Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

Vol. 9	No. 4	pp. 763-766	2010

Original Research Paper

Utilization of Mixed Leaves Litter for Converting into Vermicompost by Using an Epigeic Earthworm *Eudrilus eugeniae*

B. Jayanthi, G. Ambiga and P. Neelanarayanan
Centre for Vermibiotechnology, Department of Zoology, Nehru Memorial College (Autonomous), Puthanampatti-621 007, Dist. Tiruchirappalli, T.N., India

Nat. Env. Poll. Tech.
ISSN: 0972-6268
www.neptjournal.com

Key Words:
Mixed leaves litter
Vermicompost
Eudrilus eugeniae
Plant nutrients

ABSTRACT

The processed mixed leaves litter with cured cow dung was mixed in different proportions viz., 50:50, 60:40 and 70:30 (each concentration in triplicates) and filled in the plastic trays, individually. Hundred *Eudrilus eugeniae* adult earthworms were introduced into each of these trays. Simultaneously, a control for each of these concentrations was prepared and maintained without earthworms. The conversion ratio of mixed leaves litter into vermicompost was found to be more or less similar in all the concentrations. However, the cocoons and young ones production was found to be little higher in 50:50 proportions than the other two proportions. Further, vermicompost obtained from all the three concentrations has desired level of plant nutrients for uptake. The results of the present study suggest that the mixed leaves litter with cured cow dung at anyone of these three concentrations can be used for converting into value added vermicompost by utilizing *the* earthworm *E. eugeniae.*

INTRODUCTION

Waste is a valuable raw material located at a wrong place and which can be converted into useful products by making use of appropriate processing technology (Sharma 2000). Recycling and refuse of solid wastes help to reduce the problem of waste disposal. By utilizing the solid waste, vermicompost can be produced and eventually it is possible to bring down pollution level and to keep the environment clean. At present, the potential of vermicomposting as a viable alternative for waste management is gaining momentum in India (Mary Violet Christy & Ramalingam 2005). Application of vermicompost can improve the physicochemical and biological properties of soils (Kale 2006). Leaves litter of various plants is seen in many places, which is good source of waste for composting. Instead of converting them into compost they are burnt in public places, which ultimately result in air pollution in and around human habitations. In order to avoid such polluting activity an attempt has been made to convert these wastes into valuable product i.e., vermicompost. Bearing this in mind, the present study was made with twin objectives.

1. To compute the conversion ratio of mixed leaves litter into vermincompost by *E. eugeniae*
2. To quantify the chemical composition of obtained vemicompost.

MATERIALS AND METHODS

The present study was carried out between March 2007 and July 2007 in vermiculture unit of Nehru Memorial College, Puthanampatti. *Eudrilus eugeniae* was selected for the present study because of its surface eating behaviour. The mixed leaves litter, consist of ashoka tree leaves litter (*Polyalthia longifolia*), teak tree leaves litter (*Tectona grandis*) and neem tree leaves litter (*Azadirachta indica*)

were collected from Nehru Memorial College Puthanampatti, Tiruchirappalli district. The mixed leaves litter was subjected to shredding in order to convert it into small pieces. Later, it was cured both in the open to sun light area and in a shade for 15 days. Water was sprinkled on the waste twice in a day in order to hasten the pre-digestion process. Similar method was adopted for curing cow dung.

Plastic trays of 45×15×30 cm size were used for the present study. At the bottom of each tray a hole was made to drain the excess water. The verm beds were prepared by mixing the processed mixed leaves litter with cured cow dung in different proportions viz., 50:50, 60:40, and 70:30 and filled in the trays individually. A control experimental medium was also prepared in the same proportion and filled in the trays. All the above experiments were repeated in triplicate. After 15 days of the preparation of the experimental media in the trays, 10 clitellate *E. eugeniae* adult earthworms were inoculated into each of these trays. The earthworms entered into the media immediately after the inoculation. On the following day 90 clitellate earthworms were additionally introduced into each tray, excepting the control ones. These trays were kept undisturbed in shade. Watering was done regularly twice in a day in order to maintain the temperature and moisture content of the medium during the entire composting period.

The vermicompost was collected, sieved, air dried and weighed separately from each tray at 10 days interval for three times. The vermicompost was then analysed to quantify its chemical nutrients composition. Further, after each harvest, in each tray the number of cocoons and young ones were counted and recorded. Various chemical parameters such as pH, electrical conductivity and the macro and micronutrients viz., total nitrogen (%), total phosphorus (%), total potassium (%), organic carbon (%), total calcium (%), total magnesium (%), total sulphur (%) and carbon: nitrogen ratio were estimated by following the method suggested by Murugesa Boopathi et al. (2005). The data were subjected to statistical analysis to derive useful inferences.

RESULTS AND DISCUSSION

The mean total weight of the vermicompost obtained after vermicomposting of mixed leaves litter were 2230g (50:50), 2180g (60:40) and 2120g (70:30). The percent conversion of vermicompost was 74% (50:50), 73% (60:40) and 71% (70:30) (Table 1).

The mean number of cocoons and young ones produced by *E. eugeniae* was found to be 177 and 119 (50:50); 146 and 108 (60:40); and 125 and 104 (70:30), respectively during the composting period. The cocoons and young ones production was found to be higher in 50:50 proportion than the other two proportions.

The chemical analysis of control and vermicompost showed marginal changes in all the parameters analysed. A marginal increase in the values was observed in the following parameters such as organic carbon (OC), total phosphorus, total potassium and C: N ratio. In contrast, a decrease in the values was observed in total nitrogen, total calcium, total magnesium and total sulphur (Table 2). The nutrient status of vermicompost depends on the type of waste materials processed by the earthworms (Uma Maheswari & Vijayalakshmi 2004).

Earthworm casts have usually more neutral pH than the soil. Earthworms also contribute to several kinds of nutrients in the form of nitrogenous wastes. High solubility of nutrients in earthworm cast increases the pH of the cast (Barley 1961). According to Saini & Rathore (2007), earthworms-worked soil is being close to neutral pH which is congenial for the growth of plants and microbes. The observations of the present study corroborate the results of the earlier studies.

Table 1: Composition of predigested mixed leaves litter wastes and its conversion ofinto vermicompost by *E. eugeniae.*

Particulars	Concentrations		
	50:50#	60:40#	70:30#
Weight of mixed leaves litter in each tray (g)	1500	1800	2100
Weight of cow dung in each tray (g)	1500	1200	900
Total weight of pre-digested mixture in each tray (g)	3000	3000	3000
Number of adult earthworms introduced into each tray	100	100	100
Mean number of days taken for bioconversion	30	30	30
Mean total weight of vermicompost obtained from each tray (g)	2230	2180	2120
Mean percentage of bioconversion of vermicompost in each tray	74%	73%	71%
Mean total number of cocoons counted in each tray	177	146	125
Mean total number of young ones observed in each tray	119	108	104

#Experiments were conducted in triplicate in each concentrations.

Table 2: Quantity of various chemical constituents of control and vermicompost produced by *E. eugeniae* in 50:50, 60:40 and 70:30 concentrations.

Parameters	50:50		60:40		70:30	
	Control	vermicompost	Control	vermicompost	Control	vermicompost
pH	7.72	7.82	7.96	7.70	8.12	7.05
EC	3.5	3.5	3.9	3.4	4.2	3.9
Organic carbon (%)	7.18	9.78	7.20	9.24	7.59	9.16
Total nitrogen (%)	1.58	1.22	1.75	1.09	1.95	1.21
Total phosphorous (%)	0.42	0.54	0.40	0.50	0.38	0.48
Total potassium (%)	1.87	2.15	1.56	2.22	1.54	2.11
Total calcium (%)	4.06	3.16	4.16	3.52	4.22	3.18
Total magnesium (%)	3.15	2.59	3.20	2.41	3.19	2.57
Total sulphur (%)	0.62	0.25	0.64	0.29	0.61	0.24
C:N ratio	5:1	8:1	4:1	8:1	4:1	8:1

It is obvious that all carbon containing compounds undergo essentially oxidation process by the action of microbes, which results in the release of nutrients, CO_2 and humus. Soft plant organic materials are easily decomposed by microbes. However, tougher plant materials do not breakdown readily by soil animals. The breakdown is brought out by microorganisms, and further accelerated when they pass through the guts of earthworms, due to the presence of intestinal microflora and enzymes in the gut (Edwards & Lofty 1975, Lee 1985).

The results of the present study indicate that mixed leaves litter ingested by the earthworms undergo physical, chemical and biological degradation. Further, the results suggest that the vermicompost prepared by the three concentrations of the waste used in the present study was better in terms of the following aspects.

i. Highest rate of bioconversion.
ii. Maximum number of cocoons and young ones production in the medium.
iii. Desired level of composition of nutrients in the vermicompost, which are useful for direct uptake of plants.

Hence, it may be recommended that mixed leaves litter with cow dung at all the three concentrations may be bioconverted into a nutrient rich vermicompost, which can be used as a bioorganic fertilizer for crops.

Further, it must be noted that the total time taken for bioconversion of mixed leaves litter and cow dung in all the three concentrations was 60 days. Research work is required to find out a method in which the total bioconversion period of these wastes will be completed in about 30 days or even lesser than this.

ACKNOWLEDGEMENT

The authors thank the Management, Principal and Head of the Department of Zoology of this college for providing necessary facilities. They thank Mr. G. Mahendran, Farm Manager-cum-Agriculture Officer, Sirugamani, Tiruchy for his help. Thanks are also due to Mr. Kannan, Asst. Soil Chemist, Soil Testing Laboratory, Tiruchy for providing study material during the study period.

Special thanks are also due to Mr. M. Kandasamy, Ms. M. Sarasu and Ms. M. Kamatchi, vermiculture unit assistants, Nehru Memorial College, Puthanampatti, for their help during the study.

REFERENCES

Barely, K.P. 1961. Abundance of earthworms in agricultural land and their possible significance in agriculture. Adv. Agron., 13: 249-268.

Edwards, C.A. and Lofty, J.R. 1975. The influence of cultivation on soil animal population. In: Process in Soil Zoology, Ed. J. Vanek, Academia Publishing Home, Prague.

Kale, D. 2006. Earthworm species for degradation of organic wastes. In: Vermicompost-Crown Jewel of Organic Farming. pp.17-20.

Lee, K. E. 1985. Earthworms: Their Ecology and Relationship with Soil and Land Use. Academic Press, Sydney. 411p.

Mary Violet Christy, A. and Ramalingam. R. 2005. Vermicomposting of sago-industrial solid waste using an epigeic earthworm ***Eudrilus eugeniae*** and macronutrients analysis of vermicompost. Asian J. of Microbiol. Biotech. Env. Sci., 7(3): 377-381.

Murugesa Boopathi, P., Thiyageswari, S., Natesan, R, and Govindasamy, M. 2005. Training Manual on skill Oriented Practical Training Programme on Soil, Water and Plant Analysis for KVK Soil Scientists held during March to April, 2005 at Tamilnadu Agriculture University, Coimbatore, India.

Sharma, B.K. 2000. Environmental Chemistry. Goel Publishing House, Meerut.

Saini, V. K and Rathore, M. S. 2007. Vermiculture: A bio-catalyst of organic farming. Agrobios Newsletter, 5(18):14-15.

Uma Maheswari, S. and Vijayalakshmi, G. S. 2004. Nutrient status of different vermicompost. J. Ecobiol., 16(3): 237-239.