

Production of Vermicompost to Improve Soil Health and Texture



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Introduction

Vermicomposting is basically a managed process of worms digesting organic matter to transform the material into a beneficial soil amendment. As per the USDA guidelines for compost practices (with effect from Oct 21, 2002), vermin composts are defined as organic matter of plant and/or animal origin consisting mainly of finely-divided earthworm castings, produced non-thermophilically with bio-oxidation and stabilization of the organic material, due to interactions between aerobic microorganism and earthworms, as the materials pass through the earthworm gut. Good quality compost production in ambient temperature can be accomplished in shorter time by the process of vermicomposting that involves use of proper species of earthworms. The native cellulase activity of earthworms and microorganisms in earthworm gut promote faster decomposition of ingested organic material. The combined effect of enzymatic activity and grinding of organic materials to fineness by earthworms produces the vermicomposting and this is not observed in compost pits without earthworm. The earthworms being voracious eaters consume the biodegradable matter and give out a part of the matter as excreta or vermi-castings. The vermi-casting containing nutrients is a rich manure for the plants. Vermicompost, apart from supplying nutrients and growth enhancing hormones to plants, improves the soil structure leading to increase in water and nutrient holding capacities of soil. Fruits, flowers and vegetables and other plant products grown using vermicompost are reported to have better keeping quality. A growing number of individuals and institutions are taking interest in the production of vermicompost utilising earthworm activity. As the operational cost of production of this compost works out to less than ` 2.0/Kg., it is quite profitable to sell the compost even at ` 4.00 to ` 4.50/Kg

Process: The process of composting crop residues / agri wastes using earthworms comprise spreading the agricultural wastes and cow dung in gradually built up shallow layers. The pits are kept shallow to avoid heat built-up that could kill earthworms. To enable earthworms to transform the material relatively faster a temperature of around 300 C is maintained. The final product generated by this process is called vermicompost which essentially consist of the casts made by earthworms eating the raw organic materials. The process consists of constructing brick lined beds generally of 0.9 to 1.5 m width and 0.25 to 0.3 m height are constructed inside a shed open from all sides. For commercial production, the beds can be

prepared with 15 m length, 1.5 m width and 0.6 m height spread equally below and above the ground. While the length of the beds can be made as per convenience, the width and height cannot be increased as an increased width affects the ease of operation and an increased height on conversion rate due to heat built up.

Cow dung and farm waste can be placed in layers to make a heap of about 0.6 to 0.9 m height. Earthworms are introduced in between the layers @ 350 worms per m³ of bed volume that weighs nearly 1 Kg. The beds are maintained at about 2 40-50% moisture content and a temperature of 20–30o C by sprinkling water over the beds.

When the commercial scale production is aimed at, in addition to the cost of production, considerable amount has to be invested initially on capital items. The capital cost may work out to about `5000 to `6000 for every tonne of vermicompost production capacity. The high unit capital cost is due to the fact that large units require considerable expenditure on preparation of vermi beds, shed to provide shelter to these beds and machinery. However these expenditures are incurred only once.

Under the operational cost, transportation of raw materials as also the finished product are the key activities. When the source organic wastes and dung are away from the production facility and the finished product requires transportation to far off places before being marketed, the operational cost would increase. 2.5 However, in most of the cases, the activity is viable and bankable. Following are the items required to be considered while setting up a unit for production of vermi-compost.

About the worms: Of about 350 species of earth worms in India with various food and burrowing habits *Eisenia fetida*, *Eudrilus eugeniae* and *Perionyx excavatus* are some of the species that are reared to convert organic wastes into manure. A combination of epigeic species that form no permanent burrows and live on the surface, anecic that form semi-permanent and vertical burrows extending from the surface and endogeic that typically live throughout the deeper layers may be considered.

The worms feed on any biodegradable matter and vermicomposting units are ideally suited for locations / units with generation of considerable quantities of organic wastes. One earthworm reaching reproductive age of about six weeks lays one egg capsule (containing 7 embryos) every 7-10 days. Three to seven worms emerge out of each capsule. Thus, the

multiplication of worms under optimum growth conditions is very fast. The worms live for about 2 years. Fully grown worms could be separated and dried in an oven to make 'worm meal' which is a rich source of protein (70%) for use in animal feed.

The nutrients profile of vermin composts are:

- 1.6 per cent of Nitrogen.
- 0.7 per cent of Phosphorus.
- 0.8 per cent of Potassium.
- 0.5 per cent of Calcium.
- 0.2 per cent of Magnesium.
- 175 ppm of Iron.
- 96.5 ppm of Manganese.
- 24.5 ppm of Zinc.

Advantages of Vermicomposting:

The major benefits of vermicomposting are:

1. Develops roots of the plants.
2. Improves the physical structure of the soil.
3. Vermicomposting increases the fertility and water-resistance of the soil.
4. Helps in germination, plant growth, and crop yield.
5. Nurtures soil with plant growth hormones such as auxins, gibberellic acid, etc.

Disadvantages of Vermicomposting

Following are the important disadvantages of vermicomposting:

1. It is a time-consuming process and takes as long as six months to convert the organic matter into usable forms.
2. It releases a very foul odour.
3. Vermicomposting is high maintenance. The feed has to be added periodically and care should be taken that the worms are not flooded with too much to eat.
4. The bin should not be too dry or too wet. The moisture levels need to be monitored periodically.
5. They nurture the growth of pests and pathogens such as fruit flies, centipede and flies.