

Biotechnology at the Center of Climate-friendly Approaches to Agriculture and Waste Use

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Abstract: *The growing speed of agricultural wastes due to the large scale of urbanization and an outcome of economic development has become a trouble that produces the massive quantity of scrap and causes a serious environmental crisis which is not easy for management. Management of agricultural waste has grown to be one of the major Problems. Major components of agricultural solid wastes are biodegradable organics. Uncontrolled and improper handling can often lead to many situations where agricultural waste can become an environmental issue. Vermicomposting is the most excellent choice to deal with this problem. Vermicomposting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods and environment friendly to recycle agricultural wastes and to produce quality compost.*

Key Words: *Agriculture waste, Earthworm, Vermiwash, Organic Farming,*

1. INTRODUCTION:

Next to energy, conservative agriculture is one of the leading Green House Gas (GHG) provider and accounts for more than “33% of the country’s total GHG emissions” mainly caused by the application of chemical fertilizers and pesticides. By significantly dropping the amount of chemical inputs introduced in fields, each farmer can have a substantial involvement in reducing their carbon footprint, and in due course, their susceptibility to climate change.

After harvesting, large amount of agricultural waste are generated and left in the field for natural degradation which takes several months. Fresh organic waste materials cannot be applied to soil until they have been suitably iostabilized, because function of immature organic materials to soil may influence plant growth due to nitrogen malnourishment and Production of noxious metabolites These declined are also disposed of simply on firing in the field which results in loss of nutrients as well as causes atmospheric pollution due to the emission of toxic gases. In order to mitigate this problem, agricultural waste was predigested and utilized for the production of vermicompost by using earthworms. The need to recycle organic agricultural wastes is not just for environmental issues but also for economical and sustainable advantages. Reprocess of waste to Vermicompost provides a good option for small and marginal farmers to produce organic manure locally for use in their farms.

2. MATERIALS AND METHODS:

Agriculture Wastes and Eudrilus Eugeniae earthworm species were used for the waste degradation process. Chambers with dimension of 5cm length, 1.5m width and 1.5 m height were constructed for the preparation of compost. The chamber was covered by jute bags. One layer of Agriculture waste were spread over the ground in the chamber followed by soil and then the cow dung slurry equal to 20% weight of biomass was sprinkled. The mixtures were turned over manually everyday for 15 days in order to eliminate volatile substances that are toxic to the earthworms. After 15 days, 1 kg of Eudrilus Eugenia earthworms were introduced into Chambers. The moisture content was maintained at 60–76% throughout the study period by periodic sprinkling of adequate quantities of water. Stop watering before one week of harvest. Heap the compost .The material is sieved in 3 mm sieve, the material passed through the sieve is called as vermicompost which is stored in a polythene bags. Cocoons are collected after sieving. Recomposting is done in the same pit or bed. Similar to the above described. For draining of vermiwash a hole was provided which was connected to a tank with PVC pipes in order to use the vermiwash can be utilized as liquid manure. After twelfth weeks the samples were taken and were analyzed. This was studied in terms of various parameters such as pH, EC, moisture content, TOC, TKN and C: N ratio. The effects of vermicompost and vermiwash on various plants have been studied

3. VERMIWASH:

Vermiwash is a leach ate that is produced during the vermicomposting process and is dark brown in color. It is a collection of excretory and secretory products of earthworms, along with major micronutrients of the soil and soil organic molecules that are useful for plants. It is applied as foliar spray. This is transported to the leaf, shoots and

other parts of the plants in the natural ecosystem. It contains various enzymes cocktail of protease, amylase, urease and phosphatase. These are beneficial for growth and development of plant and stimulate the yield and productivity of crops and also microbial study of vermiwash found that nitrogen fixing bacteria like Azotobacter, Agrobacterium and Rhizobium and some phosphate solubilizing bacteria are also found in vermiwash.

4. BENEFITS OF VERMIWASH AN EFFECTIVE BIOPESTICIDE:

Vermiwash acts as a plant tonic and helps to reduce many plant diseases. A mixture of vermiwash (1litre) with cow urine (1litre) in 10 liters of water acts as biopesticide and liquid manure.

5. ANALYSIS & FINDINGS:

The pH and EC of samples were recorded by a digital pH meter and conductivity meter, respectively. These values were recorded continuously throughout the experimental period. Total N was estimated by the Kjeldahl method. Total organic carbon was measured by the method of Nelson and Sommer. Total potassium was determined after digesting the sample in diacidic mixture (HNO₃: HClO₄ = 4:1, v/v), by flame photometer (Elica, CL 22 D, Hyderabad, India). Total phosphorus was analyzed using the calorimeter method with molybdenum in sulphuric acid

Table 1. Physicochemical analysis of Agriculture waste based Vermicompost

S.No	Parameters	Initial value (%)	Vermicompost Values In Percentage (%)
1	PH	7.2	5.8
2	Electrical conductivity(EC)	3.50	3.01
3	Total Kjeldahl Nitrogen (TKN)	0.46	0.57
4	Total Phosphorus (TP)	0.04	0.29
5	Total Potassium (TK)	0.38	0.47
6	Total organic carbon (TOC)	22.3	9.8
7	Carbon Nitrogen Ratio (C:N)	51.6	21.23

6. RESULT:

Earthworms play an important role in maintaining soil fertility through vermicomposting. In the present study, The lowering of pH due to production of CO₂ which was an acidic gas and when it came in contact with water it might have formed carbonic acid, due to which pH had decreased. Generally there was an important decrease in EC, which is superlative for plant growth. With a low EC, the Organic fertilizers releases the mineral salts gradually, which is adequate for plant escalation. There was a noticeable reduction in the TOC and TOM in the final vermicompost prepared from waste using Eudrilus Eugenia and Eisenia foetida. It is due to the microbial respiration. The N content percentage increase might instigate from the addition of nitrogen through the earthworm itself in the form of mucus, nitrogenous excretory substance, growth stimulating hormones and enzymes. Phosphorus increased by the closing stages of the process owed to the mineralization of organic matter. Increase in K possibly due to the direct action of earthworm guts and indirectly by the simulation of micro flora. Moreover, the Increase in earthworm population might also be attributed to the C: N ratio decreasing with time. Decline of C: N ratio to less than 20 indicates an advanced degree of organic matter stabilization and reflects a satisfactory degree of maturity of organic waste.

7. APPLICATION OF VERMICOMPOST & VERMIWASH TO CROPS:

Vermicompost can be used for all crops such as agricultural, horticultural, ornamental, and vegetable etc.

Table 2. General rate of vermicompost application in different crops

crops	Rate
Field crops	3-5 t/ha
Vegetable crops	5-7 t/ha
Fruit crops	3-5 kg/tree
Flower crops	100 g/pot
Nursery bed and lawns	1-2 kg/m ²

But generally, vermicompost is recommended for high value vegetables and fruit crops. Application need to be done around root zone in the opened ring and covered by the soil.



Figure 1. Growth of Snake Gourd Plant



Figure 2. Escalation of Snake Gourd Plant

Since Organic agriculture invention systems are less prone to tremendous weather situation, water stress, and problems related to soil quality, it has been extensively acknowledged as one of the most feasible methods for climate change version. Through organic farming, the organic matter content on soils increases and therefore, provides higher holding capacities and resistive to drought.

Table 3. Benefits of Worm Castings

Healthy Plant Development	Calciferous glands of the earthworm excrete calcium carbonate in worm castings, essential for the development of strong cell walls and for the absorption of nitrogen.
Slow Release	Concentrated nutrient base that slow releases as and when required by the plant.
Moisture Retention	Holds up to 50% moisture, building resilience against drought and heavy rainfall as a result of climate change.
Optimal Growth	Contains auxins and cytokinins, growth hormones promoting fibrous roots and healthy plant development.
Disease Control	Contain beneficial fungus eating nematodes.
Pest Control	Contains high levels of chitinase, a natural insect repellent.

8. CONCLUSION:

Agricultural waste is no hesitation organic waste and is purely biodegradable. Hence it can be used for composting. Cow dung is easily accessible material in rural area. If it is added with the waste microbial activity increases and oxidation of organic matter takes place in faster rate and stabilized within shorter period. Also cow dung adds nutrient to the compost. Thus increases the quality of final compost. Vermicomposting is the best method in which agricultural waste can be recycled. Recycling is truly an eco friendly technology through which one can convert all organic waste into a product which is rich in nutrient content and can replace chemical fertilizer.

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