

## VERMITECHNOLOGY IN ORGANIC WASTE MANAGEMENT

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### **Abstract**

*Vermitechnology is a method of safe disposal and inexpensive treatment for a variety of organic waste of domestic and agricultural origin to produce vermicompost and worm biomass. It is an eco-friendly technology, based on rural areas to sustain it as it processes various biological wastes, avoiding pollution through the recycling of plant nutrients. Unscientific waste disposal causes many more problems, such as fly breeding, disease transmission, soil pollution, and air pollution. Earthworms are considered to be natural bioreactors, multiplying and saprophytic microorganisms, providing the necessary conditions for the processing of organic wastes. Therefore, the review examines the important role of worms in the technology of vermitechnology in managing biological waste and ecological sustainability and their future prospects. Products such as vermicompost and vermiwash in the form of organic fertilizers and bio pesticides, produced in this technology help to improve the physical, chemical and biological properties of the soil conditioner that indirectly improves soil health leading to increase of crop yield.*

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**Key Words:** *Vermicomposting, Biowaste, Natural Bioreactor, Vermiwash, Earth worm, Anthropogenic activities.*

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### **Introduction**

Vermitechnology that produces high quality natural manure using appropriate types of worms from waste. It has 3 important parts -Vermiculture i.e. ensuring the availability of appropriate species of earthworms, Vermicomposting viz. a specially designed composting system for organic waste where worms act as accelerators and Plant conservation which increase in the number of worms, it also ensures higher worm production as well as conservation. Vermitechnology helps in bio-oxidation of organic waste with earthworms and useful micro-organisms. Organic waste produced by anthropogenic activities cause pollution, reduce soil fertility and ultimately health hazards<sup>10</sup>.

Vermitechnology is a natural process of management of organic wastes and is becoming popular and cost-effective management of agricultural and domestic organic waste. Vermitechnology is gaining importance at the beginning of 21<sup>st</sup> century for sustainable waste management.

### **Components of vermitechnology**

Three types of ingredients are used in vermitechnology which are given below:

1. suitable Earth worms.
2. Waste that includes natural waste or biowaste.
3. Suitable vermicomposting holes and other associated infrastructure.

### **Suitable Earth worms:**

The selection of suitable species is based on specific organisms and

parameters. Three types of worms that can be used in farming are given below:

**Epiges:** - Epigeic worms live in piles of debris or other degrading organic matter such as litter heaps on the surface. They have a short life cycle with high production time and renewal time.

**Endoges:** - Endogeic earthworms live in the lower mineral horizon and eat more of the soil than organic matter, hence especially geophagous.

**Anecidues:** - Anecic earthworm of large size with only the colour of the front and back edges. They live in very complex canal systems in soil.

Three Species of earthworm are widely used in India for vermiculture. They are oriental worm (*Perionyx excavates*), African night crawler (*Eudrilus eugeniae*) and European night crawler (*Eisenia fetida*). Many other species of earthworms may be practiced in vermiculture and vermicomposting but such species should be properly evaluated before use for a variety of factors such as climate acclimatization, feeding rate, life cycle, life span, distribution range and availability.

#### **Disposable items:**

Disposable items for vermicomposting can be found in many sources, such as Municipal waste and Biowaste.

#### **Municipal waste:**

Municipal waste is mainly caused by urban people and is one of the most polluting and expensive to remove. In the most developed cities in the world, the daily production of municipal waste (MSW) per person varies from 2kg-4kg. It includes food debris, paper, kitchen waste and clothing etc. Lack of awareness, social cohesion and even the lack of funding for national and central governments are major causes of

improper solid waste disposal, especially in urban areas<sup>6</sup>.

#### **Biowaste:**

Biowaste comes from a variety of human, agricultural and industrial sources. The unsanitary disposal of the biowaste causes many problems, such as vector breeding, bacterial contamination, soil and air pollution, surface and groundwater contamination, pig menace, foul odour<sup>2</sup>. Biowaste can be considered as three main groups:

1. Waste of animal origin including cattle dung, poultry waste, fodder waste, waste from aquaculture<sup>7</sup>.
2. Plant material generated during and after harvesting and threshing of crop.
3. Processed items including saw dust, wood shavings, peels and pulp etc.

#### **Vermicomposting holes and other infrastructure:**

Well-designed vermicomposting holes of cement or clay are of different sizes and shapes provided with drainage channels and ventilators to ensure stable oxygen supply will be built. In order to prevent, the continuous manure formation along with earthworms, from predators, direct sunlight and rain, the entire pit should be covered with grass or asbestos or cement in accordance with the natural environment.

#### **Vermicomposting Process**

Various methods are being developed to worm the waste of natural waste to convert it into compost:

1. Multiplication of earthworms is done for the production of vermicompost in small scale in an area where high rain, fluctuation in temperature, ants, rodents, birds are abundant.

2. Culturing of earthworm after harvesting crops or in gardens.
3. Large scale commercial production of vermicompost is done in composting pit which is given below:  
In the composting pit, the first plan is bed preparation. Bedding items are usually hard or soft agricultural stems, husk dust, sugarcane thrusters and much more. At the base of the custom tank these materials are used as the first layer, then this should be covered with a thin layer of fine sand. In addition to the sand layer, another layer of soil is used in the garden.

After completion of bed preparation, the appropriate earthworms will eat away at the soft organic material and produce nitrogenous excretory products called worm casting on the surface. The worm casting is locked away before adding new feeds to the worm. In the meantime, worm casting mix with soil and form black colour humus. At harvest time the soil and a certain amount of sand may be mixed with compost. So, to avoid this problem, natural waste containing a certain amount of cow dung and water may be directly used.

Then, the hole is covered with hessian cloth. In this way the fertilized waste is pre-digested and produces heat. After 2-3 weeks, the heat created is usually reduced and worms are released depending on the type of waste, within 45-60 days, 60-70% of the waste is converted into compost. During composting the humidity and temperature of the pit should be maintained as 30-40% and 25-30° C respectively.

### **Role of Earthworms in organic waste management**

1. Earthworms play a key role to maintain soil composition and fertility of soil.
2. They accelerate the decomposition of organic matter in the soil and increase the simultaneous accumulation of soluble nutrients in the soil.
3. They increase the number of stable water aggregates, improve porosity, air permeability, water infiltration and ground water holding capacity.
4. By using life cycle and activity patterns and fragmentation, they increase microbial efficiency<sup>5</sup> and water retention capacity, promote deep root growth and facilitate fertilization.
5. Coelomic fluid of earthworm has antibacterial property and kills pathogens in vermicompost.
6. Earthworm secretes many enzymes like chitinase, cellulase, proteases, lipase etc which helps in breakdown of organic waste as well as biogeochemical cycle.
7. Earthworm's excreta is rich in nitrogenous matter increases fertility of vermicompost.

### **Vermiwash**

Vermiculture also produce a liquid called vermiwash that is collected after the passage of water through a worm action column and is very useful as a foliar spray. It contains excretory products and the mucus from the earth's worms and micronutrients from living organisms in the soil. These are transferred to leaves, shoots and other plant parts in the natural ecosystem. Vermiwash, when properly collected, is a bright and clear, yellowish liquid<sup>11</sup>. Vermiwash can be

used as liquid fertilizer. It is a collection of extracts and secretions of earthworms, as well as large soil micronutrients and beneficial organic molecules in plants<sup>11</sup>. Vermiwash appears to have natural properties that work not only as a fertilizer but also as a mild biocide<sup>12</sup>. It is found to contain a number of enzymes namely. proteases, amylases, urease and phosphatase<sup>13</sup>, soluble plant nutrients, living acids and mucus and bacteria.

### **Advantages of vermicompost**

Vermicompost consists of decomposed organic matter coated with mucopolysaccharide microbes and earthworm<sup>4</sup>. Vermicompost contains 8 times higher nitrogen(N) phosphorus(P) and potassium(K) than any other organic compost. The Carbon and Nitrogen ratio in vermicompost remains a favourable condition that allows plants to absorb nutrients. Application of vermicompost in the field creates an environment that promotes bacterial growth in the soil and thus leads to high fertility. All micronutrients essential for plant growth are present in vermicompost. The preparation of vermicompost from organic waste takes short period i.e., less than 2 months. Vermicompost is termite resistance. Vermicompost maintains soil texture and help to conserve water by increasing water retention capacity and helps in seed germination and plant growth<sup>3</sup>. Vermicompost helps in recycling of local waste. Vermiprotein produced in vermiculture can be used as a feed for poultry and aquatic animals. Vermicompost is rich in macronutrients, micronutrient, vitamins, enzymes, antibiotics, and plant growth hormones and microflora<sup>1</sup>.

Therefore, vermicompost is also known as "Black Gold".

### **Conclusion**

Vermitechnology is an eco-friendly cost-effective efficient method of decomposition of organic waste with the help of earthworms to produce organic fertilizer<sup>9</sup>. It, therefore, gives dual benefit i.e., sustainable waste management and production of organic manure which helps in organic farming. Earthworms are detritivores and feed on organic wastes which are digested in their gut to produce vermicasts which increases fertility of the soil. It destroys pathogenic organisms, reduces pollution and produces macronutrients and micronutrients which are useful in agriculture. Vermitechnology is thus production of wealth from wastes.

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