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Importance and Concept of Vermi-compost for Sustainable Agricultural Practices in the Tropics

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Abstract

Vermi-composting (VC) is a trash-free, sustainable, and cleaner way to manage organic waste. However, it encounters more obstacles. These impediments include the practical VC, which requires a considerable attention, large-scale VC needed to efficiently and broadly dispose off the trash and lack of its awareness and its uses is a major hurdle. Therefore, the farmers need diverse training and extension programs to learn about VC and how to use it. To help the farmers in transitioning to organic farming and get the best agricultural outcomes, innovative, realistic agricultural approaches must be implemented and people/farmers need to know about vermi-composting techniques and its benefits. Vermiculture and its preparation techniques are thoroughly addressed in this article.

Keywords: Vermi-composting; Earthworms; Cow dung; Sustainable agriculture

Introduction

The use of chemical fertilizers has increased dramatically since the green revolution to the point where traditional agricultural systems are entirely reliant on chemical fertilization [1]. Unquestionably, the employment of chemical fertilizers has augmented crop productivity. However, continuous and uneven application has detrimental effects on soil health, which may in turn result in stagnant crop yields in recent decades due to severe land and environmental degradation not limited to pollution, secondary and micronutrient deficiencies, and nutrient imbalances in plants and soil. Unbalanced fertilizer application also has a significant impact on the soil's microbial community [2]. Furthermore, over-use of fertilizers is thought to damage sub-surface and surface water bodies, particularly through nitrate leaching. At the same time, their input costs are rising dramatically to a point that farmers are currently able to see a decline in agricultural returns. In order to maintain soil health and crop yield, it is necessary to convert

inorganic farms to organic ones using climate-resilient integrated crop management modules, considering both the economic and environmental aspects. Recycling of organic wastes is one potential way of cutting-down the use or reliance on chemical fertilizers. Due to the major positive impacts of vermi-compost (VC) organic manure on soil attributes including soil microbial population, it is therefore regarded as a better option to enhance soil health, crop productivity, and quality in agroecosystem. Turning of organic waste into nutrient-rich compost using earthworms is known as vermi-composting. Due to its dependency for consumption of dead organic waste and release as castings, soil earthworms becomes crucial in agriculture. By releasing mineral elements in the forms, which plants may readily absorb, earthworms play a key role in boosting soil fertility and hastening the breakdown of organic debris and plant litter. Growers, companies, organizations, farms, and municipalities are increasingly using vermi-composting to manage organic wastes. VC provides a cleaner environment and an opportunity to handle manure [3]. It also offers numerous opportunities to maintain soil health and improve crop yields and quality [3]. Vermi-culture and VC sales are of two more reasons as to why farmers decide to turn vermi-composting into a company; the first; a greater way to lessen environmental risks and create a healthy, natural soil amendment through composting, the second; Vermi-composting has been a popular topic practically everywhere due to its simplicity and versatility in terms of application.

Technique (s) for vermi- compost production

Vermi-composting utilizes farmyard manure (FYM) or cattle dung as source of material. Vermi-compost (VC) preparation can also be achieved with any material that decomposes readily, such as weeds, vegetable and fruit wastes (leaves and rind), crop residues, animal roughages, and organic municipal trashes. The suitable types of earthworms for vermi-culture and vermi-compost are *Eisenia fetida* and *Eudrilus eugeniae*. In comparison to those which feed on ordinary soil, these worm species create richer casts and prefer to consume organic leftovers such as compost, vegetable wastes, and organic bedding (s). These effectively break down and decompose natural wastes, thus converting them into premium organic compost. Furthermore, these species are resilient to changes in moisture and temperature, proliferate quickly, and are active throughout the. In India, local earthworm species such as *Lampitomauritii* and *Perionyxexcavatus* are also favoured for VC.

Procedure (s) for vermi-compost preparation

1. Selection of a damp, shaded area beneath the tree line (Figure 1a and b), either on the east side or beneath the ventilated shed.

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2. Ensure that the vermi-compost beds have adequate drainage to allow excess water, which may escape through the beds. Additionally, a lot of rain may prevent water from entering beds.

Below is a detailed explanation of the procedure(s) required in producing vermi-compost using the bed method and engagement of students in vermi-compost unit (Figure 1c):

i. Smooth the surface once the location for vermicompost preparation has been chosen. Now, use bricks to create a bed that is roughly 10 × 3 x 3 feet (L x B x H). However, depending on the amount of material required and available, the size of the bed may either be reduced or enlarged.

ii. Sprinkle water on the bed's surface to moisten it (Figure 1d). Then spread a layer of dried leaves, paddy straw, *etc*., two to three inches deep at the base of the bed.

iii. Drizzle a layer of dry material with water once again. Evenly cover the top layer with a layer of cow dung or farm yard manure that is one to one and a half feet thick, and then mist it with water to keep it properly moist. The excrement from cows should not be too fresh. Since fresh cow dung generates a lot of heat and could kill the earthworms, it should be at least ten to fifteen days old. In a similar vein, cow dung should not be too old because it has decomposed and would not provide food for earthworms.

iv. Add the kitchen scraps, such as vegetable leaves, fruit rinds, grasses, animal roughage, etc., and chop them into little bits. Once more, evenly cover the left layer with a layer of cow dung that is one to one and a half feet thick, and then add enough water. Cover the cow dung layer with approximately 1 kilogramme of vermiculture, which contains 800–1000 earthworms.

v. Use jute or gunny bags to cover the vermi-compost bed (Figure 1d). Sprinkle water over the gunny bags on a daily basis to keep the vermicompost bed at the ideal temperature and moisture level.

vi. The bed should be between 35 and 40 percent wet. Therefore, to maintain ideal conditions for earthworm growth and operation, sprinkle water on a regular basis.

Duly following the above instructions, Vermi-compost can be produced in 8–10 weeks. When the vermi-compost is fully grown, it appears dark brown, granulated, highly porous, and odourless. In addition to the above method, the windrow method is another widely used technique for making vermi-compost (VC) these days. Here, a bed-sized polythene sheet is laid out on top of the correctly levelled, gently sloping dirt surface. Bricks are used to prepare the bed; only one layer of cement is applied. As advised, the aforementioned material is applied evenly layer by layer, and a doom shape is provided at the top of the bed. This approach guarantees adequate aeration and promotes the worms' quicker growth. There is less necessity

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to turn the material (s) using this procedure. The technique is also cost-effective, as it requires very less input.

Harvesting and storage of vermi-compost (VC)

Subsequent to stopping the watering process for nearly a week, creating a pile of VC on the bed with earthworms descending and congregating at the heap's base, the top part of the material is taken away from the heap and shaded for subsequent processing such as packaging in polythene bags (Figure 2) and sifting. In order to prevent the vermi-compost from losing its moisture and nutrient content, it should not be exposed to direct sunlight as to maintain atleast 40% moisture content. Sieve the VC subsequently and move any earthworms to the next new bed. There are many earthworms in the lower part of the vermicompost heap, which might be used for vermi-culture to make VC again. The VC is now prepared for use in fields, flowerpots, and fruit and vegetable crops, among other applications. Only if the ideal moisture content (40%) is maintained, VC can be stored for at least a year without losing any of its quality.

Figure 1: Selection of a damp, shaded area beneath the tree line beneath the ventilated shed **(a** and **b)**, engagement of students in vermi- compost unit **(c),** water sprinkling on the bed's surface to create moisture and use of jute or gunny bags to cover the vermi-compost bed **(d**).

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Figure 2: Packaging of the top part of the material from the vermi-compost heap in polythene bags.

Nutritional value of vermi-compost (VC)

The nutrient content (s) of VC primarily relies on the waste material or base substrate utilised for its manufacture. Likewise, the species of earthworms utilised in vermi-composting may affect the quality of the resulting VC. Nevertheless, the average nutritional concentration in the VC is presented in Table 1.

Table 1: Average nutritional concentration in the vermi-compost

Nutrient	**Content**
OC	9.15 – 17.98 %
Total N	1.50 – 2.10 %
Total P	1.00 – 1.50 %
Total K	0.60 %
Ca and Mg	22.67 – 47.60 meq/100g
Available S	128.00 – 548.00 ppm
Cu	2.00 – 9.50 ppm
Fe	2.00 – 9.30 ppm
Zn	5.70 – 11.50 ppm

Ca=Calcium, Mg= Magnisium, S= Sulphur, Ca=Calcium, N= Nitrogen, P= Phosphorus, K= Potassium, OC= Organic Carbon, Fe= Iron, Cu= Copper, Zn= Zinc, Mn= Manganese.

The nutrient profile in vermi-compost (VC) is generally higher than traditional compost (Table 2) and it reduces the application of inorganic fertilizer to a significant extent.

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Table 2: Nutrient profile in vermi-compost in comparison with traditional compost

Element	Vermicompost	Farmyard manure
C:N	15.50	31.30
N (%)	1.60	0.50
P (%)	0.70	0.20
K (%)	0.80	0.50
Ca (%)	0.50	0.90
Mg (%)	0.20	0.20
Fe (mg kg^{-1})	175	146.50
Cu (mg kg^{-1})	5.00	2.80
Zn (mg kg^{-1})	24.50	14.50
Mn (mg kg^{-1})	96.50	69.00

Ca=Calcium, N= Nitrogen, P= Phosphorus, K= Potassium, C: N= Carbon to Nitrogen ratio, Fe= Iron, Cu= Copper, Zn= Zinc, Mn= Manganese.

Conclusions

Vermi-compost (VC) has transformed kitchen gardening and vegetable growth worldwide in recent decades. VC outperforms other organic agriculture inputs. It is the greatest organic fertilizer for plant growth and productivity since it has more nutrient contents than regular composts. The organic fertilizer earthworm castings contain growth hormones, humus, nitrogen, phosphorus and potassium (N, P, and K), other minerals, beneficial bacteria, enzymes, and antibiotics. VC; an organic fertilizer improve soil organic carbon, nutrient levels, cation exchange capacity, microbial activity, biomass carbon, enzymatic activity, soil aggregation, and water retention. Earthworm castings deter pests. This significantly supports plant growth/ development and soil health. Employing VC in agriculture may reduce reliance on chemical/ synthetic fertilizers, which ultimately may aid towards reducing the greenhouse gases (GHGs) emissions, thus mitigating the adverse effects of global warming further in the tropical regions.

References

1. Nthebere, K., Prakash, T. R., Jayasree, G., Padmaja, B., Meena, A and Latha, P. C. (2023). Changes in Soil Physical Properties and Available Micronutrients as Influenced by Tillage and Weed Management Strategies under Diversified Cropping System. *Biological forum-An international Journal*. 15(9): 131-140.
2. Dincă, L. C., Grenni, P., Onet, C and Onet, A. (2022). Fertilization and soil microbial community: a review. *Applied Sciences*. 12(3): 1198.

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3. Karmegam, N., Vijayan, P., Prakash, M and Paul, J. A. J. (2019). Vermicomposting of paper industry sludge with cowdung and green manure plants using Eisenia fetida: A viable option for cleaner and enriched vermicompost production. *Journal of Cleaner Production*. 228: 718-728.