edwards, C.A., Arancon, N.Q, Metzger, J.D. (2002) The influence of humic acids derived from earthworms- processed organic wastes on plant growth. Bio-resource Technology. 84, 7-14.

Bano, K., Kale, R.D. and Vijayalakshmi, D. (1987) Production and reproduction in a tropical earthworm Eudrilus *eugeniae*. In: Palanisamy, S Ed. *Proceedings of 5th Indian Symposium of Invertebrate reproduction*, Palani Paramount Publications, Palani, India, pp 210-218.

Black, C.A. (1965) Methods of Mine soil Analysis. *American Society of Agronomy Inc* Madison, Wisconsin, USA.

Chaouli, I., Zibiliske, M., Ohno, T. (2003) Effects of earthworm casts and compost on soil microbial activity and plant nutrient availability. Soil Biology and Biochemistry. 35, 295-302.

Ismail, S.A. (1997) Vermicology–The Biology of Earthworms. Orient Longman, India Pp.92

Munnoli, P.M and Bhosle, S. (2009) Soil aggregation by vermicompost of press mud. Current Science, 95(11), 1533-1535.

Parthasarathi, K., Ranganathan, L.S. (1999) Longevity of microbial and enzyme activities and their influence on NPK content in pressmud vermicasts. Europ. J. Soil Biology. 35 (3), 107-113.

Zebarth, B.J., Neilsen, G.H., Hogue, E., Neilsen, D. (1999) Influence des amendements faits de dechets organiques surcertains proprietes physiques etchimiques due sol. Canadian Journal Soil Sciences, 79, 501- 504.