Vermicomposting

Vermicomposting is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as vermicompost. The process is an aerobic, bio-oxidation, non-thermophilic process of organic waste decomposition that depends upon earthworms to fragment, mix and promote microbial activity.

Types of Vermicomposting

Small scale vermicomposting can be done either in pits or heaps. The pit method is not preferred due to poor aeration, water logging at bottom. The heap method is the preferred method and easy to maintain.

A drawback of vermicomposting is the fact that the temperature is not high enough to kill pathogens and weed seeds. To solve this traditional thermophilic composting can integrated with vermicomposting by pre-composting the vermicomposting waste materials, pathogens and weed seeds can be destroyed.

Mixing materials: composting materials should have a C: N ratio of about 30:1. This converts in a 1:1 volume of dry and green materials. Equal volumes of carbon rich, naturally dry materials (dead leaves dried grass, straw) and nitrogen rich green plant materials (grass clippings, weeds, fresh garbage, fruit and vegetable waste) should be mixed.

Thermophilic phase: Prepare the composting bed by spreading used sacks on the ground to prevent mixing of the soil with the compost during harvesting. Pile the bed with the organic materials and water sparingly. The size of the pile can vary however; a volume of at least 1 cubic meter (1 m^3) is desired to allow thermophilic heating. A pile 1 m wide, 2 m long and 0.5 m high will have this volume. To conserve moisture and heat, the pile is covered from the top to the sides with plastic sheets or other suitable materials.

Wait for at least 15 days for the thermophilic process of composting to end. This process is characterized by a rapid increase in temperature of the pile, followed by a gradual decrease. When temperature approaches ambient temperature (<35°C), the height of the pile also subsides, remove the covering. Sprinkle with water if necessary, and start vermicomposting phase by introducing the worms.

Vermicomposting Phase: Stock the partially decomposed organic materials with earthworms, by releasing them on top of the pile. The earthworms will immediately move downward. A stocking rate of about 500 g of earthworms is sufficient for an original pile of 1 m^3. Higher stocking rates will increase the vermicast production process.

Mulch the pile with grasses to prevent excessive loss of moisture. Then cover with nylon net or any substitute material to serve as barrier against birds and other earthworm predators. Maintain sufficient moisture and aeration throughout the composting process.

Harvest the vermicompost as needed or when only a few organic materials remain intact. Use the earthworms for another round of vermicomposting.

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SUSTAINABLE LAND MANAGEMENT PROGRAM (SLMP)

VERMICOMPOSTING

(Rapid Composting)

MoANR SLM ETHIOPIA
german cooperation DEUTSCHE ZUSAMMENARBEIT
Implemented by: giz

Introduction

Vermicomposting or worm composting is a fast method of preparing enriched high quality compost. Vermicompost (worm casts or vermicasts) is rich in nutrients. Earthworm castings contain 5 to 11 times more nitrogen, phosphorous, and potassium compared with the surrounding soil (Dickerson, 2001).

The process of vermicomposting is linked with vermiculture (breeding of worms).

Vermiculture

Vermiculture is the continuous breeding of earth worms to produce a continuous supply of high quality compost.

The most common type of earthworm used for vermicomposting is *Eisenia fetida. E. fetida* is an extremely tough and adaptable worm. It is indigenous to most parts of the world and thrives in rotting vegetation, compost, and manure. They are 0.8 cm to 16 cm in length, reddish/purple to dark purple in colour with a yellow tail tip.

Earthworms are hermaphrodites, meaning they possess both male and female reproductive organs. However, two worms are still required for reproduction. Sexually mature *Eisenia fetida* have a swollen area approx. one-third of the distance between the head and the tail called the clitellum. The two worms join clitella, the large lighter-colored bands which contain the worms' reproductive organs, and which are only prominent during the reproduction process. The two worms exchange sperm. Both worms then secrete cocoons which contain several eggs each. These cocoons are lemon-shaped and are pale yellow at first, becoming more brownish as the worms inside become mature. These cocoons are clearly visible to the naked eye.

The average incubation period for *E. fetida* is between 21 and 28 days. Newly hatched worms take about 4 to 6 weeks to sexually mature and begin producing cocoons.

Once worms start breeding and laying cocoons, it can lay two to three cocoons per week for 6 months to a year. All of this is dependent upon the environment, i.e. moisture, temperature, available food, etc.

Earth worm culturing procedures

Building a worm bin: A worm bin is a box in which the worms live. Worm bins can be made from plastic or wood. In Ethiopia, wooden boxes are preferred because they're more absorbent and provide better insulation. The preferred size is 50 cm (length) X 50 cm (width) X 20 (height) cm with holes of 0.5 cm diameter on the top, bottom and sides.

The bin with a population of 2000 worms will be able to process about 7.5-15 kg of waste weekly.

Worm bin bedding: Almost any carbon source can be used as worm bin bedding, examples are dead dried leaves, hay, straw, manure and compost. Worm bin bedding material needs to be at about 60-70% moisture level. The bedding should be soaked in water to give it the consistency of a damp sponge.

Adding the worms: Worms are added by scattering them onto the bedding. Close the lid to block any light. Worms should be left about a day without adding food to work their way into the bedding

Adding food to the bin: Dry plant materials, green plant materials and, pre-fermented manures are suitable for worms. It is best to feed worms 1 to 2 times per week rather than daily. Too much uneaten food can attract insects and lack of food forces worms to move out. From the waste ingested by the worms, 5-10% is assimilated in their body and the rest are excreted in the form of vermicast.

Harvesting: After approximately 2-3 months, the contents of the worm bin will begin to look like rich black soil rather than the bedding that it started as. Move the entire contents of the bin to one side: fill the empty side with new bedding and begin to bury food waste in the new bedding. Within a short time the worms will migrate to the new food source, and the worm casting can be removed from the other side of the bin.

Five Essentials for worm rearing

Compost worms need five basic things: bedding; food source; adequate moisture; adequate aeration and protection from temperature extremes.

Bedding: Although worms consume their bedding, it is very important that is a slow process. High nitrogen levels can result in rapid degradation and associated heating may be fatal to worms carbon should be added (brown leaves etc.). When material with high carbon content is used (C: N >40: 1), it is advisable to add nitrogen supplements (manure or green plant materials) to ensure effective decomposition

Food source: Under ideal conditions worms, are able to consume food in excess of their body weight each day, although the general rule is ½ of their body weight per day.

Moisture: worms require moisture in the range of 60-70%. This may mean approximately 50% water content by weight. The feed stock should not be too wet otherwise it may create anaerobic conditions which may be fatal to earthworms.

Aeration: Worms need oxygen and cannot survive in anaerobic conditions. Lack of oxygen will kill the worms very quickly. Ensure proper bedding and adequate ventilation.

Temperature control: Most earthworm species used in vermicomposting require moderate temperatures from 15 – 35^{o} C. Higher temperatures (> 35 ^{o} C) may result in high mortality.