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WASTE MATERIALS BY VERMICOMPOSTING USING THE EARTHWORM *EUDRILUS EUGENAE*

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ABSTRACT

The present research was conducted with the purpose of explore the Vermicomposting process, which involves different stages such as import of a compost earthworm (*Eudrilus eugenae*) and production of Vermicomposting using different waste material such as decomposing waste material maize straw and cow manure. The Vermicompost produced can be of significant value to the end users like farmers for replacement of chemical fertilizers and procure better price for the organic produce using such composting material locally available at much lower cost. Use of chemical fertilizers and pesticides were promoted in the past few decades. The study also confirmed that the Vermicomposting can produce high-quality bio-fertilizers which are better compared to other commercial fertilizers in the market. Appropriate roofing materials should be used in establishing the bed's roofings to prevent excessive rain in penetrating the culture beds that can possibly kill the Vermi worms.

KEYWORDS: Vermicomposting, Waste materials, *Eudrilus eugenae.*

INTRODUCTION

The process of cultivating earthworms in order to convert organic waste into fertilizer is called Vermicomposting or Vermiculture. This process is done using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste. It feeds on the debris, manure, rotten plant parts etc and ferments it. The worms feed on the organic waste and produce nutrient-rich manure in the form of excreta. The excreta of earthworms are nutritious and hence the soil becomes fertile. They move throughout the soil and loosen the soil. This will allow air circulation to happen inside the soil and the roots get enough space to grow and extend. The converted end product or manure is called Vermicomposting. This compost will be rich in Nitrogen, Phosphorus and Potassium compared to other composts. Vermicomposting contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small-scale organic farming. According to Aristotle has said, "Earthworms are intestines of the earth." Vermiculture is basically the science of breeding and raising earthworms. It defines the thrilling potential for waste reduction, fertilizer production, as well as an assortment of possible uses for the future (Entre Pinoys, 2010). Vermicomposting is the process of producing organic fertilizer or the vermicompost from bio-degradable materials with earthworms. Composting with worms avoids the needless disposal of vegetative food wastes and enjoys the benefits of high quality compost. Earthworms are liberated and cost effective farm relief. The worms are accountable for a variety of elements including turning common soil into superior quality. They break down organic matter and when they eat, they leave behind castings that are an exceptionally valuable type of fertilizer. non burrowing species are mostly used for compost making. Red earthworm species like *Eisenia foetida* and *Eudrilus eugenae* are most efficient in compost making.

Vermicomposting is the process of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil. The castings contain high amounts of nitrogen, potassium, phosphorus, calcium, and magnesium. Castings contain: 5 times the available nitrogen, 7 times the available potash, and 1 ½ times more calcium than found in good top soil. Several researchers have demonstrated that earthworm castings have excellent aeration, drainage, and moisture holding capacity. The content of the earthworm castings, along with the natural tillage by the worms burrowing action, enhances the permeability of water in the soil. Worm castings can hold close to nine times their weight in water. using earthworms to convert waste into soil additives, has been done on a relatively small scale for some time. Vermicomposting, or worm composting, turns kitchen scraps and other green waste into a rich, dark soil that smells like earth and feels like magic. Made of almost pure worm castings, it's a sort of super compost. It is not only rich in nutrients but also loaded with the microorganisms that create and maintain healthy soil.

Following are the benefits of Vermicomposting

- Provides nutrients to the soil
- Increases the soil's ability to hold nutria nts in a plant-available form
- Improves the soil structure
- Improves the aeration and internal drainage of heavy clay soils
- Increases the water holding ability of sandy soils
- Provides numerous beneficial bacteria,

Because it's usually made in modest quantities, vermicompost is often used as top or side dressing for one's most demanding and deserving plants. Mixed with regular compost it adds a boost to garden soil. Blended with potting soil, it invigorates plants growing in containers, outside or in (properly made vermicompost has a slight, natural smell and is perfectly suitable for indoor use).

MATERIALS AND METHOD

Preparation of culture bed

Young clitellated specimens of *Eudrilus eugenae*, weighing 115–215 mg live weight were randomly picked from several stock cultures containing 500–1500 earthworms in each, maintained in the laboratory with cow dung as culturing material. Fresh different organic waste was collected from different local area. The dung consisted of a mixture of faeces and urine without any bedding material. The main characteristics of different organic waste are given in *Table 1*. All the samples were used on dry weight basis for biological studies and chemical analysis that was obtained by oven drying the known quantities of material at 110 °C. All the samples were analyzed in triplicate and results were averaged.

Experimental design for Vermicomposting

Two circular plastic tubs (diameter 14 cm, depth 12 cm) were filled with 100 g (DW) of each dung material. The moisture content of wastes was adjusted to 70– 80% during the study period by spraying adequate quantities of water. The wastes were turned over manually everyday for 15 days in order to eliminate volatile toxic gases. After 15 days, 5 clitellated hatchlings, each weighing 150–250 mg (live weight), were introduced in each container. Three replicates for each waste were maintained. All containers were kept in dark at temperature 25±1 °C. Biomass gain, clitellum development and cocoon production were recorded weekly for 15 weeks. The feed in the container was turned out, and earthworms and cocoons were separated from the feed by hand sorting, after which they were counted, examined for clitella development and weighed after washing with water and drying them by paper towels. The worms were weighed without voiding their gut content. Corrections for gut content were not applied to any data in this study. Then all earthworms and feed (but no cocoons) were returned to the respective container. No additional feed was added at any stage during the study period. All experiments were carried out in twice and results were averaged. The pH and electrical conductivity (EC) were determined using a water suspension of each waste in the ratio of 1:10 (w/v) that had been agitated mechanically for 30 min and filtered through What man No. 1 filter paper. Total organic carbon (TOC) was measured using the method of Nelson & Somers. Different types of biodegradable wastes i.e. Crop residues, Weed biomass, Vegetable waste, Leaf litter, Waste from agro-industries.

Following are the process

1. Processing involving collection of wastes, shredding and storage of organic wastes, Pre digestion of organic waste for twenty days by heaping the material along with different organic waste. This process partially digests the material and fit for earthworm consumption
2. Preparation of earthworm bed- A concrete base is required to put the waste for Vermicomposting preparation. Loose soil will allow the worms to go into soil and also while watering, all the dissolvable nutrients go into the soil along with water.
3. Collection of earthworm after Vermicomposting collection. Sieving the composted material to

separate fully composted material. The partially composted material will be again put into Vermicomposting bed.

4. Storing the Vermicomposting in proper place to maintain moisture and allow the beneficial microorganisms to grow.

Selection of site for Vermicomposting production

Vermicomposting can be produced in any place with shade, high humidity and cool, discarded cattle shed or poultry shed or unused buildings can be used. If it is to be produced in open area, shady place is selected. A thatched roof may be provided to protect the process from direct sunlight and rain. The waste heap for Vermicomposting production should be covered with moist gunny bags.

Sr. no.	Bedding Material	Absorbency	Bulking Pot.	C:N Ratio
1.	Straw – general	Reduced	Medium	45 - 135
2.	Straw – wheat	Reduced	Medium	95 - 175
3.	Loan cutting grass	Reduced	Good	123 - 927
4.	Decomposing material	Reduced	Good	66
5.	Leaves (dry, loose)	Medium	Medium	42 - 84

Vermicomposting and its utilization

Vermicomposting is nothing but the excreta of earthworms, which is rich in humus and nutrients. We can rear earthworms artificially in a brick tank or near the stem / trunk of trees (specially horticultural trees). By feeding these earthworms with biomass and watching properly the food (bio-mass) of earthworms, we can produce the required quantities of Vermicomposting.

RESULTS AND DISCUSSION

The temperature in the Vermicomposting unit was measured regularly and recorded was 26 °C (average), i.e., within the range of 0–34 °C The results for humidity indicated that the unit was moist to wet (85%), which was in the range of 82–92% for rapid growth. The pH recorded between 6.55 and 7.55 was in the range of 6–10 for Vermicomposting The total amount of Vermicomposting produced was 68 kg and the estimated total population of earthworms by the passive method was 300-350 number of initial worms used in Vermicomposting was 5500 and after 75-80 days this number increased to 12,000. described that 0.57 kg of earthworms can process about 0.57 kg of organic material (at 71–82% moisture) and produce approximately 0.23 kg of vermicompost per day (40–50% conversion rate). The chemical analysis was conducted in mixed sample of dry waste material, one mixed cow manure sample, and one mixed vermicompost sample.

Sr. no.	Parameter	Cow manure	Dry grass	Vermicompost
1.	C/N ratio	12:09	22:9	13:1
2.	Total organic carbon (%)	22.07	41.00	16.45
3.	Total-Cu (ppm)	35.0	7.01	27.12
4.	EC (mS/cm)	5.72	3.00	3.71
5.	Total-Fe (%)	1.62	0.18	1.56
6.	Total-K (%)	0.89	1.35	0.78
7.	Total-Mn (ppm)	598	192	603
8.	Total-N (%)	1.57	1.78	1.56
9.	Total-P (%)	0.76	0.28	0.61
10.	Total-Zn (ppm)	897	116	701

The pH was slightly acidic in the vermicompost, followed by the raw material and the cow manure, slight decrease in salinity in the vermicompost compared to the cow manure. The total organic carbon was 16.45%, 41.00% and 22.07% in the vermicompost, raw material and cow manure, respectively. The total nitrogen was 1.56% in the vermicompost and 1.78% in the raw material. The C/N ratio in the vermicompost, and cow manure was the same (12:09) but relatively high (22:9) in the raw material. Total phosphorus was 0.61%, 0.28% and 0.76% in the vermicompost, raw material and cow manure, respectively. The total potassium was 0.59% in the vermicompost, 1.21% in raw material and 0.83% in cow manure, indicating a decrease in the vermicompost, compared to the cow manure and raw material. The total zinc, manganese, copper and iron concentrations are higher in the vermicompost than in the raw material, indicating an accumulation of these micro-elements in the vermicompost, but lower than in cow manure.

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