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Value Added Vermicompost for Better Farm Profits

Kirti Sharma[1], Anil Kanaujia[2], Mohan Ji Saxena[3], Anup Kalra[4]

R&D Executive, Ayurvet Research Foundation, kirti.sharma@arfmail.in
[2] General Manager-R&D, Ayurvet Research Foundation, ank@arfmail.in
[3]Managing Trustee, Ayurvet Research Foundation, mjsaxena@arfmail.in
[4]Director of Corporate Affairs, Ayurvet Limited, akalra@ayurvet.com

Abstract

Vermicomposting is an eco-friendly, efficient & rapid technique to waste management as it utilizes tons of waste to produce nutrient rich organic fertilizer (vermicompost). Vermicompost is rich in NPK, calcium (Ca), magnesium (Mg), zinc (Zn) and manganese (Mn), humic acid, organic carbon, beneficial microbes etc. which helps in soil remediation, maintain plant growth and yield, disease and pest control, etc., but it is not efficient enough to provide plants with the necessary quantity of macro and micronutrients precisely as per the crop's need. With every passing year, the soil fertility status evaluation in the country puts forward new cases of nutrient deficiency, especially the micronutrients, owing to their very narrow range of deficiency and toxicity. As a result, there is an opportunity to improve the nutrient contents of vermicompost to ensure that they are delivered to crops quickly and effectively.

Keywords*:* "Vermicomposting; Value addition, Farm profits, Organic waste, Enrichment".

1. Introduction

Over the last few decades numerous human activities have led to an increased accumulation of waste materials due to industrialization and urbanization. According to the literature, about 2.01 billion metric tons of solid waste is produced annually, and it is estimated that this number will increase to 3.40 billion metric tons by 2050. Thus, there has been an increasing interest to find an eco-friendly, rapid and financially favorable technique for efficient waste management that is an entry point to sustainable development [**1**].

Although many strategies have been proposed and implemented for proper solid waste management, including source reduction, curbside recycling, material recovery, waste to energy, landfill dumping, incineration, and composting, etc. Vermicomposting can act as a viable biotechnological technology for the same.

Vermicomposting (**Fig.1**) is waste management technology that involves decomposition of organic fraction of solid waste in an eco-friendly way to a level in which it can be easily stored, handled, and applied to agricultural fields without any adverse effects. Simply, organic waste is converted into nutrient-rich product known as vermicompost. It is rich in NPK, calcium (Ca), magnesium (Mg),

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zinc (Zn) and manganese (Mn), humic acid, acceptable C:N ratio, etc. Vermicomposting is a joint action of microorganisms and earthworms in environment-controlled conditions. The microbes present in the system are responsible for biochemical degradation of organic matter, whereas earthworms play their role in conditioning of substrate, altering of biological activity and interact with other organisms in the soil and can affect various micro flora and micro fauna communities.

Figure 1: Process of Vermicomposting [2]

Excessive use of inorganic fertilizers without organic supplements not only deteriorates the physical and chemical properties of soil but also pollutes the surrounding environment. It can cause excessive leaching of nutrients and salinity-induced plant stress. Vermicompost has several benefits: soil remediation, maintain plant growth and yield, disease and pest control, etc. It is important for agriculture and horticulture purposes because it is used as fertilizing material as it enhances soil fertility physically, chemically and biologically**.** Physically, vermicompost-treated soil has better aeration, porosity, bulk density and water retention. Chemical properties such as pH, electrical conductivity and organic matter content are also improved for better crop yield and biologically it increases the size, biodiversity and activity of the microbial population in soil. Although vermicompost have been shown to improve plant growth, the application at high concentrations of vermicompost could lead to slower plant growth, implying that vermicompost should be applied at appropriate concentrations in order to obtain maximum plant yield.

Different studies have proposed that application of vermicompost is not efficient enough to provide plants with the necessary quantity of macro and micronutrients precisely as per the crop's need. With every passing year, the soil fertility status evaluation in the country puts forward new cases of

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nutrient deficiency, especially the micronutrients, owing to their very narrow range of deficiency and toxicity. As a result, there is an opportunity to improve the nutrient contents of vermicompost to ensure that they are delivered to crops quickly and effectively. Enriching the vermicompost with inorganic minerals to avail the nutrients to the plants can be an option [**2, 3, 4, 5, 6**].

Macro/micro nutrient enrichment in vermicompost:

Process for preparation of vermicompost: Fill the pit (8' x 2' x 2' ,L x W x B) with pre cooled cow dung (500 Kg) and 5 Kg neem leaf, sprinkle water 2 times a day, turnover dung every day, 400 g of earthworms after 10 days. Sprinkling of water and turning of in process material is continued for 45 days, sieve the material to get final vermicompost (200 Kg). Thus produced compost is used for further enrichment with macro/micro nutrient.

Following processes may be adopted for desired enrichment:

1. **Zinc & Iron enriched vermicompost**:

Add 5 Kg each of $ZnSO_4$ & $FeSO_4$, 0.05 L zinc mobilizing & zinc solubilizing bacterial solution to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like maize, wheat, paddy, barley, etc.

2. **Boron enriched vermicompost:**

Add 0.5 Kg granular boron (disodium tetra borate pentahydrate) to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of vegetables like potato, tomato, bitter gourd, broccoli, cauliflower, brinjal, radish, pumpkin, etc.

3. **Phosphorous Sulphur Nitrogen (PSN) enriched vermicompost:**

Add 2 Kg of rock phosphate, 5 Kg pyrite, 0.2 Kg urea and 0.05 L phosphate solubilizing bacterial solution to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like wheat, paddy, vegetables, edible oils, maize, soyabean etc.

4. **Nitrogen Phosphorous Potassium (NPK) enriched vermicompost:**

Add 10 Kg of rock phosphate, 10 Kg waste mica and each of 0.05 L nitrogen fixing, phosphate solubilizing & potassium mobilizing bacterial solution, 0.1 Kg Trichoderma viridae to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like cereals, vegetables, edible oils, etc.

5. **Zinc enriched vermicompost:**

Add 10 Kg $ZnSO_4$, 0.05 L zinc mobilizing/solubilizing bacterial solution to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like wheat, paddy, chickpea, soyabean, brinjal, etc.

6. **Dolomite enriched vermicompost:**

Add 10 Kg dolomite, 0.1 Kg Trichoderma viridae and each of 0.05 L nitrogen fixing, phosphate solubilizing, potassium mobilizing & potassium solubilizing bacterial solution to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like wheat, paddy, vegetables, etc.

7. **Mica enriched vermicompost:**

Add 15 Kg of rock phosphate, 15 Kg waste mica and 0.1 Kg Trichoderma viridae, 0.05 L nitrogen fixing bacterial solution to 90 Kg vermicompost and mix thoroughly. This compost may be utilized for the better productivity of crops like sugarcane, potato, etc.

Development of enriched compost could be an alternative and cost effective option to prepare a value added organic fertilizer and to utilize agricultural waste and low-grade materials such as rock

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phosphate and waste mica along with bioinoculant in place of costly chemical fertilizers for crop production and maintaining soil health [**7**]. Recommended dose of fertilizer applied on any crop play an important role. Implement the 4R: right time, right source, right place and right rate (**Fig. 2**) [**8**].

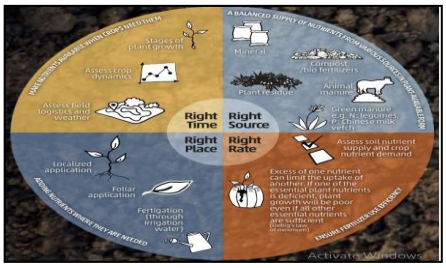

Figure 2: 4 R Rule for soil nutrients [8]

This can be decided on the basis of soil testing results. Soil analysis helps farmers to check the soil heath of their fields. A soil health card provides information on the nutrient status of soil, along with recommendations on the dosage of nutrients to be utilized for improving its fertility and health [**9, 10**].

Ayurvet Research Foundation (ARF) a public charitable trust undertakes various initiatives for the sustainable integration of livestock and agriculture for the benefit of farmers and society at large. In the year 2020, Govt. of Haryana sanctioned Soil Health Card project to ARF to carry out fertility status study of 3000 acres of land of village Baroda Mor, block Mundlana, tehsil Gohana, Sonipat, Haryana and distribute the cards well before the harvesting of Rabi crop in year 2021. Team ARF systematically carried out the registration of farmers, collection of 3000 soil samples, analysis for 12 parameters namely N, P, K (Macronutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, B (Micro - nutrients); and pH, EC, OC (Physical parameters) using Pusa STFR Meter, User instruction manual., fertilizer recommendation and distribution of cards [**11**].

It is highly recommended that soil health index (of selected area for sowing) should be known prior to using fortified compost for enrichment of appropriate specific nutrients. This will help to provide required dose of specific nutrient/s according to the soil & plant needs because excess of one nutrient can limit the uptake of another. If one of the essential plant nutrients is deficient, plant growth will be poor even if all other essential nutrients are sufficient [**8**].

4. Conclusion

Enriching the vermicompost with different type of raw materials like rock phosphate, waste mica, $FeSO_4$, $ZnSO_4$, sulphur, microbial inoculants etc. may prove to be an efficient source to provide plants with the necessary quantity of macro and micronutrients for crop cultivation. Different types of crop need different nutrients in appropriate dose but what if soil has enough of it. Hence, soil

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References

1. Vuković, A., Velki, M., Ečimović, S., Vuković, R., Štolfa Čamagajevac, I., & Lončarić, Z. (2021). Vermicomposting—Facts, benefits and knowledge gaps. *Agronomy*, *11*(10), 1952.
2. Ali, U., Sajid, N., Khalid, A., Riaz, L., Rabbani, M. M., Syed, J. H., & Malik, R. N. (2015). A review on vermicomposting of organic wastes. *Environmental Progress & Sustainable Energy*, *34*(4), 1050-1062.
3. Lim, S. L., Wu, T. Y., Lim, P. N., & Shak, K. P. (2015). The use of vermicompost in organic farming: overview, effects on soil and economics. *Journal of the science of food and agriculture*, *95*(6), 1143–1156.
4. Sengupta, S., Mukherjee, S., Halder, S., Bhattacharya, P., Enrichment of vermicompost for improving soil quality and ensuring Zn and Fe bioavailability through rice grain. J Pharmacogn Phytochem 2020;9(1):246-254.
5. Das, D., Abbhishek, K., Banik, P., Swain, D.K., Comparative evaluation of changes in soil bio-chemical properties after application of traditional and enriched vermicompost, Environmental Technology & Innovation, Volume 28, 2022.
6. Anil Kanaujia et al, International Journal of Advances in Agricultural Science and Technology, Vol.8 Issue.1, January-2021, pg. 45-51.
7. Biswas, D.R. Nutrient recycling potential of rock phosphate and waste mica enriched compost on crop productivity and changes in soil fertility under potato–soybean cropping sequence in an Inceptisol of Indo-Gangetic Plains of India. *Nutr Cycl Agroecosyst* 89, 15–30 (2011).
8. https://www.fao.org/3/cc5069en/cc5069en.pdf
9. https://agriinfo.in/preparation-of-soil-test-results-and-fertilizer-recommendation-1807/
10. https://www.drishtiias.com/to-the-points/paper3/to-the-point-paper-3-soil-health-card-scheme
11. Anil Kanaujia et al, International Journal of Advances in Agricultural Science and Technology, Vol.8 Issue.6, June-2021, pg. 1-9.

A Brief Author Biography

Kirti Sharma – Skilled R&D Executive with M. Sc. Chemistry from Thapar Institute of Engineering & Technology (Patiala). Currently pursuing executive diploma in Food Quality Assurance & Quality Control from IGMPI (Delhi). Having 3 years of experience in quality control

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of animal feed, food, medicinal plants, compost, soil & water, executed research & development activities on 5 F- Fuel, Food, Fertilizer, Feed, Fodder, published 10 articles in peer reviewed international & national journals, magazines, etc., Expertise in chemical testing & documentation as per ISO 17025:2015, hands on experience in instrumentation like HPLC for active ingredient, column chromatography for isolation of marker compounds, UV Visible spectrophotometer, Flame photometer, etc.

Dr. Anil Kanaujia – Skilled Scientist with 27.6 years of experience in natural product chemistry and medicinal chemistry based new drug discovery research, process chemistry, research on food safety, isolation & characterization of molecules from medicinal plants using Flash chromatography , 1H, 13C and 2D NMR spectroscopic techniques; commercialization of standardized herbal extracts, standardization of polyherbal formulations, analytical research & method development and validation using HPLC-PDA, HPTLC, AAS, UV VIS spectrophotometer etc. instrument techniques. Credited with 14 patents (10 US, 1 Chinese, 3 Indian), published 51 research articles in peer reviewed international and national journals.

Sh. Mohan Ji Saxena – Managing Trustee of Ayurvet Research Foundation and former Managing Director of Ayurvet Limited with more than 40 years of experience in Animal health and nutrition. Contributed immensely in new product development, their standardization for safety and efficacy. Published more than 100 research articles in peer reviewed National and International journals.

Dr. Anup Kalra – Director of Ayurvet Limited with more than 30 years of rich experience in Animal health and nutrition. Contributed immensely in positioning livestock health care products in India and abroad. Published 50 research articles in peer reviewed National and International journals.