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COMPARATIVE STUDY OF THE NUTRIENT VALUE OF ORGANIC COMPOST AND VERMI COMPOST PRODUCTION AT ST. JOSEPH VERMICOMPOST YARD, TIRUCHIRAPPALLI, TAMILNADU, INDIA

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ABSTRACT: Composting and vermicomposting are sustainable processes that convert organic waste into nutrient-rich compost and vermicompost through the biological activity of microorganisms and earthworms, respectively. In the present study, vegetable waste and cow dung were collected from St. Joseph's College campus and used in various treatment combinations for both composting and vermicomposting. After a 60-day period, the matured compost and vermicompost were harvested and analyzed for their nutritional composition and heavy metal content. The results indicated that vermicomposting treatments yielded significantly higher nutrient values compared to conventional composting. This study highlights the effectiveness of vermicomposting as a superior method for organic waste management and advocates for the widespread adoption of composting technologies as environmentally sustainable solutions.

Keywords: St. Vermicompost Yard, Organic and Vermicompost, Nutritional composition, Heavy metal composition

INTRODUCTION

Composting and vermicomposting are two well-known processes for reclaiming solid organic waste. The final products—compost and vermicompost—can be used as sources of organic matter for soil amendment, as nutrient sources for fertilization, or as growing media constituents in soilless cultivation (González et al., 2016). Vermicomposting is a bio-oxidative process that involves the joint action of earthworms and microorganisms. While the microorganisms present in the feedstock and in the gut of the earthworms carry out the biochemical degradation of organic matter, the earthworms fragment the substrate, increasing the surface area accessible to microbial activity (Prakash and Karmegam, 2010). India has the potential to produce approximately 4.3 million tons of compost annually from municipal solid waste, significantly bridging the gap between the availability and demand for organic manure. Composting transforms raw organic residues into a humus-like material that can be used as a soil amendment, seed starter, mulch, or natural fertilizer. It is a natural process of recycling organic matter—such as leaves and food scraps—into a valuable fertilizer that enriches soil and promotes plant growth (Shelia Hu, 2021). Organic composting refers to the decomposition of organic waste materials into nutrient-rich soil amendments through natural microbial activity. This method plays a crucial role in sustainable agriculture by enhancing soil fertility while reducing dependency on chemical fertilizers. In contrast, vermicomposting employs earthworms to convert organic waste into high-quality compost rich in nutrients and beneficial microbes (Soobhany, 2018). The composting process involves the decay and breakdown of organic solid waste into a humus-like substance, which serves as an excellent natural fertilizer. Microorganisms and earthworms are integral to this process, requiring optimal levels of carbon, nitrogen, oxygen, and water to function effectively. Compostable materials include organic kitchen waste, green waste, animal dung, sugarcane residue, food leftovers, vegetable and fruit peels, and even industrial sludge. The time required for compost to mature depends on the type and quantity of waste materials added. Though the raw materials typically have low nutrient content, they decompose slowly, releasing essential elements that enrich soil over time. Both organic composting and vermicomposting are increasingly adopted in agricultural and horticultural practices to improve soil structure and fertility. Among the various earthworm species used in vermicomposting, *Eisenia fetida* (commonly known as red wigglers) are the most popular and effective (Figure 1).

Figure.1 Study species: *Eisenia fetida* (Red Worm)

A. ORGANIC COMPOST

In this method, simply all the waste (brown and green materials) are collected piled up in a pit or in a container and left open to atmosphere to get decayed. If the composting is done in pit, then it is covered with soil at top and mixed at specific time intervals. And if composting is done in a container, then holes are made in container at sides and bottom for air circulation. Water is added in at alternate days in any of the method used in order to maintain optimum moisture content for process. The food scraps, grass clippings, leaves, animal manure, and coffee grounds are all compostable. Composting is a process that uses organic waste materials like leaves, grass, fruits, and vegetables to produce humus, a natural fertilizer rich in fiber and inorganic nutrients. This process is beneficial for lawns, gardens, and farms, as it accelerates plant growth and is environmentally friendly. The composting process can vary depending on the method or equipment used (Grazia policastro et al., 2023).

B. VERMICOMPOSTING

It is a process in which decomposition of organic material like fruit and vegetable waste is done by adding various species of worms such as red wigglers, redworms and earthworms. In this process compost would take comparatively less time as taken for vermicomposting. Sometimes during the process of composting a liquid is produces from the compost, which is called 'Vermi wash'. The vermicompost effectively improves soil quality and enhances the microbial activity and nutrient recycling to produce high equality crops (Nurhidayati et al., 2018). The vermicompost is a biofertilizer to the end-users like farmers for replacing chemical fertilizers and procuring better prices for the organic produce using such composting material (Ramnarain et al., 2019; Annapoorani, 2019

MATERIALS AND METHODS

EARTHWORM CULTURE

The species of earthworm, *Eisenia fetida* were cultured in big tanks constructed inside the Vermicompost Yard, St. Joseph's College campus (Figure.2). They are the most commonly earthworm species used for vermicomposting due to their wide range of temperature tolerance, high reproductive potential and ubiquitous with a worldwide distribution

Figure 2. St. Joseph's Vermi compost yard.

COLLECTION AND PREPARATION OF SAMPLE FOR COMPOSTING:

The substrate for composting material was collected from St. Joseph's College premise which is including plant waste, hostel vegetable wastes. The collected waste material was cut into the organic cutter machine (Figure.3) shade dried for one week, and used for further experiments.

Figure 3. Organic Cutter machine

EXPERIMENTAL DESIGN

THE COMPOSITION OF FEEDSTOCK IN

The experiments were conducted in triplicates using three cylindrical green bag, each with a capacity of 15 L. For proper aeration and drainage, holes of 0.5 cm diameter were drilled on the bins. Two types of composting beds were prepared: one for organic composting and the other for vermicomposting. In both setups, vegetable waste, cow dung, and plant waste were mixed in specified proportions. The vermicomposting bed included earthworms, while the organic composting beds did not. Each bed used 150 g of earthworms for vermicomposting. Throughout the study period, the moisture level was maintained at approximately 50–60% by periodically sprinkling potable tap water. Two distinct beds, representing organic composting and vermicomposting respectively, were used for the experimental purpose (Figure 4 and Figure 5).

Figure 4. Organic Compost bed

Figure 5. Vermicompost bed

COMPOST ANALYSIS

A 100 g homogenized sample was collected from each bed (two samples in total), taken randomly and non-destructively on the 60th day of the experiment. The average values were used to minimize experimental error. Each sample was analyzed for the following physico-chemical parameters: ash content, bulk density, specific gravity, particle density, pH, moisture content, CO_2 release, volatile solids, and carbon content. Additional parameters included moisture, bulk density, particle size, electrical conductivity (mS/cm), pH, total organic carbon, total nitrogen, total phosphorus, and total potassium. All tests were conducted in the Department of Botany, St. Joseph's College, Tiruchirappalli, following the methodology described by Sheetal Singh et al., 2013. Furthermore, each sample was analyzed for heavy metals such as Arsenic (As_2O_3), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Nickel (Ni), Zinc (Zn), and Lead (Pb), using the protocol established by Waikhom Roshan Singh et al., 2016.

RESULT AND DISCUSSION

In India, our current waste disposal practices and attitude are largely focused on simply getting rid of waste by throwing it away. Waste management is a streamlined process used by organizations and individuals to dispose of, reduce, reuse, and prevent waste. It remains a major challenge, particularly in urban agglomerations across the country. Compost can serve as a valuable natural fertilizer and is far more environmentally friendly than synthetic fertilizers (Manohara and Belagali, 2014). Sumiyati et al. (2020) reported that several methods exist for the composting process. Among these, the pit method is considered easy, cost-effective, time-efficient, and natural for producing manure and fertile compounds by decomposing biodegradable waste. Organic waste can be recycled into valuable products such as compost and biogas, both of which have significant applications in agriculture. The present study was conducted to evaluate different composting techniques and assess their potential benefits. Data presented in Tables 1 and 12 indicate that both organic and vermicomposting systems positively influence waste management. Of the two, vermicompost was found to produce higher quality compost. This study demonstrated increased efficiency in compost production. Organic compost is generated through the natural degradation of organic waste, while vermicompost is produced through biological degradation using earthworms. Federico A Gutiérrez-Miceli et al., 2007 noted that vermicomposting is an eco-friendly and cost-effective method—ideal for solid waste management and environmental sustainability. It can effectively manage domestic solid waste, stabilizing materials with low toxicity, pathogens, and heavy metals. The results of the present study revealed that vermicompost contains higher nutrient values and beneficial levels of heavy metals that play a vital role in plant growth and soil enrichment. Similarly, Ievinsh, 2011 explained that a compost bin is a container in which organic waste is placed to decompose over time into compost. Even in the absence of a container, decomposition will eventually occur in a compost heap or pile. Using a compost bin is an excellent way to reduce the volume of garbage sent to landfills. Our study successfully identified and assessed the most

efficient and user-friendly composting method. When both methods were compared, vermicomposting was found to be superior. Bharat Kumar and Divya Topal (2015) reported that vermicompost is a good source of various micronutrients, environmentally acceptable, and a practical way to convert organic waste into a valuable resource. It is an eco-biotechnological process that transforms complex, energy-rich organic substances into simpler, usable forms. After analyzing all parameters of both compost types, it can be concluded that vermicompost is the superior organic compost for field applications. Nutrient values such as total nitrogen, potassium, carbon, phosphorus, lead, copper, and zincwere comparatively higher in vermicompost than in organic compost. However, the values of total potassium were found to be equal in both composts. Therefore, further studies should be done in area of soil physical, soil chemical and biological properties of composting and vermicomposting college premise.

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