

Research Article



Studies on Vermicomposting of Vegetable Waste Using *Eisenia foetida*, *Lampito mauritii*

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ABSTRACT

Vermicomposting technology is a fast growing one with its pollution free, cost effective and efficient nature. Vegetable waste from market and homes are source of environmental pollution, global climatic changes and human health hazards. Methods of their disposal and management are not satisfactory. This study has been done for reducing the pollution due to Vegetable waste by converting it into compost by using earth worm very successfully, economically, and usefully. There the study was planned to make the conversion of vegetable waste of compost using partially decomposed vegetable waste. The earth worm species used for this *Eisenia foetida*, *Lampito mauritii*. pH, temperature, moisture content was monitored by providing proper percentage. The partially decomposed organic waste were converted in to castings by earthworms. The castings obtained on the top surface of the bin were in the range from 20 to 30 days depending on the type of waste. The *Eisenia foetida* earth worm was quick composter than castings obtained were sieved, dried, tested, and used manner. Thus the vermicomposting process helps in the disposal of organic waste in a safe, economic and useful manner.

Keywords: vermicomposting, cow dung, vegetable waste, earth worm

INTRODUCTION

India and many other countries are suffering from the entire problem due to urbanization, which are a very rapid process and a worldwide phenomenon. Deteriorating quality of urban environment is one of its important impacts. SOLID WASTE is its major contribution the complexity in character solid waste and its volume is greatly increasing due to increase of living standards and population density. Hence the importance of efficient "SOLID WASTE MANAGEMENT" is increasingly recognized.

Vermicompost in recent years has gained importance because of it contains favourable aerobic bacteria and has higher nutrient value such as nitrogen, phosphorous, potassium etc.^{1,2}

Vermicomposting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle agricultural wastes and to produce quality compost. Earthworms consume biomass and excrete it in digested form called worm casts. Worm casts are popularly called as Black gold. The casts are rich in nutrients, growth promoting substances, beneficial soil micro flora and having properties of inhibiting pathogenic microbes. Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physicochemical and biological properties. It is highly useful in raising seedlings and crop production.

Vermi is the Latin Word for worm. Vermicomposting is simply composting with worms. vermicomposting refers to the method of converting organic waste in to worm castings. It is one of the most cost efficient and environmentally friendly methods of waste disposal.³ Vermicomposting is the best biotechnology to reduce the

load on the treatment and disposal of biodegradable agro waste. Earthworms have ability to convert organic waste into valuable resources containing plant nutrients and organic matter, which are essential for maintaining soil productivity.

Earthworm belongs to phylum Annelida of Animal kingdom. They are long and cylindrical in shape and size having a large number of grooves. Earth worms are so called because they are almost always terrestrial and burrow into moist – rich soil emerging at night to forage.

The earth worms are long, thread – like elongated, cylindrical, soft bodies animals with uniform – ring like structures all along the length of their body. These bodies consist of segment arranged in linear series grows called annuli. The nutrient statuses of vermicompost of all earthworm species produced from both the wastes were more than that of the compost and that of their respective substrates.⁴ Moreover, the vermicompost produced by *Eisenia fetida*, *Lampito mauritii* possessed higher nutrient contents. Therefore the present study was planned as vermicomposting of vegetable waste using earthworms varieties.



MATERIALS AND METHODS

Sample Collection

The vegetables wastes are collected from Thiruthuraiipoondi, Thiruvavur Dt, Tamil Nadu. The



vegetables waste was collected for a week and precomposted for 18 days period to vermicomposting for thermal stabilization and initial of microbial degradation. Only plant based materials (such as vegetable peelings leaves or grass).

Cow dung was collected from slaughter house of cattle. Earthworm, (*Eisenia foetida*, *Lamptio mauritii*) was collected from Biominin Laboratory in Sundarakottai, Mannargudi, Thiruvapur Dt, TamilNadu. Microbial population was isolated, identified, before and after composting.

Experimental Designing

The experiments were conducted in plastic pots with each capacity of 5 kg waste with a small hole at the bottom: substrate and cowdung were taken in 3:1 ratio. 5 kg two species of earthworms, (*Eisenia foetida*, *Lamptio mauritii*) each plastics pots were introduced in earthworms.

The pH, temperature, and moisture content was maintained between 40% and 50% during the study by periodically sprinkling of an adequate quantity of water. All the pots were covered on the top by jute cloth cover and wire mesh to prevent and protect the earthworms from the predators-centipedes, moles, and shrews; small holes were drilled at the bottom of each pot which was filled with small stones up to a height 5cm for air circulation and good drainage. The processes of vermicomposting and composting were carried out for a period of 48 days. Ph, temperature and moisture content were monitored and maintained by sprinkling adequate quantity of water at frequent intervals.

Partially decomposed

Vegetable waste + cow dung

2:3 (ratio)

Height-18 cm

Length+Breadth-30+25

RESULTS

Composting and vermicomposting are biooxidative processes that stabilize organic matter. Vermicomposting includes coupled activities of earthworms and microorganisms. Stabilizing the organic matter and does not involve a thermophilic phase.

In the present study, aerobic composting carried out using vegetable waste in combination with cowdung. Two earthworms were selected for this study namely (*Eisenia foetida*, *Lampito mauritii*). Three plastic pot were chosen in this experiment two pots inoculated with worms. One pot inoculated with *Eisenia foetida*, and another pot inoculated with *Lampito mauritii*, one is kept with control. During composting the changes in bio physicochemical parameters were observed and are noticed in Table 1,2,3,4.

Microorganisms Diversity Monitoring

Species of microorganisms were isolated and identified from vegetable waste, and cow dung before composting and after composting.

Before composting, the vegetable waste, and cow dung containing microorganisms are such as *Staphylococcus aureus*, *Pseudomonas aerogenusa*, *Bacillus subtilis*, *Penicillium*, *Aspergillus sp*, *Rhizopus*. (Table 1)

After composting the vegetable waste, and cow dung containing microorganisms are such as *Saimonella*, *Bacillus*, *Pseudomonas*, *Mucor*, *Streptomyces*, *Aspergillus sp* and *Fusarium*. (Table 1)

Bacterial colonies were observed, confirmed by morphological and biochemical characteristics and manual (Table 2). In both stage of composting process predominantly presented microorganisms like *Staphylococcus*, *Pseudomonas*, *Bacillus*, *Penicillium*, *Aspergillus sp*.

Changes in pH

The pH had slow decrease during vermicomposting. The pH of the composting material was 6.5. As the composting process progressed the pH reduced to 5.9. The pH value raised rapidly to 8.6. During the cooling stage, the pH reduced towards neutrality i.e, 6 (Table 3) and (Table 4).

Initially, many materials such as vegetable waste are matabolic process during composting further affect the pH of the material. It was monitored at weekly intervals.

Changes in Temperature

The temperature was found to increase from the during composting and vermicomposting stage. Where actual decomposition of vegetable waste occurs. All the temperature of the waste was recorded 30 to 40°C using thermometer.

As the composting process progressed, the temperature was raised to 39.1°C. In the temperature was raised to 40.2°C. Where it fluctuated between 35 to 40°C for the period of one week and then gradually to 33.4°C at cooling stage (Table 3) and (Table 4).

Changes in Moisture Content

The moisture content was recorded as 39-42% and gradually reduced to 25% at the end of the cooling stage. The vermicomposting process requires a moisture content of 40 -45% hence the moisture content was monitored (Table 3) and (Table 4).

Comparison has been made between two species of earthworms *Eisenia foetida* showed better vermin castings than *Lampito mauritii*. More vermin castings has established in pot 2 by *Eisenia foetida*. Castings which in rich microorganisms enhance the plant growth hormones. The casting obtained were sieved, dried, tested and used as required.



The result showed the increase in earthworm population in two pot (*Eisenia foetida*, *Lampito mauritii*).

Epigeic worms such as *Eisenia foetida*, do reproduce very quickly given good idea conditions, compost worm population can be expected to double 50 days. Theoretically, this means that initial stock of 5 kg of worms can become 8 kg after 50 days.

Table 1: Microorganisms Populations of Before Composting and After Composting

Microorganisms	Before composting	After composting
<i>Staphylococcus aureus</i>	+	-
<i>Pseudomonasa aerogenasa</i>	+	+
<i>Bacillus subtilis</i>	+	+
<i>Salmonella</i>	-	+
<i>Penicillium</i>	-	+
<i>Streptomyces</i>	+	+
<i>Aspergillus</i>	-	+
<i>Rhizopus</i>	-	+
<i>Mucor</i>	-	+
<i>Fusarium</i>	-	+

Table 2: Morphological Characteristics and Biochemical Characteristics

Biochemical test	<i>B. subtilis</i>	<i>S. aureus</i>	<i>Salmonella</i>	<i>P. aerogenasa</i>
Gram staining	+	+	-	-
Shape	Rods	Cocci	Rods	Rod
Indole	-	-	-	-
MR	+	+	+	-
VP	+	-	-	-
Citrate	-	-	+	+
Urease	-	-	-	-
Catalase	+	+	+	+

Table 3: Physicochemical Analysis of During Composting

Composting Stage	Days	p ^H	Temperature (°C)	Moisture content (%)
1.	1 to 7	6.5	30.5	39.6
2.	8 to 14	5.9	39.1	42
3.	15 to 21	6.7	40.2	43
4.	22 to 28	7.2	33.4	38.00
5.	29 to 35	6.1	36.2	41
6.	36 to 42	6.4	40.5	41.00
7.	43 to 49	6.3	40.9	43

Table 4: Physicochemical Analysis of During Composting

Composting Stage	Days	p ^H	Temperature (°C)	Moisture content (%)
1.	1 to 7	7.2	32.5	35.6
2.	8 to 14	7.1	32.0	40.2
3.	15 to 21	7.5	31.0	40
4.	22 to 28	7.2	30.0	39.3
5.	29 to 35	7.1	29.5	38
6.	36 to 42	6.9	29.8	40
7.	43 to 49	6.8	30.5	41

DISCUSSION

Our study reports were similar to the finding of the⁵ pH of the organic waste is vary from acidic to basic (2.5 to 1.50) and pH is 6.5 in *Eisenia foetida*, *Lampito mauritii*. stabilization of vegetable market waste through vermicomposting. Vegetable waste from market and homes are source of environmental pollution, global climatic changes and human health hazards. Methods of their disposal and management are not satisfactory. Earlier on vermicomposting of kitchen and vegetable waste could not provide a simple and satisfactory method of waste recycling.

Our finding were correleated to similar reported also⁶ Nutrient status of vermicompost of urban green waste processed by three earthworms species- *Eisenia foetida*, *Eudrillus eugeniae*, and *perionyx excavatus* Physical parameters- temperature, moisture, pH, and electrical conductivity were also recorded. The nutrients-Nitrogen, Phosphorus, Potassium, calcium, and magnesium-increased in the vermicompost and compost while the carbon, C/N and C/P ratios decreased as the composting process progressed from 0 to 15, 30, 45, and 60 days.

CONCLUSION

The vermicompost of vegetable waste acts as an excellent base for the establishment and multiplication of beneficial and symbiotic microbes. It being a natural means of soil fertility management strategy for sustainable agriculture. The large scale practice of vermicomposting may have for reaching effect in environmental conservation, sustainable development and improving community health. This is a eco-friendly and cost effective method. It is an ideal method for the management of solid waste.

Hence concluded that hold promise to play a significant role in protecting environment as it uses waste as raw material and in building up of soil, fertility and improving soil health for sustainable agriculture. Besides from this study, was extended to collect vermiwash, castings for the application pot, field trial for some agriculture crops.

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