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Importance of Vermicompost in Crop Production and Soil Health Improvement

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Vermicomposting is the process of making compost by feeding earthworms material from the soil and allowing them to release it once they have digested it. This type of compost is known as vermicompost. Humic acids found in earthworm guts help in the transformation of soil biomass into nutrient-rich essential elements. Vermicomposting is an aerobic, biological method and is proficient to convert eco-friendly organic substances. Vermicompost stimulates to influence the microbial activity of soil, increases the availability of oxygen, maintains soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of the plant. Several research findings have established the beneficial effect of vermicompost on soil health through improvement in the physical, chemical, and biological properties and subsequently better crop growth and yield. The present work highlights the beneficial role of vermicompost and the preparation and utilization of vermicompost with special emphasis on how vermicompost can address the emerging soil health problems for sustainability in soil health and the ecosystem.

Key words: Vermicompost, Earthworm, Soil Health

Introducation

Vermicompost is rich organic manure consists of macro and micronutrients, plant growth promoting substances, beneficial micro-organisms that are necessary for plant growth.Vermicomposting is nourishing organic fertilizer having high amount of humus, nitrogen 1–3%, phosphorous 1.55–2.25%, potassium 1.85–2.25%, traces in micronutrients, more beneficial soil microbes like 'nitrogen fixing bacteria' and mycorrhizal fungi. Microbial population of nitrogen-fixing bacteria and Actinomycetes increases by the application of vermicompost. The amplified microbial activities improve the availability of soil phosphorous and nitrogen. Vermicomposting is an aerobic, biological method and is proficient to convert eco-friendly organic substances. Vermicompost stimulates to influence the microbial activity of soil, increases the availability of oxygen, maintains soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of the plant. At subsequent stages vermicompost ensures the proper supply of macro-and micro-nutrients, vitamins and plant growth promoting hormones which have positive effect on plant growth and development. The use of vermicompost would have facilitated better aeration, adequate drainage, improved soil biological activities and created a favourable soil environment for deeper proliferation of roots and higher nutrient extraction from soil, caused more vigorous plant growth. The increased plant height and branches might be due to the involvement of nutrients in cell wall development and cell differentiation which

resulted in elongation of shoot and root in plants. The application of vermicompost there was increase in the availability of phosphorus to plant and because of this, the content of phosphorus in plant also increased. Increment in phosphorus content in plant is also expected due to better buffering capacity of vermicompost for incipient moisture stress and improving phosphorus availability to plant. The combined application of chemical fertilizers along with enough bulk of vermicompost has always stimulated the uptake of nutrients and partly might be because of stimulated microbes flush and improved root growth due to congenial soil physical condition. The increased nitrogen content and uptake might be due to increased supply of all essential nutrients directly through organic and inorganic sources to crop or indirectly through checking the losses of nutrient from soil solution thereby increase the nutrient use efficiency. Soil health being an attribute of physical, chemical and biological properties of soil is constantly declining and is often cited as one of the reasons for deteriorating or decreasing crop yields and low input use efficiency. For sustainable crop production, it is essential for all concerned to understand the soil environment in which plants grow in totality, to recognize the limitations of that environment and to ameliorate wherever possible without damaging the soil quality..

Composition of Vermicompost

S.No	NUTRIENT	CONTENT
1	Organic Carbon (C)	9.18 to 17.98 %
2	Total Nitrogen (N)	1.5 to 2.10 %
3	Total Phosphorus (P)	1.0 to 1.50 %
4	Total Potassium (K)	0.60 %
5	Calcium (Ca) & Magnesium (Mg)	22.00 to 70.00 m.e / 100 g
6	Available Sulphur (S)	128 to 548 ppm
7	Copper (Cu)	100 ppm
8	Iron (Fe)	1800 ppm
9	Zinc (Zn)	50 ppm

Importance of Vermicompost in Crop Production

- The vermicompost is a rich source of nitrogen, calcium, phosphorus, and magnesium as well as a source of important micronutrients for plant growth.
- The use of vermicompost would have facilitated better aeration, adequate drainage, improved soil biological activities and created a favourable soil environment for deeper proliferation of roots and higher nutrient extraction from soil, caused more vigorous plant growth.
- Vermicompost contain sufficient amount of vitamins, amino acids, antibiotics, enzymes and hormones that are helpful in growth and development of plants.
- Vermicompost provide complete nutrition to plants and create resistance in plants against insect–pest and diseases.
- Vermicompost increase water holding capacity of the soil and save irrigation. Further, it also reduces the expenditure on costly chemical fertilizer inputs thus, reducing overall cost of cultivation.
- The higher grain yield achieved through vermicompost which increased availability of more nutrients through continuous slow release and improved the growth parameters and yield of crop.
- Vermicompost use in crop result in maximum growth parameters and consequently yield attributes as a result of higher rate of photosynthesis which is always associated with higher productivity.

- Application of vermicompost with inorganic fertilizer judiciously increased the nitrogen supply which resulted in the increased conversion of carbohydrates in to proteins which in turn are elaborated in to protoplasm.
- The positive impact of availability of individual plant nutrients and humic substances from vermicompost and balanced supplement of nitrogen through inorganic fertilizers might have induced cell division, expansion of cell wall, meristematic activity, photosynthetic efficiency and regulation of water intake into the cells, resulting in the enhancement of yield attributes.
- Microorganisms present in the worm casts might fix atmospheric N in such quantities that are significant for the earthworm metabolism and as a source of nitrogen for plant growth.

Importance of Vermicompost in Soil Health Improvement

- Vermicompost is a good quality manure that contain several essential nutrients needed by the crops such as nitrogen, phosphorus, potassium, calcium, magnesium and micronutrients viz. iron, zinc, copper, manganese in sufficient quantity that increase the productivity and quality of crops.
- Application of vermicompost in soil improves physical, chemical and biological properties of the soil. It improves soil structure due to which soil become porous and permeable to soil and water.
- Soil rich in vermicompost acts as a warehouse of organic carbon and most of the available plant nutrients and as a source of energy for microorganisms.
- Vermicompost help to increase biological activity of soil microbes and improve soil structure, water holding capacity and other physico-chemical properties of soil.
- Vermicompost improved the soil available N, P, K, and micronutrient and numerically change in soil pH, electrical conductivity and organic carbon content in soil.
- Earthworms' casting contains a high percentage of humus. Humus helps in aggregation of soil particles resulting into better porosity, which in turn improve aeration and water holding capacity of the soils. Moreover, humic acid present in humus provides binding sites for the several plant nutrients viz. calcium, iron, potassium, sulphur and phosphorus.
- The increase in the available N, P, K and micronutrient content of soil might be due to release of those nutrients added through vermicompost with inorganic fertilizers to the soil after mineralization.
- Application of vermicompost promotes greater microbial biomass and diversity in the soil.
- The application of vermicompost increased the population of soil microbes such as Azotobacter chroococcum, Azotobacter vinelandii, Bacillus stearothermophilus, Bacillus megaterium, Pseudomonas putida, and Bacillus subtilis.
- Vermicompost has the ability to bioaccumulate toxic compounds to decrease soil pollution. Earthworms can bioaccumulate heavy metals such as cadmium (Cd), mercury (Hg), lead (Pb), copper (Cu), manganese (Mn), calcium (Ca), iron (Fe), and zinc (Zn) in tissues without affecting their physiology.

Conclusion

The resulting vermicomposting has been shown to have several positive impacts on plant growth and soil health. Vermicompost application in soil not only improves structure and aggregation but, also enhance organic matter level, nutrient status, cation exchange capacity, microbial activities, microbial biomass carbon and enzymetic activities. Thereby, help in promoting plant growth and sustain soil health. At subsequent stages vermicompost ensures the proper supply of macro-and micro-nutrients, vitamins and plant growth promoting hormones which have positive effect on plant growth and development. The use of

vermicompost would have facilitated better aeration, adequate drainage, improved soil biological activities and created a favourable soil environment for deeper proliferation of roots and higher nutrient extraction from soil, caused more vigorous plant growth. The increased plant height and branches might be due to the involvement of nutrients in cell wall development and cell differentiation which resulted in elongation of shoot and root in plants. Vermicomposting can be a potential technology for recycling available organic wastes as a source of quality organic manures to maintain good soil heath.