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Recycling of Organic Wastes into Compost through Vermicomposting

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INTRODUCTION

The term "organic waste" encompasses a wide range of materials, often discarded but valuable resources in disguise. Understanding its origins and typical composition is crucial for effective management and utilization. The vermiculture procedure was first introduced in the 1970s by biology instructor Mary Appelhif. She developed the idea of employing red wiggler worms (Eisenia fetida) in both indoor and outdoor systems to transform kitchen waste into worm compost. Importance of Vermiculture. Vermiculture is the science of raising and breeding earthworms to harvest their potential for waste reduction and fertilizer production. Vermicomposting involves biodegradation of organic waste with the help of earthworms to produce high-quality compost. Earthworms can be used for animal protein supplementation and as fish bait, but their castings remain the principal product. Vermicomposting is a natural method for producing compost using earthworms. Vermicomposting is also called composting with worms. Vermicomposting is considered an eco-friendly method of utilizing organic wastes into compost that can be used as fertilizers. The vermicomposting process utilizes various worm species, primarily red wigglers, white worms, and other earthworms. Vermicomposting leads to the production of a mixture of bedding materials, decomposing food or vegetable waste, and vermicast. Vermicompost is a nutrient-rich organic fertilizer and soil conditioner that is relatively simple for plants since it contains water-soluble elements. Inorganic fertilizer made from worm castings is occasionally utilized. In this article, we will discuss the objectives, types, methods, advantages, and disadvantages of vermicomposting.

Common Sources of Organic Waste

Organic waste is generated from various sectors, including.

- Households: Food scraps (fruit peels, vegetable trimmings, leftover meals), yard waste (grass clippings, leaves, branches), and paper products.

- Agriculture: Crop residues (stalks, husks), animal manure, and processing by-products.
- Food Processing Industry: Fruit and vegetable processing waste, meat and poultry processing waste, and dairy by-products.
- Restaurants and Food Service: Food scraps, used cooking oil, and packaging materials.
- Retail and Wholesale: Spoiled produce, unsold food items, and packaging materials.
- Municipal Solid Waste (MSW): A mixture of organic and inorganic materials, with organic waste typically forming a significant portion.

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Scope of Vermicomposting:

The scope of vermicomposting is wide ranging and encompasses various aspects of waste management, agriculture, and environmental sustainability. Some key areas of its scope include:

1. Organic Waste Management: Vermicomposting provides an environmentally friendly solution for managing organic waste generated from households, businesses, and agricultural activities. It diverts organic waste from landfills, reducing greenhouse gas emissions and environmental pollution.

2. Soil Health and Fertility: Vermicompost is rich in essential nutrients such as nitrogen, phosphorus, potassium, and beneficial microorganisms. When added to soil, vermicompost improves soil structure, water retention, aeration, and nutrient availability, promoting healthier plant growth and increased crop yields.

3. Sustainable Agriculture: Vermicomposting supports sustainable agriculture by reducing reliance on synthetic fertilizers and chemical pesticides. It fosters soil biodiversity, enhances soil resilience to environmental stressors, and reduces the risk of soil erosion and nutrient runoff, thereby contributing to long term soil health and ecosystem sustainability.

4. Resource Efficiency: Vermicomposting is a resource efficient process that requires minimal energy and water inputs compared to traditional composting methods. It utilizes natural biological processes and harnesses the feeding activities of earthworms to efficiently convert organic waste into valuable compost.

Significance of Vermicomposting:

The significance of vermicomposting lies in its numerous environmental, economic, and social benefits, including:

1. Waste Reduction and Recycling: Vermicomposting reduces the volume of organic waste sent to landfills, mitigating landfill congestion and associated environmental impacts. By recycling organic waste into nutrientrich compost, vermicomposting contributes to a circular economy and promotes resource conservation.

2. Climate Change Mitigation: Vermicomposting helps mitigate climate change by diverting organic waste from landfills, where it would decompose anaerobically and release methane, a potent greenhouse gas. Instead, vermicomposting facilitates aerobic decomposition, minimizing methane emissions and promoting carbon sequestration in soil.

3. Cost Savings and Revenue Generation: Vermicomposting can lead to cost savings for municipalities, businesses, and households by reducing waste disposal costs and providing a low-cost alternative to chemical fertilizers. Additionally, vermicompost production can

generate revenue through the sale of highquality compost to farmers, gardeners, and landscaping companies.

4. Community Engagement and Education: Vermicomposting promotes community engagement and environmental awareness by involving individuals, schools, and community organizations in composting initiatives. It provides opportunities for hands-on learning about waste management, soil health, and sustainable agriculture, empowering communities to take proactive steps towards environmental stewardship.

Requirement to set up a vermicomposting Unit:

The following items are required to set up a vermicomposting unit.

1.Composting pit or bed
2. Thetch/ G.I sheet roof shed
3. Earthworm
4. Vermicomposting materials

1. Composting pit or bed: Depending upon the requirement and availability of waste material to be composted, the size of the pit or bed can vary. In general the following three composting pit are used in vermicomposting.

a) Vermicomposting of wastes in field pit: It is preferable to go for optimum size ground pit of 10mx1mx1m (LxWxD).
b) Vermicomposting of wastes in ground heaps: Dome shaped beds with organic wastes are prepared and the optimum size of ground heap is 5mx1mx1m(LxWxH).
c) Vermicomposting of wastes in large unit: Vermicomposting is taken up in large unit such as series of rectangular brick columns, cement tanks, stone blocks etc. The dimension of structures may be varied with availability of waste material to be composted and area availability. It is preferable to go for optimum size ground pit of 5mx1mx0.5m (LxWxD).

Ground Heap

Field Pit

Cemented tank

HDPE Febric vermi bed

2. Vermi shed (Thetch/G.I sheet roof): A low-cost thatch roof shed of convenient size is required to protect the vermicompost pit and for conserving optimum temperature and moisture for composting.

Thetch roof shed

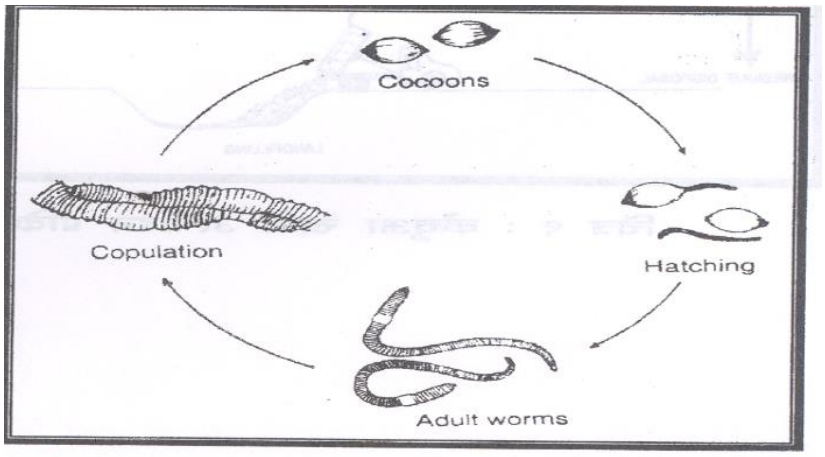
G.I Sheet roof shed

3. Earthworm: Earthworms are considered as best friends of farmers since time immemorial and are referred to as intestines of the earth. Selection of suitable species of earthworm is important in vermicomposting. In the whole world only 3-4 species are in wide use. In India only two peregrine species namely *Eisenia foetida* (Red Compost worm) and *Eudrilus eugeniae* (African Night Crawler) are being extensively used for vermicomposting. Under ideal conditions, these earthworms multiply 10-15 times in 70-90 days. In general daily uptake vary from 100 to 300mg/g body weight. Besides these several other species are also in use but they are to be tested for suitability for particular type of climatic condition.

Eudrilus eugeniae
(Night crawler)

Eisenia foetida
(Tiger worm or Red wrinkle)

Earthworm



Life cycle of earthworm

Earthworms live in the soil and perform following role:

- Earthworms eat plant biomass, which fall on the form of mulch.
- Earthworms are effective tool for speedy development of wastelands.
- Earthworms recharge ground water.
- Earthworms maintain soil aeration.
- Earthworms produce 10 mm soil per year, which is produced by nature in 200 years.
- Earthworms maintain soil temperature and moisture.
- Earthworms increase root volume and bacterial activity about 10 fold.
- Earthworms feed on soil and soil organic matter and convert it to compost, making the soil rich in nutrients.
- Earthworms are natural tillers of soil.
- Earthworms aerate and pulverize soil.
- Earthworms make soil porous, improving drainage.
- Earthworms increase water-holding capacity of soil.
- Earthworms encourage growth of useful microorganisms, which also make soil rich.

Earthworms produce enzymes, hormones, vitamins and antibiotics, thereby increasing immunity of plants against some pests

4. Vermicompost materials: Almost all type of biologically degradable and decomposable organic wastes can be used in vermicomposting. Commonly used composting material are listed below:

A) Animal dung: Dung of all domestic animals like cattle, sheep, horse, goat and poultry dropping etc.
B) Agricultural wastes: These comprise of all items discarded after harvesting and threshing of produce e.g. stem, leaves, husk, peels, vegetable, waste, orchard leaf litter, processed food waste, sugarcane trash, press mud and processing waste etc.
C) Forestry wastes: wood shavings, peels, saw dust and pulp, forest leaf litter.
D) Waste paper and cotton cloth:
E) City refuge:
F) City leaf waste: Leaf litter from avenue or residential area.
G) Biogas slurry:
H) Industrial waste: Food processing, distillery etc.



Preliminary treatment of composting material

Organic wastes that are decomposable to be subjected to certain preliminary treatments to enhance vermicompost ability. First step is proper collection, sorting or separation of compostable, non- biodegradable like plastics, stone, glass, ceramic and metals. Even in kitchen waste, heavily spicing waste should be got separated. Separated matter, if possible be spread in a layer up to one foot and be exposed to sun for a day. This removes fuel smell and kills unwanted organisms. This is always not possible in present day city living where open space is a limited factor. In such a situation, mixing of decaying organic waste produce be done with somewhat pretreated leaf litter in approximate ratio ranging from 10-40% of the waste to be vermicompost. Leaf litter or agricultural wastes should be broken into pieces for enhancing decomposition. Vegetable produce infected with insect pests require some chemical treatment (4% neem insecticidal formulation) because their life stage continue in waste and hinder earthworm activities.

Vermicompost preparation

- Basic raw material: Any organic material generated in the farm like bhusa, leaf fall etc.,
- Starter: Cow dung, Biogas slurry, or urine of cattle
- Soil animal: Earth worms (Species: Eisenia foetida)
- Thatched roof/vermi shed.
- pH: Range between 6.5 and 7.5.
- Moisture: 60-70% of the moisture below and above range mortality of worms taking place.
- Aeration: 50% aeration from the total pore space
- Temperature: Range between 18^0C to 35^0C.

Procedure filling of vermicomposting beds or pits:

- It is mostly prepared in either pit or heap method. The dimensions either heap or pit are 10 x 4 x 2 feet. The length and width can be increased or decreased depending on the availability of material but not the depth because the earthworms' activity is confined to 2 feet depth only.
- At the day of 24^{th}, 4000 worms are introduced in to the pit [$1m^2$ =2000 worms] without disturbing the pit by regular watering
- The turnover of the compost is 75% [the total material accommodated in the pit is 1000 kg; the out turn will be 750 kg]
- Stop watering before one week of harvest
- Sometimes the worms spread across the pit come in close and penetrate each other in the form of ball in 2 or 3 locations
- Heap the compost by removing the balls and place them in a bucket. However, under most instances, top layer has to be disturbed manually. Earthworms move downward and compost is separated After collection of compost from top 28 separated. layers, feed material is again replenished and composting process is rescheduled
- The material is sieved in 2 mm sieve, the material passed through the sieve is called as vermicompost which is stored in a polythene bags.
- Vermicomposting is done under thatched roof to protect worms against rain and sun.
- Recomposting is done in the same pit or bed.

Physico-chemical characteristics of vermicompost:

S. No.	Character Vermicompost	Range
1.	Moisture (%)	22.2-22.6
2.	pH (1:2)	6.65-6.94
3.	Total organic carbon (%)	28.15-29.98
4.	Total Nitrogen (%)	1.42-2.12
5.	Total P (%)	0.81-2.41
6.	Total K (%)	1.1-1.21
7.	Total S (%)	0.41-0.63
8.	Total Ca (%)	0.90-7.54

Advantages of Vermicomposting

The principal advantages of vermicomposting are:

1. Aids in plant development, germination and crop yield.
2. Enhances the soil's physical structure.
3. By using vermicompost, the soil becomes more fertile and water-resistant.
4. Develops the plant's roots.
5. Provides auxins, gibberellic acid, and other plant growth hormones to the soil as fertilizer.
6. Adds essential nutrients to the soil like nitrogen, phosphorus, and potassium.
7. Helps recycle organic waste in a useful manner.
8. Can be done indoors and in small structures allowing year-round availability of compost.

Disadvantages of Vermicomposting

The following are some major disadvantages of vermicomposting:

1. The process of transforming organic waste into useful forms is time-consuming and can take up to six months.
2. Vermicomposting requires a lot of maintenance. The feed must be added regularly, and it is important to watch that the worms are not overfed.
3. They promote the development of diseases and pests like fruit flies, centipedes, and flies.
4. It emits an extremely unpleasant smell.

5. The container for waste shouldn't be either dry or very damp. Periodically, the moisture levels must be checked.
6. Limitation on the amount of waste that can be composted at a time.
7. Hot and cold weather can affect the activity of the worms impacting the rate of composting.

Benefits of vermicomposting

Vermicomposting provides us a tool for use in recycling degradable organic wastes into useful products known as vermicompost. Few benefits of vermicomposting can discussed as follows:

1. Triggers the beneficial soil microorganisms and the naturally present earthworms in the soil.
2. Improves the porosity, aeration and infiltration of the soil.
3. Improve soil structure.
4. Eliminates dependence on chemical inputs.
5. Brings the soil pH to neutral status.
6. Helps in converting all the plant litter and other organic farm wastes into useful compost.
7. Enhances the qualities like taste, size and improved productivity for a long period up to five years.
8. Reduce pollution
9. Can be produced nearest to the site of use.
10. Vermicompost has biofertilizers, social issues, and a profitable enterprise.
11. Vermiculture and vermicompost both improve soil fertility and reduce the use of harmful chemicals, with a higher nutritional profile than traditional compost.
12. Vermicomposting is essential for social and environmental protection, as it reduces the use of chemical fertilizers and reduces the amount of waste produced by urban areas. Earthworms feed on industrial, urban, domestic, agricultural, animal, paper and solid waste, and wastewater.
13. Vermicompost has a better benefit-cost ratio and net profits, increasing technical efficiency and productivity, and reducing the need for chemical fertilizers.

CONCLUSION

Composting reduces greenhouse gas emissions by diverting organic waste from landfills, where it would decompose anaerobically and generate methane. Composting also sequesters carbon in the soil. Vermicompost is rich source of primary, secondary and micronutrients, vitamins, growth hormones and immobilized micro flora. It is also reported by experts that vermicompost is five times richer in available nitrogen, seven times phosphorus, eleven times potassium, two times magnesium and calcium and eight times Actinomycetes bacteria than the upper six inches of soil.

REFERENCES

Guptaa A.K., Chaudharyb A., Panthic B., Chaudharyd A.K., Gautame E. and Sirpat Badhaif S. (2022). Vermicomposting. i Tech Mag, (4)23-24.

Kumar A., Jha A.K. and Kumar A. (2022). Physico-chemical characterization of vermicompost and enriched vermicompost. Pharma Innovation Journal, 11(4): 1462-1465.

Rath S.D., Padhy H.M., Mishra P. and Mishra B.K. (2023). Review of Literature on Bioremediation of Organic Waste Through Vermicomposting for Sustainable Agriculture. Journal of Biotechnology and Biochemistry, 3(9)21-27.

Shinde R., Naik S. K. and Sarkar P.K. (2020). Recycling of Organic Waste through Vermicomposting. Agriculture Observer, 1(6)14-20.

Thirunavukkarasu A., Sivashankar R., Nithya R., Sathya A.B., Priyadharshini V., Kumar, B.P., Muthuveni M. and Krishnamoorth S. (2023). Sustainable organic waste management using vermicomposting: a critical review on the prevailing research gaps and opportunities. Environmental Science Processes & Impacts.

https://iere.org/what-is-an-organic-waste

https://www.Vermicomposting - Definition, Types, Objectives, Process, Etc. – Geeksfor Geeks

https://www.Vermicomposting | Its Methods, Advantages and Disadvantages - Farm Practices