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CONSIDERATIONS ON THE IMPORTANCE OF VERMICOMPOST PRODUCTION

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Abstract: Vermicompost is of significant importance in agriculture and horticulture because it is a natural organic fertilizer that can help improve soil health and increase plant production. It is rich in nutrients such as nitrogen, phosphorus, potassium and micronutrients, which are essential for plant growth and development. Vermicompost can help improve soil structure by adding organic matter and improving the water–holding capacity of the soil. It contains a variety of beneficial bacteria and fungi, which help to increase soil health and protect plants from diseases and pests. Vermicompost tea, known as organic bio–fertilizer, contains microbes, nutrients, and plant growth promoters, and its application has shown an improvement in seed germination, growth and yield enhancement, and plant disease suppression
Keywords: vermicompost, organic wastes, organic bio–fertilizer, earthworms

1. INTRODUCTION

For sustaining soil fertility and boost crop production, organic wastes such as cattle droppings, rejects from the kitchen, sewage sludge or anaerobically digested animal manure have been used in agriculture for a long time (Sinha, R.K. et al, 2009; Sim, E.Y.S. et al, 2010; Quilty, J.R. et al, 2011). The application of compost and vermicompost as soil fertilizers helps in preserving, restoring soil fertility (Kumar, R. et al, 2013; Passarini, K.C. et al, 2014) as well as enhancing soil biodiversity by substantially improving microbial biomass (Hernandez, T. et al, 2014).

Physically, vermicompost–amended soils have better aeration, porosity, structure (Zhu, F. et al, 2017), and chemical parameters like pH, conductivity, organic matter and nutrient status enhanced considerably and led to improved crop growth and yield due to vermicompost application (Lim, S.L. et al, 2015).

Vermicompost tea, known as organic bio–fertilizer, contains microbes, nutrients, and plant growth promoters, and its application has shown an improvement in seed germination, growth and yield enhancement, and plant disease suppression (Khattiyaphutthimet, N. et al, 2020; Arancon, N. et al, 2020).

2. MATERIALS AND METHODS

Earthworms harbor a variety of decomposer microbes in their gut and excrete them along with nutrients in their excreta, and both are found to be mutual partners. An overview on the effect of vermicompost and associated microbes on agriculturally useful traits is depicted in figure 1 (Vijayabharathi, R. et al, 2014).

These microorganisms directly or indirectly contribute to the beneficial properties of vermicompost and vermiwash in enhancing soil health, plant growth, and hence agricultural productivity.

Bacteria play an important role in the decomposition process because they help break down organic material into simpler substances that can then be used by plants to grow and thrive. In general, vermicompost contains a variety of beneficial bacteria that help improve soil health and stimulate plant growth.

In addition to bacteria, fungi are also present in vermicompost. They help break down organic material and transform it into nutrients. Fungi can also help plants grow and develop by forming a symbiosis with their roots, called mycorrhiza. Mycorrhizae are a mutualistic relationship between fungi and plants, which help to absorb and transfer nutrients and increase the plant's ability to adapt to soil stress. Therefore, the presence of fungi in vermicompost can have a beneficial effect on soil and plant health.

The input material (raw material) for vermicomposting is essential. If the earthworms don't like the food/environment, they don't perform and eventually disappear. This is why this technology has not been adopted frequently. Composting earthworms have certain environmental requirements:

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temperature 15–30°C, humidity 60– 80%, pH level 6–8, complete aerobic conditions and sufficient feed (C/N ratio: 25:1) with a lax structure. Most of the time, mixtures from different resources need to be modified/diluted/supplemented to match the required quality.

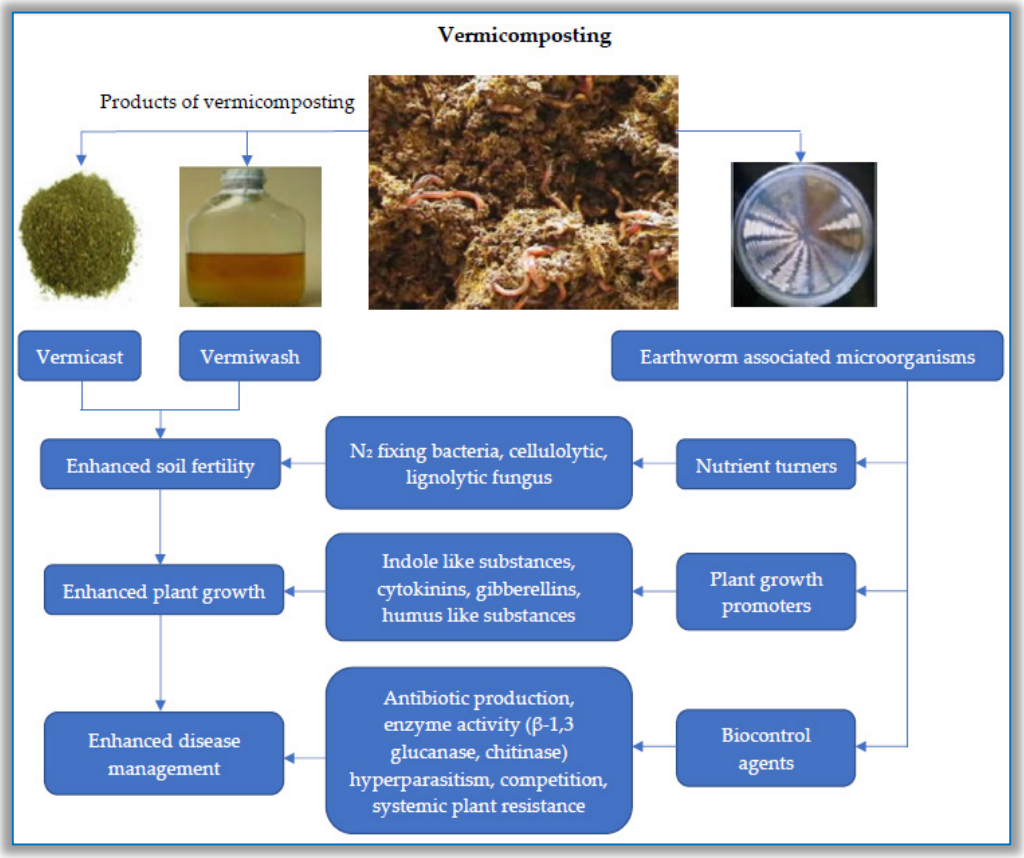

Figure 1 – Overview of vermicompost and its associated microbes on plant growth (Vijayabharathi, R. et al, 2014)

For the industrial production of vermicompost, a large investment in equipment is required: installation of shelves, containers for substrate and worms; crusher; drip irrigation system; mechanical sieve; packaging equipment; devices for measuring and controlling the microclimate in the room and in the substrate; shovels, buckets, conveyors; tractor with trailer for manure.

3. RESULTS

Industrialization and urbanization have led to an increased accumulation of waste materials that are transformed into a nutrient–rich and high–quality product called vermicompost by the vermicomposting process (figure 2). Vermicomposting is an ecofriendly and economically favorable biotechnological process that involves the interaction of earthworms and microorganisms (Vuković, A. et al, 2021).

Composting earthworms need a hospitable living environment, usually called a "bed". Bedding is any material that provides the earthworm with a relatively stable habitat. This habitat should have the following characteristics:

Figure 2 – Conversion of organic waste into compost and vermicompost and the potential uses of vermicompost (Vuković, A. et al, 2021)

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high absorption capacity, good loosening potential, low protein and/or nitrogen content (high carbon–to–nitrogen ratio).

Some materials are even suitable on their own to make good beds, while others lack one or more of the above features and need to be used in different combinations. Table 1 lists some of the most commonly used beds and provides some data on the absorbency of each material, the potential for tarnishing and carbon–to–nitrogen (C:N) ratios.

Table 1. Commonly used materials for the production of vermicompost

Material	Absorption	Potential for slackening	C:N ratio
Cattle droppings	medium–good	good	22–56
Peat moss	good	medium	58
Corn silage	medium–good	medium	38–43
Hay – in general	low	medium	15–32
Paper from the municipal waste stream	medium–good	medium	127–178
Newspapers	good	medium–good	170
Bark – hard essence	low	good	116–436
Bark – soft essence	low	good	131–1285
Corrugated cardboard	good	medium	563
Shredded cattail waste	low	good	170
Waste paper fibres	medium–good	medium	250
Ground waste paper	good	medium	54
Sawdust	low–medium	low–medium	142–750
Splinters from clearing shrubs	good	low	53
Hardwood chips	low	low	451–819
Softwood chips	low	low	212–1313
Leaves (dried, loose)	low–medium	low–medium	40–80
Corn stalks	low	good	60–73
Corncobs	low–medium	good	56–123

The first two materials in Table 1 – horse manure and peat moss – were tested in a separate experiment as part of a pilot project funded by AcțiunEco in 2003–2004. Both materials performed well, with horse manure taking the lead. Since horse manure was freely available and is a renewable resource, it was used as a balance in the study. If available, it is generally considered to be an ideal bedding. High C:N ratio (for dung), good loosening characteristics (due to high straw content) and relatively good moisture retention make it an excellent medium for E. fetida. It can be improved somewhat by adding a material with high absorbency, such as peat moss or shredded paper (or cardboard), (which will increase absorbency and also increase the C:N ratio a little – another plus).

4. CONCLUSIONS

In conclusion, vermicompost is a valuable source of organic fertiliser that can help improve soil health and increase plant production in a sustainable way. It is produced by decomposing food scraps and other organic waste with the help of compost worms, which transform organic material into a nutrient–rich fertiliser. Vermicompost also contains beneficial bacteria and fungi, which help to increase soil health and protect plants from diseases and pests. By using vermicompost, reliance on synthetic chemical fertilisers, which can be harmful to the environment and human health, can be reduced. The use of vermicompost can be a viable and affordable option for local farmers and gardeners who want to promote sustainable farming practices and protect the environment.

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