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VERMI-COMPOSTING: AT A GLANCE

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Abstract: *Such huge amounts of organic wastes also create a problem for safe disposal. Most of these organic residues are just used for burning or land filling. In nature there several organisms (micro and macro) that have the capability to transform organic waste into valuable resources containing plant nutrients and organic matter, which are important for maintaining soil productivity. Microorganisms and earthworms play vital role by helping nature to maintain nutrient flows from one system to another and also reduce environmental degradation.*

Microorganisms and earthworms play vital role by helping nature to maintain nutrient flows from one system to another and also reduce environmental degradation. The earthworm population is about 8-10 times more in uncultivated land than compare to the cultivated one. This clearly indicates that earthworm population shrinkages with soil degradation and that can be used as a sensitive soil degradation indicator. Vermicomposting, which could provide a real solution to tackle the problem of safe disposal of waste as well as the necessary plant nutrients for sustainable productivity. Vermicomposting can be describe as a simple biotechnological process of composting, in which some species of earthworms are used to boost the process of waste transformation and produce a improved end product. Vermicomposting differs from composting in several ways.

Keywords: *Organic wastes, nutrient, microorganisms, earthworms and Vermicompost.*

Introduction: In present day environmental degradation is a major threat challenging the world and the extensive use of chemical fertilizers contributes mainly to the deterioration of the environment by depleting of fossil fuels, production of carbon dioxide (CO_2) and contamination of water resources. It leads to huge loss of soil fertility because of imbalanced use of fertilizers that has harmfully impacting agricultural productivity and causing soil degradation. There is a rising realization that the taking on of ecological and sustainable farming practices can only back the declining trend in the global productivity and environment protection [1,2]. Tropical soils are deficient in many necessary plant nutrients and hugeamounts of such nutrients found in domestic wastes and agricultural byproducts are wasted. Cities and rural areas of India produce nearly 700 million tons organic waste annually which is either burned or land filled [3]. Such huge amounts of organic wastes also create a problem for safe disposal. Most of these organic residues are just used for burning or land filling. In nature there several organisms (micro and macro) that have the capability to transform organic waste into valuable resources containing plant nutrients and organic matter, which are important for maintaining soil productivity. Microorganisms and earthworms play vital role by helping nature to maintain nutrient flows from one system to another and also reduce environmental degradation. The earthworm population is about 8-10 times more in uncultivated land than compare to the cultivated one. This clearly indicates that earthworm population shrinkages with soil degradation and that can be used as a sensitive soil degradation indicator. Vermicomposting, which could provide a real solution to tackle the problem of safe disposal of waste as well as the necessary plant nutrients for sustainable productivity [4].

Vermicomposting can be describe as a simple biotechnological process of composting,

in which some species of earthworms are used to boost the process of waste transformation and produce a improved end product. Vermicomposting differs from composting in several ways [5]. It is a mesophilic process, using microorganisms and earthworms that are active at 10-32°C. This process is quicker than composting, since the material passes through the earthworm gut, the resulting earthworm casts are rich in microbial activity and plant growth regulators, and fortified with pest repellence characteristics. In short, vermicomposting, which is a type of biological process which has capability to transform garbage into 'gold' [6].

Advantages of Vermicomposting: Vermicomposting has several advantages over traditional composting. Some important advantages are as follows.

Vermicompost: After digesting organic matter by earthworms excrete waste product called castings which is rich in nutrients. As food passes through their digestive tract, worms secrete chemicals, which break down organic matter into sustainable plant nutrients. These chemicals and organic matter, excreted with their castings, which improves soil texture, structure and aeration. From the Latin word "vermi," which means this product provides nutrients that are instantly available to plants. It can be applied several ways, such as for mulching, incorporated into potting mixes or add in water as a liquid fertilizer.

Enriching Soil: Earthworms leave soil 5-10% richer in the essential plant nutrients of nitrogen, phosphorus and potassium than before consuming it. As an organic fertilizer it can be used like a substitute for synthetic fertilizer. Vermicompost is superior over traditional compost for its capability to improve soil physical, chemical and biological properties. Vermicompost is a colloid, which has capacity to holds up to nine times its own weight in water. This helps to provide water even in dry spell.

Better Plant Growth and Yields: One of the important aspect of compost formed by earthworms is that it is totally organic. Harmful chemicals are absent and there is no need to mix it with anything. Vermicompost has special value in organic farming communities. It also enhances plant growth and better crop yields, accepted by many researchers. Application of vermicompost results improve air-water relationship in soil, that accelerate plant growth [7]. Even vermin liquid fertilizers can also increase crop growth up to 50%. It helps to reduce deficiencies caused by various micronutrients. Unlike chemical fertilizers, it is not easily get leached out from soil, due to presence of worm mucus. This also helps to supply nutrients for long duration. Increase microbial population in soil, which makes soil more alive. It encourages producing of healthy plants with quality products and maintaining a sustainable nutrient cycle. It also contains plant hormones which quicken seed germination and better root development.

Suppressing Disease: Disease like damping off, which is an infectious seedborne plant disease causing by pathogens like as Pythium, Phytophthora and Rhizoctonia species. Seeds rotting occur before germination or young seedlings prematurely wilt in infected land. Synthetic chemicals are used conventionally to pretreat seeds. Successful Pythium damping off suppression in some vegetablescan be done by applying vermicompost on the surface of synthetically pretreated seeds. Vermicompost which are heat-sterilized has no efficiency to control disease.

Disadvantages of Vermicomposting: Vermicomposting has also some disadvantages, such as-

Time Taking: It can take 5 to 6 months for earthworms to consume the applied organic matter and formed into a desirable manure, while in traditional composting can produce organic matter into compost in just three months. In case of active farm, this may betoo long to wait.

Problematic Odor: Vermicompost tank has an earthy odor and this can be a major factor in some cases, which leads turn off composting or reduce its production. Sometimes, insufficient ventilation for the worms, excess feeding of the worms and even using wet foods can produce problematic smells.

High Maintenance: Traditional compost processes needs relatively low maintenance compare to vermicomposting. Regularly providing food for worms and constantly monitor moisture level requires additional labor.

Problems of Pest-pathogen: Traditional compost heaps heat up during the decomposition process, which kills pathogens, weed seeds and other pest. In case of vermicomposting, it must cool enough to support earthworm life. So, vermicompost may still place for pest and pathogens. Moreover, vermicompost bins can accelerate the growth of bugs and pests that are remain in the initial soil and organic matter, for example fruit flies, centipedes and flies

Time of Harvesting: Harvesting of manure from vermicompost system requires careful measures to separate the worms and collect the soil amendment. This is a time consuming process, based on vermicompost bin size and worm population present in manure. On the other hand, traditional compost heap can be used directly by simply taking out the required amount of soil amendments with little need of separation or filtering the product.

Basic Guidelines for Vermicomposting: Starting up a vermicomposting is apretty good idea as there are many benefits and the process is quite simple. *Available space: The size composting bin should be based on available space. In case of indoor space it has to be well ventilated, while in case of outdoor space it should be protected against direct sun and frost. Since regular feeding and watering required for the process, there should be enough space for roaming around and systematic monitoring.*

Required Size: Before starting worm farming calculating the size of the bin, for regular and active production based on input supply and demand. For organic waste of12 kg in weight per week, a bin with a surface area of 2.25 square meters required. The bin only needs to be about 30 cm deep and has enough space for occasional addition of inputs, since there is always a chance of getting more wastes from several sources. Length of bin can be increase with same width depend on organic matter available.

Preparation of Pitor Tank: Pit can be developed by using concrete walls with 1m deep and 1.5m wide, while in case of above ground tank or bin 1.5m width and 0.9m height with required length. Now a days polythene sheets also can be used as low cost equipment. Bottom and walls should pore less to avoid leaching loss and worm migration in soil.

Amounts of Worms Required: For each cubic foot of worm space there is a need of 0.2 kg earthworms. Different earthworm species has different consuming capacity of organic matter. Two most popular species are Eiseniafetida and Eudriluseugenae, they live in the upper layer of soil surface. Size and type of species should taking care while adding the amount of earthworm in bin or pit.

Maintenance and Harvesting: Even though worms can tolerate temperature ranging from 0ºC to 40ºC, but the ideal range is 25-30ºC for multiplication. Regular watering required for maintaining a moisture level of 40-45%.The ratio of organic matter and animal dung slurry should be 5:1 for preparation of quality vermi manure. Place layers of dung slurry and organic matter alternatively from the bottom to the top. Cover the surface with jute bags, to protect worms from birds and to regulate moisture and temperature. A hole can be made on bottom to take out excess water from tank, which is also known as vermiwash, can be used as pest repellent and also has anti-bacterial properties. Proper shedding required to avoid direct sunlight on the surface. Generally, it takes 4-5 months or even sometimes 6 months to ready the vermicompost. Stop watering for one week and let the surface layer to get dry and to move worms into lower layer. Gently take out upper 15 cm layer of vermi manure, separate the worms from it followed by drying, sieving and packing of final product.

Application of Vermicompost: It can be used for all types of crops including agricultural, horticultural, plantation, ornamental and vegetables at any stage of the crop. In case of field crops required amount around 2-3 t ha^{-1}vermicompost can be apply by mixing with seed during sowing time or by direct application when the seedlings are 15 cm in height. In case of fruit trees amount of vermicompost needed 4-5 kg $tree^{-1}$ depending on the age of the plant. For better application, a ring of 15-18 cm deep can be made around the plant, where vermicompost placed and cover up with soil. Vermicompost at 1 t ha^{-1} applied in the vegetable nursery bed seedlings, results healthy seedlings. It can be apply at the rate of 0.5kg $plant^{-1}$at the time of transplanting. In flower plants vermicompost can be used at 0.5-1 kg ha^{-1}. Irrigation after vermicompost application gives better result.

Conclusion: The worm castings contain higher percentage of both macro and micronutrients than the garden compost. Apart from other nutrients, a fine worm cast is rich in NPK which are in readily available form and are released within a month of application. Vermicompost enhances plant growth, suppresses disease in plants, increases porosity and microbial activity in soil, and improves water retention and aeration.

Vermicompost also benefits the environment by reducing the need for chemical fertilizers and decreasing the amount of waste going to landfills. Vermicompost production is trending up worldwide and it is finding increasing use especially in Western countries, Asia-Pacific and Southeast Asia.

References

1. Wani, S. P. and Lee, K. K.(1992). Biofertilizers role in upland crops production. Pages 91-112 *in* Fertilizers, organic manures, recyclable wastes and biofertilisers (Tandon HLS, ed.). New Delhi, India: Fertilizer Development and Consultation Organisation.
2. Wani, S. P., Rupela, O. P. and Lee, K. K. (1995). Sustainable agriculture in the semi-arid tropics through biological nitrogen fixation in grain legumes. *Plant and Soil*, 174:29-49.
3. Bhiday, M. R. (1994). Earthworms in agriculture. *Indian Farming*, 43(12):31-34.
4. Wani, S. P. (2002). Improving the livelihoods: New partnerships for win-win solutions for natural resource management. Paper submitted in the 2nd International Agronomy Congress held at New Delhi, India during 26-30 November 2002.
5. Gandhi, M., Sangwan, V., Kapoor, K. K. and Dilbaghi, N. (1997). Composting of household wastes with and without earthworms. *Environment and Ecology*, 15(2): 432-434.
6. Vermi, Co. (2001). Vermicomposting technology for waste management and agriculture: an executive summary. (http://www.vermico.com /summary.htm) PO Box 2334, Grants Pass, OR 97528, USA: Vermi Co.
7. Marinari, S., Masciandaro, G., Ceccanti, B. and Grego, S. (2000). Influence of organic and mineral fertilisers on soil biological and physical properties. *Bioresource Technology,* 72(1): 9-17.