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70

# Manufacture Of Vermicompost from Agriculture Waste as An Eco-Friendly Initiative by SPEC

**Hetal P. Shah[a]*, Shital Patel[b], Dr. Neel Talati[c]**

Sardar Patel Institute of Applied Science, Sardar Patel Education Campus, Sardar Patel University, Bakrol, Vidhyanagar, Anand, India.

**Abstract**

Organic farming is conceived as one of the alternatives to conventional agriculture in order to sustain production without seriously harming the environment and ecology which are more scientific than those of the conventional. Vermicomposting is an eco-friendly method, transforming agricultural waste into nutrient-rich vermicompost through the activity of earthworms. This process of Vermicomposting manages agricultural waste and its potential to alleviate environmental burdens. The detrimental impact of unchecked waste disposal on the environment necessitates innovative, eco-friendly practices for waste management. This paper focusing on optimizing the process's efficiency, the impact of different agricultural waste compositions and the potential of Vermicomposting, incorporating its role in repaying nature's debt by restoring by soil health, soil minerals, water holding capacity, soil micro-organisms and nutritional values of yielding crop as well as decreases plant pest populations. Vermicomposting is a self-promoted, self-regulated, self-improved and self-enhanced, low or no-energy requiring zero-waste technology, easy to construct, operate and maintain. It excels all other biological or mechanical technologies for production of 'bio-fertilizer'. To enhance Soil health and biodiversity vermicompost usage is very crucial. The research also explores the utilization of specific earthworm species, the effects of different waste materials, and innovative methodologies to improve the overall quality and yield of Vermicompost.

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**Keywords:** Vermicompost, Organic farming, Agricultural Waste, Earthworm Species, *Eisenia fetida*, Sustainable Agriculture, Waste Management, Manufacture, Quality Assessment, Commercial Viability.

**Introduction:**

Agricultural waste management remains a critical challenge globally. Vermicomposting, utilizing earthworms to decompose organic waste, presents an environmentally sustainable solution.

Vermicompost is used for conversion of Agriculture wastes into a nutrient- rich material. "Vermi" means worms (earthworms) and "compost" means farming [Meenakumari T et al, 2012].

This paper delves into the optimization of the Vermicomposting process, emphasizing the influence of various agricultural waste sources on vermicompost quality and output.

**1. Earthworm Species Selection and Management:**

This section explores the selection of earthworm species crucial for efficient vermi composting. It scrutinizes the physiology, behaviour, and adaptability of various species, determining their effectiveness in decomposing different agricultural waste materials. Additionally, it discusses management practices to ensure optimal earthworm growth and reproduction rates.

*E. fetida* worms are used for Vermicomposting of both domestic and industrial organic waste [Albanell E et al, 1988]. *E. fetida* is known under various common names such as red worm, brandling worm, panfish worm, trout worm, tiger worm, red wiggler worm, and red California earthworm [Orozeo FH et al, 1996].

**2. Influence of Agricultural Waste on Vermicomposting:**

The impact of different types of agricultural waste such as crop residues, animal manure, and other organic materials on vermicompost production is evaluated. It examines the carbon-to-nitrogen ratio, moisture content, and chemical composition of various agricultural residues, elucidating their effects on the Vermicomposting process.

**3. Quality Assessment and Commercial Viability:**

The evaluation of vermicompost quality parameters, including nutrient content, and the absence of pathogens, is essential. This section also delves into the commercial viability of vermicompost production, analyzing market demands and potential economic benefits.

The research focused on the production of vermicompost from agricultural waste as an eco-friendly solution for waste management and its role in repaying the environmental debt accrued due to unsustainable practices. The following review critically evaluates existing literature, highlighting key studies and insights pertaining to Vermicomposting, its benefits, and its role in sustainable agricultural practices.

**4. Vermicomposting Process and Methodologies:**

Numerous studies, such as those by Edwards (2010) and Atiyeh et al. (2002), have extensively documented the vermi composting process. Earthworm species such as Eisenia fetida and Eisenia andrei play a pivotal role in breaking down organic matter, converting it into nutrient-rich vermicompost. Methodologies for optimizing the process, including the use of different bedding materials, feedstocks, and environmental conditions, have been explored by researchers like Domínguez (2004) and Ndegwa et al. (2000).

**5. Benefits of Vermicompost:**

Research by Singh et al. (2018) and Lazcano et al. (2008) has highlighted the various benefits of vermicompost. This organic fertilizer is rich in essential nutrients, enzymes, and beneficial microorganisms. Its application in agriculture has shown improvements in soil structure, water retention, and enhanced plant growth. Studies by Subler et al. (2004) and Edwards and Arancon (2004) further emphasize its role in suppressing plant diseases and improving soil health.

**6. Environmental Impacts and Sustainability:**

The environmental implications of vermi composting have been a subject of interest. Studies by Garg and Kaushik (2005) and Kahlon and Kaushal (2016) have investigated the reduction of greenhouse gas emissions through the vermi composting process, emphasizing its potential in mitigating environmental pollution. Additionally, vermicomposting's contribution to

sustainable agricultural practices, as highlighted by Lal (2015), supports reduced dependency on chemical fertilizers, thereby promoting ecological balance.

**7. Repaying Nature's Debt:**

The concept of "nature's debt" and the role of vermi composting in ecological restoration have been touched upon in philosophical and practical terms by authors such as Weil (2019) and Blouin et al. (2013). The idea that human activities need to reciprocate and restore balance to nature's cycles is central to the ethos of vermi composting. By converting waste into a resource, this eco-friendly approach aids in replenishing degraded soils and reviving ecosystems.

- There are many benefits of organic farming by using organic manure.
  - ✓ A 40-45 % expense occurs for adding nutrition, which will reduce by using organic manure for organic farming.
  - ✓ There is only benefit, no harmful effects.
  - ✓ Humic Acid is present in organic Manure which contains all the nutrients which are required to plants.
  - ✓ Analysis results are shown on the bag of organic manure.
  - ✓ All the microelements are present in organic fertilizers which are required for growth as well as plant health because for complete growth all the nutrients must need.
  - ✓ If used with natural decomposer sour butter milk, then low chances of pest and weed into the plants.
  - ✓ Carbon and Nitrogen ratio is higher than the decomposition ratio is low that is more beneficial for soil.
  - ✓ When organic carbon is increase in organic manure it will increase the fertility into the soil and it will help to the next crop production also.
  - ✓ Result is 100 % in crop production by using organic manure.

Soil is responding to the urea fast because that soil is not containing nitrogen so, it is responded fast and the soil is only respond to that crop only and day by day it loses its

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fertility. But when organic manure used that soil contain the nitrogen and it becomes more fertile day by day.

**Materials and Method:**

- Ingredients of Vermicompost:

1. **Esina Foetida:**
   - ✓ Esina Foetida species of earth worms
   - ✓ Quantity per Bed: 4-5 kg approximately (4000 pieces)
   - ✓ Also known as Red Worms (Australian Species)
   - ✓ This species can re grow in 21 days and produce double.
2. **Cow Dung:**
   - ✓ 700-800 kg dung is required for vermin compost.
   - ✓ Allow it to dry for 8 – 10 days in open area, after that transfer it to vermicompost bed.
   - ✓ It is very important to dry because it reduces the chances of contamination.
3. **Dry Soil:**
   - ✓ If Vermicompost does in vermi bed or a plaster of land, then Dry Soil required for cover the bed bottom layer.
   - ✓ It Should be dry (Goralu Soil)

4. **Biodegradable waste:**
   - ✓ Biodegradable waste can compost and regulate the ecological cycle.

**Material used for Vermicomposting:**

1. Vermi Bed: 12/4/2 Size
2. Jute for covering the Bed
3. Sieve for separate vermi from manure

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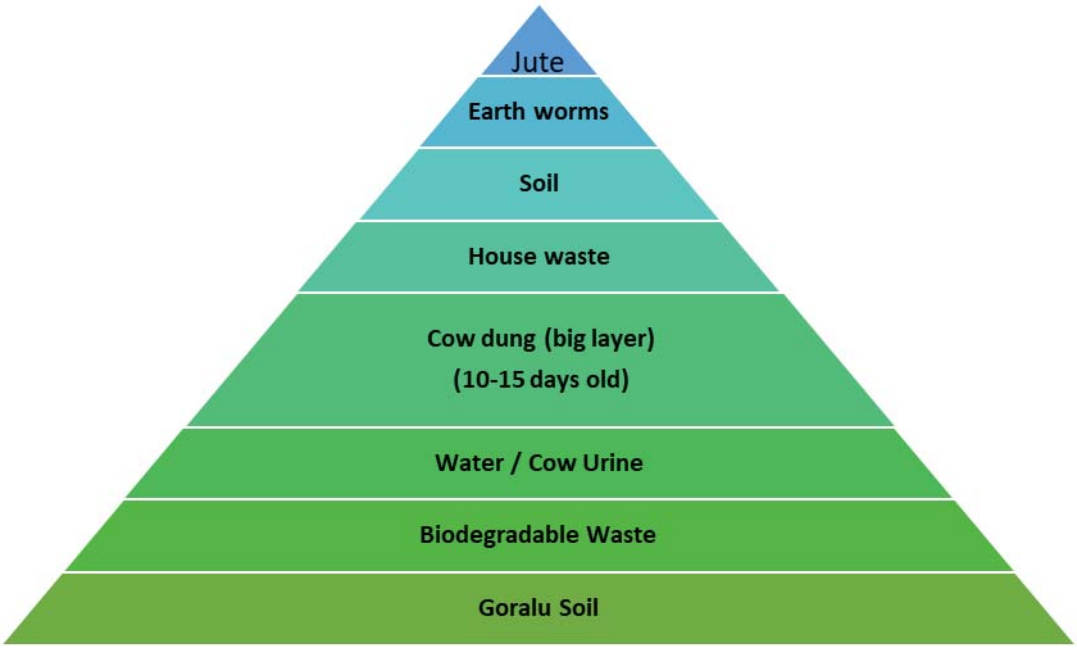
**Method of Vermi Composting:**




**Layers of vermin bed from bottom to Top**

The layers of vermicompost method are followed from the procedure of Anand Agriculture University.

**Method:**

**Step 1:** Allow Cow dung to dry for 8-10 days

**Step 2:** Transfer cow dung into the vermi bed and mix it with soil and agriculture waste**.**

**Step 3:** After transferring the above material into the vermi bed for 8- 10 days check the temperature of Vermi bed mixture. It should be range from 35° C - 40° C.

**Step 4:** If found its temperature is in normal range then transfer the earth worms as per requirement that is 4-5 kg into the vermi bed and provide the water for two times to maintain the humidity of soil and compost. Moreover, cover with jute so that it can provide moisture to the earth worms.

**Step 5:** The earth worm will double in just 21 days approximately and compost the manure from 50 to 65 days.

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**Step 6:** Organic compost when ready has to be transfer from vermi bed to the open area for allows it to dry and sieve vermi compost to separate the earth worms from compost and package into the bag.

**Result:**

The vermi compost was ready within 60 days after transferring the earth worm into the vermi bed. It was very nutritive compost with sufficient level of Nitrogen, Phosphorus, Potassium, and organic carbon. Moreover, other physical parameters are also in range.

The values of parameters have given below with their normal range by using *Eisenia fetida, P.* earthworm species.

**Table 1: List of Parameters analyzed of vermi compost**

| S. No | Parameters | Method | Units (%) | List of Parameters range which analyzed | Specification (Normal Range) |
|---|---|---|---|---|---|
| 1 | Moisture | FAO method | % | 22.47 | 15.0–25.0 |
| 2 | Colour | Physical observation | – | Brown | Dark brown to black |
| 3 | Odour | | – | No odor | Absence of foul odor |
| 4 | Bulk density | FAO method | $g/cm^3$ | 0.37 | 0.7–0.9 |
| 5 | Total organic carbon | IS method | % | 46.14 | Minimum 16.0 |
| 6 | Total nitrogen | IS method | % | 0.92 | Minimum 0.5 |
| 7 | Total phosphorus | IS method | % | 1.7 | Minimum 0.5 |
| 8 | Total potassium | IS method | % | 1.31 | Minimum 1.0 |

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| | | | | | |
|---|---|---|---|---|---|
| 9 | pH | pH Meter | – | 6.78 | 6.5–7.5 |
| *E. fetida: Eisenia fetida, P.* | | | | | |

**Fig: 1 Day-1 of Vermi compost**

**Fig: 2 Day-60 of Vermi Compost**

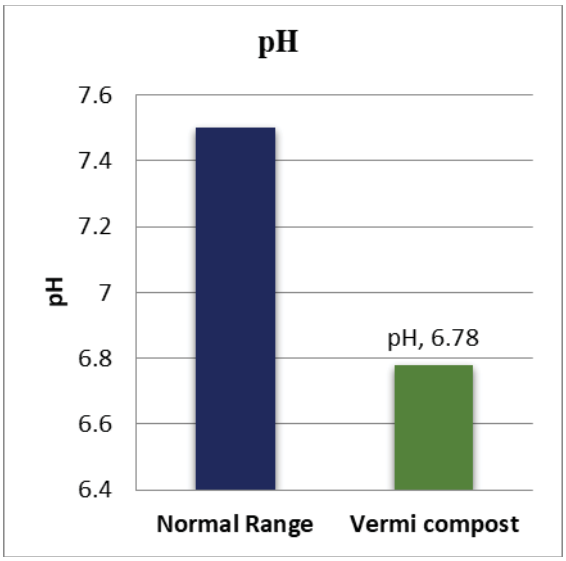


**Fig: 3**

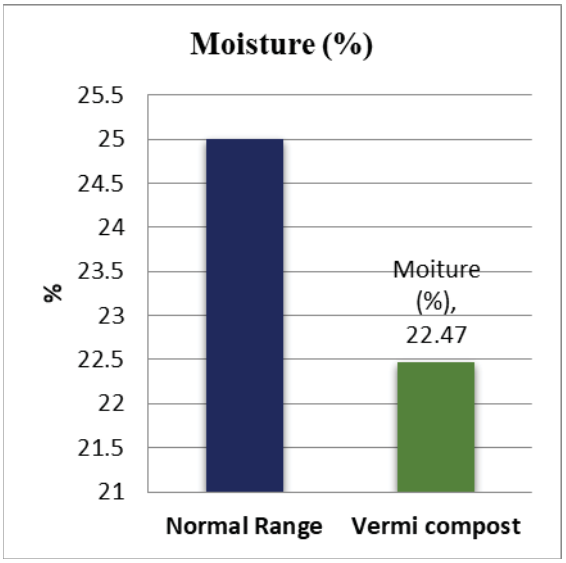


**Fig: 4**

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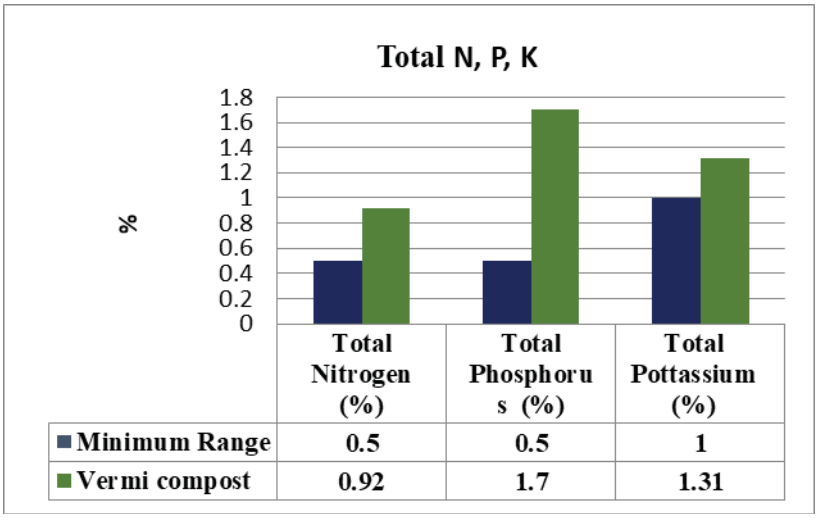


Fig: 5

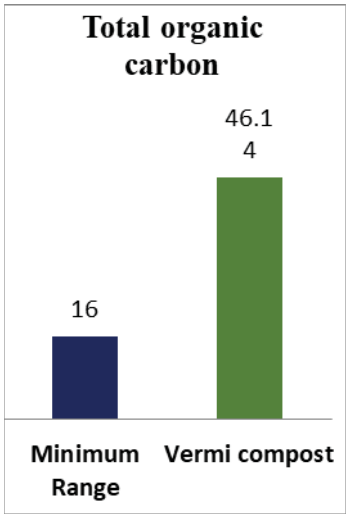


Fig: 6

- ✓ The result obtained depends upon environmental conditions on locations. It depends on the test. It should depend according to the environmental condition. The level of nutrients in compost depends on the source of raw materials and the species of earthworm.
- ✓ The vermi compost shows the higher values then the Minimum range that indicates vermi compost contains higher nutritive values which are need by soil to grow plants.
- ✓ Vermicompost produced from the agriculture waste is not only having crucial effects on soil health and growth, quality and yield of the crop but also playing a key role in the eradication of pollution hazards and act as an eco friendly.

**Conclusion:**

In conclusion, this paper emphasizes the importance of Vermicomposting as a sustainable method for converting agricultural waste into nutrient rich vermicompost. It underscores the need for further research and technological innovations to optimize the process improve product quality by using Biofertilizers and decomposer and enhance its commercial feasibility. Vermicomposting stands as a promising avenue to mitigate environmental concerns and contribute to sustainable agricultural practices.

**References:**


- Atiyeh, R. M., et al. (2002). "The influence of earthworm-processed pig manure on the growth and yield of greenhouse tomatoes." Bio resource Technology.
- Anand Agriculture University, Anand.
- Domínguez, J. (2004). "State of the art and new perspectives on Vermicomposting research." In Proceedings of the International Symposium on Vermicomposting.
- Edwards, C. A. (2010). "Earthworm ecology." CRC Press.
- Garg, V. K., & Kaushik, P. (2005). "Vermicomposting of mixed solid textile mill sludge and cow dung with the Epigeic earthworm Eisenia foetida." Bio resource Technology.
- Lal, R. (2015). "Restoring soil quality to mitigate soil degradation." Sustainability.
- Singh, R., et al. (2018). "Eco-friendly management of agricultural waste through vermi composting: A review." International Journal of Recycling of Organic Waste in Agriculture.
- Weil, R. R. (2019). "Nature's wealth: How to restore, conserve, and enhance the environment." Oxford University Press
- Sharmila k j* et al, 2019. "Nitrogen, phosphorus, and potassium range of vermicompost using *eisenia fetida* and *perionyx excavatus*".
- Kaur P. Et al, 2015, Effect of vermicompost and vermi wash on growth of vegetables.
- Amir Aynehband et al, 2017, Vermicompost: An eco-friendly technology for crop residue management in organic agriculture.
- Jayanta Mistry, 2015, Journal of advanced studies in agricultural, biological and environmental sciences.
- V. Dhanalakshmi et al, 2014, Impact of addition of vermicompost on vegetable plant growth.

- Rakesh Joshi et al., 2014, Vermicompost as an effective organic fertilizer and bio control agent: effect on growth, yield, and quality of plants.
- Barik T et al., 2010, Production of vermicompost from agricultural waste- A review.
- Rahman A'ali et al., 2017, Effects of raw materials on vermicompost qualities.
- Archana Singh et al., 2020, earthworms and vermicompost: an eco-friendly approach for repaying nature's debt.