Vermicomposting Improving the Procedure by the Inoculation of Waste Decomposer

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Abstract

Environmental issues are being raised by the fast rise in organic waste generation that has resulted from urbanisation and population expansion. There is pollution and greenhouse gas emissions from traditional processes like land filling and incinerating. Earthworms turn organic waste into nutrient-rich vermicompost, which increases soil fertility and structure. Vermicomposting is a sustainable and natural waste management method. Given its high population density and need for greater food production, India stands to gain greatly from this environmentally benign and effective waste management technique. Research indicates that it typically takes 45–60 days for garbage to break down. With the aid of a waste decomposer, the process may be improved to accomplish quicker degradation in less time. That's what the current research addresses. Comparison between the vermicompost bed with and without the additional inoculum revealed that the latter exhibited slower deterioration. India is a nation with a dense population where this strategy may assist increase crop yield and quality. The amount and quality of crops increased as a result of rising food production needs. Though more work is required to shorten the vermicomposting process for organic farming, progress is being made.

Keywords: Faster degradation, vermicomposting, trash decomposer, and floral waste

INTRODUCTION

Urbanisation and population growth have resulted in an unsettling surge in the generation of organic waste and the related environmental issues. Conventional trash disposal techniques like land filling and incinerator utilise a lot of resources and increase pollution and greenhouse gas emissions. Vermicomposting has become a feasible option in this context as a natural and sustainable waste management method. Earthworms are used in vermicomposting to transform organic waste into nutrient-rich vermicompost, which is a useful tool for enhancing the fertility and structure of soil. The basic materials for vermicomposting are quite varied.

The technique of vermicomposting on Eisenia fetida utilising dry grass clippings, rice straw, and cow dung has been investigated by Ramnarain Y.I. et al. (2018). They clearly demonstrated that the maximum rate of vermicompost generation was achieved when rice straw and grass were combined. Global environmental issues must be resolved by the recycling of urban garbage. Municipal garbage contains organic material that is high in nutrients, cellulose, lignin, and proteins (Das et al., 2018). Composting is widely acknowledged as an effective method of managing solid waste, and it may recycle nutrients (Alshehrei and Ameen, 2021). Through aerobic biodegradation, composting turns trash into stable humus-like materials (Gong et al., 2018). The final product may be used as a substitute for peat as a potting substrate (Gong et al., 2018) or to enhance soil qualities in agricultural areas (Papafilippaki et al., 2015).

The cellulose and lignin in vegetable waste have been shown in a few prior investigations to impede the thermophilic composting process. Vermicomposting, a unique kind of compost, may be used to handle these wastes (Gong et al., 2019). It is well known that the earthworms in vermicomposting enhance the breakdown of cellulose (Aira et al., 2007; Karmegam et al., 2021). Furthermore, several additives have been effectively added to wastes rich in cellulose and lignin, including cow manure and mushroom wasted straw (Balachandar et al., 2021). Additionally, the vermicomposting process's cellulose breakdown was enhanced by the addition of nutrient-rich green manure (Karmegam et al., 2021). Additionally, the vermicomposting process was enhanced by microalgal biomass (Alshehrei et al., 2021). When food waste is vermicomposted, the mangrove fungus Acrophialophora jodhpurensis is used as a bio-catalytic agent. This shortens the composting time and improves the final vermicompost quality. The best additives for raising the compost's quality were determined to be charcoal, cow manure, and mangrove fungus.

The vermicomposting process was enhanced by the three mangrove fungus. Vermicomposting-related active fungus may thrive in mangrove environment.

By enabling earthworms and microorganisms to interact throughout the worm gut, vermicomposting is a low-cost technological solution that turns agricultural waste into organic fertilisers (El-Haddad et al., 2014).

Nonetheless, vermicomposting times vary, with durations of 75 days (Bharadwaj, 2010), 90 days (Bansal and Kapoor, 2000), and 100 days (Garg et al., 2006). Sharma and Garg (2020) reported on the three-week pre-degradation of buffalo dung and parthenium prior to the 90-day vermicomposting process using E. fetida. A mature product may be achieved in 25–30 days instead of the 45–60 days required by a standard vermicomposting technique. Kauser and Khwairakpam (2022) employed the rotating drum compost method, which shortened the vermicomposting process by 15-20 days.

Vermicomposting is a sustainable and environmentally beneficial way to address the issues of degraded soil and waste management. Waste reduction, soil enrichment, and economic feasibility are just a few of its many advantages that make it an appealing option for people, communities, and agriculture. Accepting vermicomposting may be very important in resolving environmental issues and encouraging sustainable practises globally as we work towards a more resilient and sustainable future. An effort has been made to shorten the process's length while still producing a high-quality result. Farmers and environmentalists are now pushing organic farming as a way to protect people from the harmful impacts of chemical fertilisers. The current research aims to produce high-quality and abundant compost while shortening the vermicomposting process.

MATERIAL AND METHODS

Preparation of the Inoculum: A one-liter inoculum was made using a commercial waste decomposer of the Generic brand that was bought online. Ten grammes of jaggery, fifteen grammes of waste decomposer, and one litre of distilled water were added to this and allowed to sit for seven days.

Setting Up the Vermicomposting Bed: Concurrently For the experiment, a total of six beds with equal composition mixes were set up. One kilogramme of floral waste, one kilogramme of cow manure, and 250 grammes of coconut peat were combined to create the composition combination, which was left for seven days to partly degrade. In order to continue the experiment, 20 earthworms (Eisenia fetida) were added to each of the six beds, which were labelled A, B, C, D, and E. Five of the beds then received an inoculum, with bed A serving as the control bed without an inoculum. As test samples, the aforementioned inoculum was gradually added to the other five beds in the following amounts: 5

ml (B), 10 ml (C), 15 ml (D), 20 ml (E), and 25 ml (F).

Enhancement of Physical Factors

The physical parameters were kept at their optimal level in accordance with the Shouche et al. (2011) methodology.

Table 1: Composition of mixture for degradation and volume of inoculum added

S. No.	Composition mixture	Group	Volume of inoculum added (ml)
0	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	A	Without inoculum (control)
1	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	B	5ml
2	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	C	10ml
3	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	D	15ml
4	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	E	20ml
5	1Kg Floral waste +1 Kg Cow dung +250gms coconut peat	F	25ml

Fig. 1. Prepared inoculum

In order to increase the final vermicompost quality and decrease the composting duration, the mangrove fungus Acrophialophora jodhpurensis was used as a bio-catalytic agent during the vermicomposting of food waste (Alshehrei and Ameen, 2021). Tiwari et al. (2021) came to the conclusion that vermicomposting eliminates pathogens from compost created from faeces, sewage sludge, and plant wastes in addition to being an excellent waste management technique for managing garbage from temples.

Fig. 2. (A) Vermicomposting Bed Day 1 (B) Vermicomposting Bed Day 32 after adding 20 ml inoculum

High efficacy composting in containers has been shown to improve soil properties such as soil conductivity, stability, erosion resistance, fertility, and plant nutrition (Celik et al., 2004). According to Kim et al. (2008), in-vessel composting technology is more suited for the degradation of organic substrates because it requires less space and time and offers superior control and performance. However, vermicomposting is a similar aerobic breakdown of organic materials that also uses earthworms to transform the material into a vermicompost, which resembles humus (Munroe, 2007). To turn organic waste into useable soil conditioners, composting and vermicomposting are also often suggested biological waste treatment techniques (Tognetti et al., 2005).

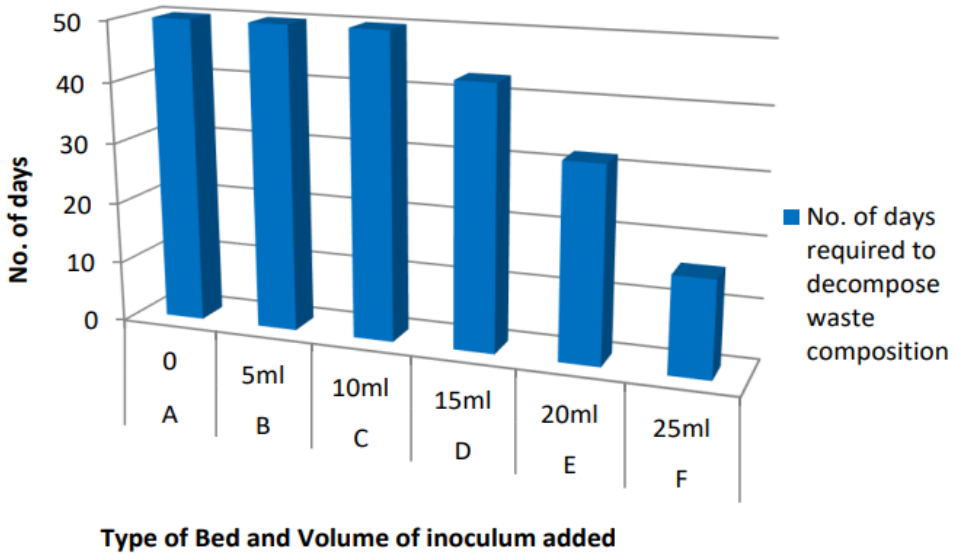

Fig. 3. No. of days required for vermicomposting using waste decomposer

CONCLUSION

Vermicomposting has shown to be a highly effective and environmentally responsible method of waste treatment. Thus, a great lot of research has been conducted in this area, and several conclusions have also been made. India is a more densely populated nation of farmers. A greater amount of food production is required. As the need grows, assistance with crop quantity and quality becomes essential. Although there has been a lot of progress in this direction, more work has to be done. Organic farming will gain from a shorter vermicomposting period.

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