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Earthworms - Friends of the Farmers

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SUMMARY

The use the vermicompost for any agricultural use is highly beneficial to the soil, which reduces the soil pollution and maintains the soil fertility by slow release of nutrients unlike chemical fertilizers. besides earthworms are called as the friends of the farmers because they maintain the soil pure and fertile.

INTRODUCTION

Vermicomposting is a process that uses earthworms to increase composting speed while maintaining high quality. Vermicompost is a nutrient-rich organic fertiliser and soil conditioner that contains water-soluble nutrients. It is used in gardening, organic farming and sustainable farming.

Suitable earthworm species for vermicomposting:

- *Eisenia fetida, the red wiggler or tiger worm (Eisenia andrei)*
- *Lumbricus rubellus, does not adapt as well to the shallow compost bin as does Eisenia fetida*
- *Eisenia hortensis, European nightcrawlers, aka dendrobaenas, dendras, and nightcrawlers*
- *Eudrilus eugeniae, African Nightcrawlers*
- *Perionyx excavatus*, Blueworms may be used in the tropics.

There are nearly 3600 different types of earthworms in the world, which are divided into two groups: burrowing earthworms and non-burrowing earthworms. *Pertima elongata* and *Pertima asiatica* are burrowing species that live deep in the soil. Non-burrowing types *Eisenia fetida* and *Eudrilus eugenae*, on the other hand, live in the upper layer of soil surface. Non-burrowing earthworms consume 10% soil and 90% organic waste; they convert organic waste into vermicompost faster than burrowing earthworms. Burrowing earthworms only come to the soil surface at night. These bore holes in the soil to a depth of 3.5 m and produce 5.6 kg casts by consuming 90% soil and 10% organic waste.[Nagavallemma K. P *et al.*, 2006]



Advantages

Soil

- Increases soil aeration
- Enriches soil with microorganisms (adding enzymes like phosphatase and cellulase)
- Microbial activity in worm castings is 10 to 20 times higher than in the soil and organic matter that the worm consumes

- Attracts deep-burrowing earthworms that are already present in the soil • Increases water retention capacity

Plant growth

- Enhances germination, plant growth, and crop yield
- It helps in root and plant growth

Economic

- Creates low-skill jobs at local level
- Low capital investment and relatively simple technologies make vermicomposting practical for less-developed agricultural regions

Environmental

- Helps to close the "metabolic gap" through recycling waste on-site.
- Enriches the soil and reduces the soil pollution levels.

Soil waste management

Vermicomposting is a low-cost technology process for processing or treating organic waste. The comparison study between conventional composting and vermicomposting revealed that vermicomposting produced an enriched compost with high levels of N, K, and P, resulting in a reduction in heavy metals. Using the vermicomposting process, solid waste can be decomposed into valuable compost, providing an efficient substitute for chemical fertilisers while also reducing pollution. As a result, it is critical to use advanced waste to energy and vermicomposting processes rather than the currently prevalent waste management practises. [Fatimah Alshehrei *et.,al* 2021].

- Organic waste from kitchens or farms can be digested by earthworms, resulting in a non-toxic material with a well-built structure. This has the potential to increase its economic value in the market, as well as act as a material that can condition the soil for healthy plant growth.
- Vermicompost contains minerals required for plant growth, improves nutrient availability in the soil, and is thus a complex fertiliser.
- The worm castings also contain beneficial microbes that help protect plants from a variety of diseases. Unlike chemical fertilizers, compost produced in vermiculture has no undesirable smells. It normally only smells like rich soil. Worm casting compost is generally used not only during a plant's vegetative stage but also during its flowering phase.
- vermicompost has a lot of potential in the horticultural and agricultural industries as plant growth media. There have only been a few studies that have looked at how plants react to the addition or substitution of vermicompost to soil or greenhouse container media. The majority of these studies confirmed that vermicompost are beneficial to plant growth. Vermicompost, whether used as soil amendments or as components of horticultural media, increased seed germination and seedling growth and development rates.
- Research into kitchen waste treatment using vermicomposting with the Earthworm, Eudrilus Eugeniae. They combined kitchen waste and cow dung. In 60 days, they had high-quality compost. They observed an increase in parameters such as total nitrogen (percent), available phosphorus (percent), and exchangeable potassium during vermicomposting (percent). They also noticed a drop in pH.
- Nutrient content: When compared to chemical fertiliser, vermicast produced a higher percentage of protein and carbohydrates in garden peas. A review of the data revealed that using "Parthenium Vermicompost" at a rate of 5 t/ha improved the food quality of eggplants (Solanum melongena). Vermicompost application increased chlorophyll content, pH of juice, total soluble solids of juice, micro and macronutrients, carbohydrate (percent) and protein (percent) content, and improved fruit and seed quality. According to research, humic acid treatments, plant growth promoting bacteria, and vermicomposts could be used to promote sustainable agriculture while reducing the use of chemical fertilisers.

The humus produced by vermicomposting serves as a binding site for plant nutrients, aiding in the control of plant diseases and stimulating plant growth. Humus also improves water permeability and retention, resulting

in improved plant health and more efficient use of soil moisture. Nitrogen concentrations in vermicompost are higher than in aerobic compost piles, according to Cuban researchers. The nitrogen content of earthworm castings ranges between 1.5 and 2.2 percent. It contains 1.8-2.2 percent phosphorous and 1.0-1.5 percent potassium and can be left in the soil for up to five years. . Worm populations under vermiculture can double in 60-90 days.[Hemalatha *et al.*, 2013].

Vermicast :

Vermicast is a type of vermicompost that is slightly different from vermicompost. Vermicast, also known as worm castings, is worm excrement that has been separated from the rest of the compost. The decaying organic material is consumed by the worms, who then flush it out of their system as 'castings' or 'worm manure.' Worm castings are high in nutrients. Worm castings are rich in bacteria, decaying plant matter, enzymes, earthworm cocoons, and other byproducts. Magnesium, nitrates, phosphorus, potassium, zinc, borax, iron, carbon, calcium, copper, cobalt, and nitrogen are abundant in the manure. Worm castings are typically dark brown and football-shaped. When added to the soil, they improve soil aeration and increase the soil's ability to retain water.

Vermiwash

A growth regulator for plants Vermiwash is a liquid plant growth regulator that contains a high concentration of enzymes, vitamins, and hormones such as auxins, gibberellins, and others, as well as macro and micronutrients. Vermicompost is a nutritive 'organic fertiliser' rich in NKP (nitrogen 2-3%, potassium 1.85-2.25%, and phosphorus 1.55-2.25%), micronutrients, beneficial soil microbes such as 'nitrogen-fixing bacteria' and 'mycorrhizal fungi,' and is scientifically proving to be'miracle growth promoters & protectors' . In vermicompost, exchangeable (K) was more than 95% higher. There is also a good amount of (Ca), (Mg), (Zn), and (Sn) (Mn). Furthermore, vermicompost contains enzymes such as amylase, lipase, cellulase, and chitinase, which continue to break down organic matter in the soil (releasing nutrients and making them available to plant roots) even after they have been excreted. (An adequate amount of vermicompost applied annually results in a significant increase in soil enzyme activities such as 'urease,' 'phosphomonoesterase,' 'phosphodiesterase,' and 'arylsulphatase.'The soil treated with vermicompost has significantly more electrical conductivity (EC) and near neutral pH.

Procedure for preparation of vermicompost

Bed Method:

Composting is done on the pucca / kachcha floor by making bed (6x2x2 feet size) of organic mixture. This method is easy to maintain and to practice.

Pit method:

Composting is done in cemented pits 5x5x3 feet in size. Thatch grass or other locally available materials are used to cover the unit. This method is not preferred due to poor aeration, water logging at the bottom, and higher production costs.

Process of vermicomposting

- The vermicomposting unit should be placed in a cool, moist, and shady location.
- Cow dung and chopped dried leafy materials are mixed in a 3: 1 ratio and left for 15–20 days for partial decomposition.
- A layer of 15-20cm chopped dried leaves/grasses should be kept at the bottom of the bed as bedding material.
- Beds of partially decomposed material, 6x2x2 feet in size, should be made.
- Each bed should contain 1.5-2.0q of raw material, and the number of beds can be increased based on raw material availability and demand.
- Red earthworm (1500-2000) should be released on the upper layer of the bed. • Water should be sprinkled immediately after the worms are released.
- Keep beds moist by sprinkling water on them daily and covering them with gunny bags/polythene.

- After 30 days, the bed should be turned once for maintaining aeration and for proper decomposition. • Compost gets ready in 45-50 days .
- The finished product is 3/4th of the raw materials used.

Preventive measures.

- The unit's floor should be compacted to prevent earthworm migration into the soil.
- To avoid excessive heat, use cow dung that is at least 15-20 days old.
- Organic wastes should be free of plastics, chemicals, pesticides, and metals, among other things.
- Aeration should be maintained to allow earthworms to grow and multiply properly.
- The optimal moisture level (30-40%) should be maintained.
- A temperature of 18-25oC should be maintained for proper decomposition.

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