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A study on organic waste management with reference to vermicomposting

M Hanumantha Raju
Ph.D., Assistant Professor in Zoology, Department of UG & PG, Zoology, Government College for Women (Autonomous), NAAC 'B' Graded (in new pattern) College with CPE, Guntur, Andhra Pradesh, India

Abstract
Industrialization, urbanization, increase in population are some reasons for the high production of organic waste on earth. The waste should not be dumped and it has to manage (or) dispose properly, otherwise the ecosystem will suffer on long run. Waste Management or waste disposal is a multidisciplinary process where the waste is managed from its production level and disposed to the final state without damaging the environment. Collection, transport and proper treatment are the gradual steps comes under waste management technique. In India it is estimated that the waste generated is 28% recycled, 12% is composted and 3% is used for energy recovery. South Korea stands first in world by recycling 36% waste and 23% composting and using 25% for energy recovery.
In the present study a special focus is paid on organic waste treatment by converting the waste into natural eco-friendly plant manure or fertilizer with the help of earth worms. This technique is one of the best methods and so adopting all over the world. This process is also known as vermicompost. Vermicompost is an aerobic, non-hazardous, biological waste management method. Rearing of earthworms (vermiculture) and production of vermicompost undergo simultaneously in this process.

Keywords: population increase, generation of waste, threat to ecosystem, waste management- composting – vermiculture, production of vermicompost

Introduction
Increase in population and increase according to the requirement of food materials other needs leaded to high production of organic waste everywhere in the world. Green Revolution, Industrialization & urbanization were also the causes for the higher production of waste in Indian rural and urban areas. Any type of the waste generated by anthropogenic activities must be treated or disposed. In this context environmentalists, organic chemists, Government & Non-Government organizations etc concentrated on the treatment methods of converting wastes into non-hazardous, recyclable, eco-friendly end products. (2,14 & 15).
In the present study a special attention is paid on converting the organic waste material generated from plant & animals into a non-toxic, natural, plant manure using earthworms. This process is called vermicompost and it is one of the cheapest, beneficial, easy maintainable and mostly adoptable method everywhere in the world. Earthworm species Eesinia fetida were used. The generated vermimanure increase the plant growth and also the fertility of the soil. [1, 2, 5].

Vermi Culture & Vermicomposting
These two words are deeply interrelated with each other. Vermiculture means rearing of earthworms and vermicompost is a process where the organic waste material is breakdown & converted into natural fertilizer, with the help of earthworm's 'vermin' is a Latin word related to worms.
The history of vermiculture reveals that Egyptions were the first to recognize the properties of the earthworm and scholars from Aristotle to Darwin also observed the capacity of the worms to decompose & convert the household organic waste into a natural fertilizer. This manure increases the soil fertility and acts as soil conditioner. Earthworms consume more & more food along with mud and releases the undigested excretory matter in the form of fine black granules called vermicompost or worm castings. This method is cost-effective, eco-friendly and mostly adopted everywhere in the world [7, 8, 10, 12].
Later the literature reveals that vermicompost came practically into practice in various countries like U.S. U.K. and Japan in the years 1960 and as a small-scale industry afterwards. Where as in India vermiculture was started first in 1985 and it became a good waste management technique to convert organic waste generated domestically or industrially into manure and is practiced successfully in states like Maharastra, Madhya Pradesh, Madras & Punjab around in 1990's. [9, 10, 15]. The previous date reveals that the waste generated is recycled 30-35% and 10-25% composed and less than 20% is used for energy recovery globally [16].

Earthworms
Earthworms are round shaped, invertebrate organisms living in or on the surface of the soil. The body is long, slender and divided into equal segments or annual rings. The animals have a long, straight digestive track. There is a symbiotic relationship between the minoorganisms present in the intestine of the worm and to the worms. The microorganisms help the worms to digest organic matter which it consumes and the worms gives accommodation to the worms in it's intestine. Like that earthworms take more and more dead & decaying organic matter as food and convert into plant manner in the form of warmcastings.

Even though earthworms are hermaphrodite, sperms and eggs will not mature at same time in a same animal. Two earthworms come side by side and sperms are transferred in copulation. In that way the worms reproduce and increase their population. The main aspect in vermiculture is rearing of earthworms and vermicompost production occurs produced simultaneously.

The generated manure is collected from the surface of the vermi bed and it is cleaned and packed in gunny bags as per the requirement. The farmers use this manner to flower, fruit& garden plants. This manure is natural and more nutritive than the yard compost.

When it comes to culture earthworm species of E.fetida are commonly used in vermiculture. Generally, they are surface feeders and their decomposing capacity is very high and they increase the action of microbial & fungal activity of the organic matter. So in the present study E.fetida are selected for vermiculture [3, 4, 8, 9, 10].

The author is an Assistant Professor in Zoology and as there is a certificate course in "vermiculture" in the syllabus for U.G. students and an interest arise on this topic for the author. The department of zoology approached "Annadhata vermiculture unit", Gorantla, Guntur, which is 5 kms from the college to observe the activities going in the unit in detail. The dept. already having MOU with that unit under Industrial Development Training. The author is also very much interested to know personally and for the sake of the students to visit the unit.

This unit was established in outdoors as a small-scale industry and it was running successfully more than 10 years. The unit has 6 permanents long vermibeds, each measuring 5x2x1 meter size and out of which 4-5 are used for vermiculture simultaneously at a stretch. The beds are made of cement and all the beds are covered with sheds and are protected from rats, snakes & other animals. The physical conditions like Temperature, Light, Soil, pH, water are maintained properly and a regular strict observation will be done by 4-5 regular employees.

Earthworm species Eisenia fetida were cultured and a net production of 1 quintal per 100 tonnes of cowdung manure with in a period of 3-4 months. The first harvest will come within 3 months and the next in 15-30 days. The actual activities which will be conducted in the process of vermiculture are described one by one in the following [7, 10, 11].

Methodology

1. Cleaning the Site

First the selected site is cleaned neatly and marked as per required measurements. The edges of each vermibed (5x2x1 meter size) are fixed with bricks and the bed walls are constructed with cement.

2. Preparation of Vermibeds

The vermibeds were first filled with fertile black soil at the down surface.

A mixture of dry cowding, dry rice straw and dry leaves is applied on the soil as layer by layer. Now the vermibeds are watered regularly twice a day for 7-10 days. The cowding mixture starts decomposing and microorganism will develop and further are useful as food material for earthwarms.

The vermibeds are covered with Tarpaulin sheets to protect the worms from sunlight.

3. Introduction of Earthworms

The moist cowding mixture is ready to introduction of worms. As E.fetida species are surface feeders, it is easy to maintain and so they are commonly used for vermiculture. 5-6kg worms per 100 kg of cowding weight are introduced in vermibeds.

An average 5cm length worms are introduced. The organic matter in vermibed develop more and more microorganisms and the worms will consume them. The microbes present in the intestine of the worms will decay the organic matter. The worms absorb the food and the undigested food along with mud is excreted in the form of warm castings.

4. Re Introduction of Worms & Using New Vermibeds

Generally, the harvest of vermicompost will come within 3 months for the first time after the introduction of worms. The second harvest comes in a period of one month. After removing the manure from the surface of vermibeds, it is separated, cleaned and packed as per the requirement and send out.

For the second harvest again, the worms are introduced and new beds are prepared as per the process.

5. Feeding the Earthworms

After introduction of earthworms a special attention should pay to feed them. Vegetable, fruit waste and cowdung has to dump as food. The feed is given regularly according to the rate of consumption by the worms.

Animal originated material like meat; bones, eggshells & plastic are not to be thrown as food at any circumstances.

Vermicompost unit is the closed in summer seasons due to high temperature.

Photo 1: Construction of Vermibeds

Photo 2: Earth worms species E. fetida

Photo 3: Separating vermicompost

Conclusion

The vermicompost technique is an efficient waste management method and also producing natural fertilizer, where ever it is practiced. This is a cost effective, eco-friendly, waste management process and on the other side, the earthworms increase the soil fertility & the soil texture. Vermiculture and vermicompost will undergo simultaneously in this process.

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