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ORIGINAL PAPER

Vermicompost enrichment: A tool for preserving health by substituting chemical fertilizer

Dr. Pallabi Das[1] and Dr. Anshu Ahlawat[2]

[1]*Assistant Professor- Department of Animal Nutrition, M.B. Veterinary College, Rajasthan*
[2]*Asscociate Professor and Head, Department of AGB, CoVSc & AH, KU, Junagadh*

Corresponding author : dranshuahlawat@gmail.com

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ABSTRACT

Cow manure is an excellent source of fertilizer, and earthworms help create the distinctive vermicompost. All agree that vermicompost is preferable to chemical fertilizers. There is a lot of cow dung, but there aren't many vermi tanks. Here, we've spoken about some inventions to speed up maturation by using decomposers, bacteria, and fungal species, and we've evaluated many techniques. It was discovered that the slurry approach greatly increased the phosphorus percentage, slightly increased the K percentage compared to the usual method, barely changed the N content, and almost doubled the population of beneficial bacteria, fungus, and azotobacter. After phosphate solubilizing bacteria and N-fixing bacteria were introduced, there have been reports of increases in the N and P contents of manure. In addition to having a favorable impact on the nutrients in manure, waste decomposers containing the fungi *Trichoderma viridae*, strains of the bacteria *Pseudomonas fluorescence*, and *Azotobacter cerococcid* also have a symbiotic influence on the population of earthworms. The pile composting method that is enhanced with a decomposer will prove to be highly beneficial for handling large amounts of garbage with little effort and time.

Keywords: Vermicompost, Vermi tank; Earthworm, Nitrogen and Phosphorus

INTRODUCTION

People are more aware than ever before of the harmful consequences of chemical fertilizers (Chandini *et al*., 2019). Due to the positive outcomes and high demand for organic products, farmers (Yangchan *et al*., 2019 as well as Kumar *et al*., 2019) showed organic vermi compost over chemicals with ease. Due to decreased environmental degradation, organic farming also improves ecological conservation (Das *et al*., 2020).

Vermi compost is a simple alternative to chemical fertilizers (Thakur *et al*., 2021). Vermi compost is a great growth booster and protector for agricultural plants since it is richer in NPK, ashes, and helpful soil microorganisms (nitrogen fixing and phosphate solubilizing bacteria, and actinomycetes) than conventional compost (Bhatta *et al*., 2021). Earthworms and mesophilic bacteria work together throughout the mesophilic vermicomposting process to convert organic wastes into the useful byproduct known as vermicompost (Bhat *et al*., 2017). Earthworms support the development of "beneficial decomposer aerobic bacteria, Earthworm hosts millions of microbes hydrolytic enzymes protease, amylase, lipase, cellulose and chitinase and hormones that helps in rapid decay of complex organic matter into vermicompost in a relatively shorter duration of 2 months (Maji *et al*., 2017). It is termed Verm wash, a liquid fertilizer rich in plant growth hormone that is utilized as a foliar spray, and it percolates through vermibed columns (Gudeta *et al*., 2021).

IMPORTANCE OF VERMICOMPOST

- The earthworm casts also include higher levels of plant nutrients such as N, C, P, K, Ca, and Mg.
- High aeration, porosity, and capacity to store water.
- Auxins and cytokinin, which are plant growth hormones, are present.
- Earthworms speed up the process of mineralization and turn manures into castings with higher levels of humification.

Table 1. Composition of nutrients in vermicompost is as follows (Nagavallemma *et al*., 2004):

Organic carbon: 9.5–17.98%	Calcium: 1.18 -7.61%
Nitrogen: 0.5–1.50%	Copper: 2–9.50 mg/kg
Phosphorous: 0.1–0.30%	Iron: 2–9.30 mg/kg
Potassium: 0.15–0.56%	Zinc: 5.70–11.50 mg/kg
Sodium: 0.06–0.30%	Sulfur: 128–548 mg/kg
Magnesium: 0.093-0.568%	C:N :15.5

Environment for earthworms

The ideal conditions for earthworms are 15 to 25 °C, a moisture content of 75 to 90%, a low ammonia concentration of the waste of 1 mg, a low salt content of 0.5%, and a pH of 5 to 9.

METHODS OF VERMICOMPOSTING

1. Bin composting: Composting in bins is one of the most popular small-scale composting techniques. The trash can be formed of many materials, such as plastic or recycled containers. A bin might range in size, but ideally it should measure 45 x 30 x 45 cm. For optimal aeration and drainage, the area around the bin needs to have holes everywhere.

2. Pit composting: This technique is employed in large-scale manufacturing. Pit dimensions should be 2.5 m by 1 m by 0.3 m. To promote aeration and block direct sunshine and rain, a shed-like structure with pen sides is required.

3. Pile composting: For larger-scale production, employ this technique. Anywhere under a greenhouse can be used to create the piles. It should be approximately 40 centimeters tall. If Gauthan has an abundance of cow dung and no space in the vermi tank, this approach is quite helpful. Any length and width are possible.

4. The traditional approach: In this approach, the tank is filled with a layer of broken bricks (3–4 cm thick) to allow for the drainage of extra water. A 3 cm layer of a 1:1 mixture of sieved garden soil and dried cow dung serves as the earthworms' bed. The tank is then filled with alternate layers of half-decomposed cow dung and chopped rice straw, each layer being 6 cm thick. 2 kilograms of earthworms are added to the tank. Gunny bags should be used to keep the moisture on the upper layer. After 60 days, the matured VC is removed from the tank. The C:N ratio decreases as vermicomposting proceeds. An indicator of vermicompost maturity is the CN ratio. The C:N ratio should be under 20.

5. Slurry method (non-enriched): In a cemented tank, cow dung and water are combined in a 3:5 ratio to create slurry. The slurry can be supplemented with the partially decomposed leftover grass paddy straw. After 5-7 days, 2 kilograms (or about 2000 earthworms) are added. It became vermicompost after 50–55 days.

Vermicompost fortified with fungus and bacteria

There are numerous bacterial and fungal strains that are actively used as waste decomposers to speed up the process. These strains were discovered to be efficient in the vermicomposting process to shorten the time. The bacteria *Pseudomonas fluorescence* and the fungus Trichoderma viridae, as well as the bacterial strains *Azotobacter cerococcid*, are combined thoroughly. It is beneficial to perform a preliminary fermentation with Trichoderma since it shortens the vermicultivation period and improves the vermicompost's yield and quality. *A. cerococcid*, *P. fluorescence*, and fungal *T. viridae* were the three organisms that had the most notable favorable effects on earthworm populations and dry weight, respectively. The availability of organic waste

rich in nutrients and the increase in surface area of waste consumed due to earthworm mechanical action are what account for the larger fungus population.

CONCLUSION

Crops grown with chemical fertilizers have contaminated soil and low nutrient value in comparison to crops grown organically since chemical fertilizers are made from "vanishing resources" of the earth. To safeguard the agro-ecosystem and safeguard human health from dangerous chemicals, organic farming must be encouraged. Vermicompost use in organic farming, together with its enrichment, has the potential to replace chemical fertilizers, lower costs, and produce organic goods that are more valuable to consumers.

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