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MANAGEMENT OF DIFFERENT TYPES OF WASTES BY VERMICOMPOSTING USING EARTHWORM VARIETIES.

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ABSTRACT

Vermicompost is an eco-friendly fertilizer, have an important contribution to agriculture.It have higher level of available of macro and micro nutrients like as carbon, nitrogen, phosphorous, potassium, calcium and magnesium derived from the wastes. These wastes include industrial, agricultural plant debris and domestic waste such as paper waste, cattle dung. Hence the present study was planned by use of three varieties of earth worms were used such as *Eisenia foetida*, *Eudrilus engeniae* and *Perionyxexcavates*.The wastes namely paper cattle dung and plant debris are rich in carbon while deficient in nitrogen so Cow dung was mixed with it to make it suitable for three earthworms.A mixture of waste paper, plant debris and cattle dung mixed in the ratio of 1:1 and designed asT1, T2, T3, control. A significant difference was detected among weight and number of earthworms in the treatments, which the highest weight and population growth of worms occurred in T1-60% of paper waste, T2-50% of plant debris, T3-30% of cattle dung.After 90 days time excellent quality and quantity of compost was produced by the three earthworms. Physical and biochemical parameters were analyzed before and after treatment. After treatment the parameters like, total nitrogen (0.5-1.50%) Phosphorus (0.1-0.30%) and exchangeable potassium (0.15-0.56%) was increased Compared with three earthworm varieties of *Eisenia foetida*showed better degradation of all the three types of wastes, especially paperwaste. This study clearly indicated that vermicomposting is a suitable technology for bioconversion of newspaper waste, Cow dung and plant debris to valuable organic rich manure.

Keywords: Vermicompost, Plant Debris, Paper Waste, Cattle Dung, *Eisenia foetida, Eudrilus eugeniae and Perionyx Excavates.*

INTRODUCTION

Vermicomposting is a bioconversion, oxidation process of organic materials and involves a joint action of earthworms and microorganisms which is widely being used for solid waste management (Manyuchi and Phiri, 2013).Worms are frequently allowed to as farmer's companions and qualities cultivates Worms are critical in soil development, essentially through their exercises in consuming natural matter, dividing and blending it personally with mineral particles to frame totals. Fertilizing the soil is one technique for usage of natural earthworms to deliver compost, wealthy in plant supplements. The job of worms in further developing soil richness is notable. Night crawlers feed on natural matter and discharge undigested matter as worm projects. As of late, there has been a lot of accentuation on readiness of vermicompost by utilization of night crawlers. Many examinations have been made on the vermicomposting of creature excreta, sewage muck and agroindustrial squanders.Nonetheless, there is a little data on the utilization of yield

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deposits for the development of vermicompost. In this process, earthworms feed on the organic materials and convert it to vermicompost and vermiwash. Vermicompost has sweet and gritty wonderful smell like the smell of first downpour(Kadam, 2004). The epigeic earthworm *Eisenia foetida* is the most suitable species for vermicomposting as they have small size, short lifecycle and high rate of reproduction as well as high conversion of organic waste into compost (Nath *et.al*, 2009; Chauhan and Singh, 2012).

During their taking care of, worms advance microbial movement extraordinarily, which inturn speeds up the breakdown of natural matter and adjustment of soil totals. According to the previous studies, in developed countries approximately 80% of waste can be recycled and reused, and about 20% transfer to the sanitary landfill or incinerator facilities. (Mousavi *et.al.,*While in Iran onlyabout 8% of waste is recycled, and the rest is mainly landfilled in an unsanitary manner, which is not only uneconomical, but also inflicts massive damage on the environment (Jamshidi *et.al*., 2015).Hence the present study is planned to management the different types of wastes by using earthworm varieties.

Materials and methods

Collection of substrate and earthworms

The wastes were collected from Sundarakkottai, Mannargudi Thiruvarur District. Such as Cattle dung, paper waste and plant debris. Different types of earth worm species namely *Eisenia foetida, Eudrilus eugeniae* and *Perionyx excavates* were procured from Periyar Maniyammai University, Thanjavur.

Experimental setup

Vermicomposting was carried at in three set of experiments such as, T1 paper waste with *Eisenia foetida,* T2 plant debris with *Eudrilus eugeniae*, T3 Cattle dung with *Perionyx excavates* and T4 Control.

Preparation of Compost bed

Vermicomposting was carried out in cement pits with dimension of 2X2 feet .The pit had proper aeration of minimum 1 cubic feet in volume. Trays of proper dimensions were kept below the pit to collect the drained water from pit. A green shade net was used to prevent the escape of earthworms from the pit and to avoid predators from harming the earthworms (Gurav and Pathade, 2011).

Following precautions were taken during vermicomposting

Vermicompost pit was protected from direct sunlight. The moisture level was maintained well in the pit for good compost formation. Pests were avoided which might harm the earthworms. The pit was well covered to avoid the earthworms from escaping the pit. Sufficient aeration was provided by proper stirring of the waste to get rid of foul odour. (Aruna *et.al,* 2006).A proper shed was built around the pit so that rain water does not enter the pit.

Production and storage of vermicompost

The processes of vermicomposting were carried out for a period of 90 days. The temperature of 30^0C and 80% moisture content were maintained by sprinkling adequate quantity of water at frequent intervals. After preparation of vermicompost, water was not added for 5 days to make the compost easy for shifting. The compost was collected in a separate container so that the earthworms settled at the bottom were reused for next batch of vermicomposting. The vermicompost obtained was brownish-black color having a pleasant earthy smell. The prepared vermicompost was packed in polythene bags and stored.

Extraction of vermiwash

During the process of vermicomposting drained water was collected as vermiwash which was used for further screening. The vermiwash was collected in trays and transferred into sterile glass bottles and stored in refrigerator at 4^0C (Aruna *et.al,* 2006).

Physico - Chemical analysis of vermicompost

Vermicompost was tested for pH and concentrations of Organic Carbon (Walkley and Black method), Nitrogen (Micro Kjeldahl), Phosphorus (Olsen method), Potassium (Flame photometry),and C/N ratio was analyzed (Bremner and Mulvaney, 1982).

Results and discussion

The agricultural waste and domestic waste was collected namely paper waste, plant debris,cattle dung. Paper waste material was rich values of pH, organic carbon. However, other nutrient such as total nitrogen available phosphorus and exchangeable potassium were found in very trace amounts. The process of vermicomposting activity significantly modified the physical and chemical properties of paper waste material that can be an important tool for organic farming.

S. No.	Parameters	Duration of Vermicomposting		
		0 day	45 days	90 days
1.	pH	8	7.6	7.3
2.	Total nitrogen (%)	0.13	0.25	0.37
3.	Available phosphorus (%)	0.79	0.97	1.17
4.	Exchangeable potassium (%)	0.085	0.128	0.28
5.	C : N ratio	30.3	16.32	5.35

Table.1 Effect of vermicompost on different physico-chemical parameters of paper waste

It was clearly evident from the result of Table.1 that the values of pH, Total nitrogen (N) available phosphorus (P) and exchangeable potassium (K) increased over 90 days of vermicomposting. Lowest values of total nitrogen (0.13%), available phosphorus (0.79%) and exchangeable potassium (0.085%) were found in control (0day). Moreover, as the time period increases during vermicomposting, these parameters also increased and their maximum values i.e. total nitrogen (0.37%), available phosphorous (1.17%) and exchange able potassium (0.28%) were obtained after 90 days of vermicomposting.

Type of Waste	Number of Earthworms			Body Weight (gm)			Cocoon Production		
	0 Days	45 Days	90 Days	0 Days	45 Days	90 Days	0 Days	45 Days	90 Days
Paper waste	25	30	42	33.75	38.25	55.75	Nil	18	47
Cattle dung	25	28	40	33.3	38.1	54.3	Nil	16	45
Plant debris	25	27	38	32.8	36.3	53.8	Nil	15	43

Table.2 Impact of composting period on earthworm number, biomass and cocoon production

The data shown in Table.2 clearly indicated that there was no mortality of worms in the predecomposed paper waste. Garg. *et.al* (2006).While working growth and reproduction of *E. foetida* in animal wastes also opined that precomposting is very essential to avoid the mortality of worms. The changes in biomass and cocoon production were also noted by Suthar, 2007 and attributed the cause of difference in substrate composting quality.

Table.3 clearly indicated that vermi biotechnology reduces the amount of waste and also improves the nutrient content of the product (vermicompost) to be used as a biofertilizer in agricultural practices. (Muddasir Basheer *et.al*.2013).Weight loss in case of paper waste was found to be 60%.Over all the result highlighted that paper waste vermicomposting showed rich source of organic manure(Fig.1).

Type of Waste	Initial weight of substrate (kg)	Final weight of vermicompost (kg)	Loss % during vermicompost
Paper waste	5	2.4	60%
Cattle dung	5	2.2	63%
Plant debris	5	2.0	65%

Table.3 Impact of vermicomposting on weight loss of organic substrate.

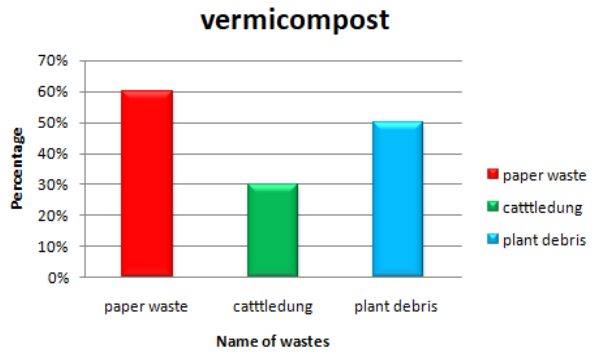

Figure:1 Details of Percentages of vermicompost produced from different types of wastes.

Conclusion

This study provided scientific information on the vermicomposting of plant debris, news paper and cattle dung either alone or in combination. The use of *Eisenia foetida* for vermicomposting of residues on the basis of their nutrient content may reduce the burden of synthetic fertilizers. The wastes from pre-digested farm waste- residue mixture raised on marginal lands can be used for recycling and conversion of quality manure.

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