IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 9, September 2019
ISSN (Online) 2348 – 7968 | Impact Factor (2019) – 6.248
www.ijiset.com

Reclaiming of Horticultural waste by vermicomposting technology: Might Be Used as a Potential Bio-Humus for Organic farming

[1]Dr.G.Subbulakshmi, [2] Dr .R.Thiruneelakandan, [3] Patatri Pramanik
[1]Assistant professor, [2] professors, [3] UG graduates

[1 & 3] Chemistry, Jain University Bangalore- 560027, India

[2]Chemistry, BIT Campus, Anna University- University College of Engineering, Tiruchirappali-620024, India

Email – [1] lakshmisubbu499@gmail.com, [2]rtkchemaut@gmail.com, [3]patatrip@gmail.com

Abstract: Horticulture Productions in Bangalore has a unique demand in India. Horticultural waste refers to tree trunks and branches, plant parts and trimmings generated during the maintenance and pruning of trees and plants all over in district. Wastes recycling can bring tremendous benefits to agriculture and land management in long run. The use of earthworms in the degradation of various types of wastes is continuing from the past for so many years. Vermicomposting is a bio-conversion process which is widely being used for solid waste management. In this bio-conversion of horticulture waste process, earthworms feed on the organic waste to produce more cocoons, vermicomposts and vermiwash as product.The process can be completed by180 days using earthworms Eudrilus Eugenia. Vermicompost and vermiwash can be used for all crops as bio-fertilizers.Vermicomposting can be used for solid waste management and the production of bio-fertilizers.

Key words: Horticulture waste; Earthworm; Vermicompost; Vermiwash; Plant growth;

1. Introduction

In Bangalore Horticulture production is very high. This abundance of raw materials is causing major problems in the disposal of the waste. The practice of vermicompost is at least a century old but it is now being received worldwide attention with diverse ecological objectives such as waste management, soil detoxification, regeneration and sustainable agriculture. Vermicomposting is the bio-conversion of organic waste into solid and liquid biofertilizers through the earthworms gut which act as the bio-reactor (Manyuchi et al.2014).The non-burrowing earthworms eat 10% soil and 90% organic waste materials; these convert the organic waste into vermicomposts faster than the burrowing earthworms (Kamineni et al.2014). Vermicompost, a very potential organic input for agriculture, contains beneficial microorganisms, both major (N, P, K) and micronutrients, enzymes and hormones. Vermicomposting is a simple bio-technological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better product (Mistry, 2015). Selection of earthworm species is an important factor because only few species are able to survive and adjust to a particular type of environment .The exotic earthworm species namely Eisenia foetida and Eudrilus Eugenia are commonly used for breaking down the organic waste. Vermicompost contains enzymes like amylase, lipase, cellulase and chitinase, which continue to break down organic matter in the soil (to release the nutrients and make it available to the plant roots). The present study is therefore aimed at utilizing Horticultural wastes along with cow dung and soil for the preparation of vermicomposts using Eudrilus eugenia and Eisenia foetida earthworms and also to monitor the pH, Electrical Conductivity (EC), Total Organic Carbon (TOC), Total organic Matter (TOM), Total Kjeldahl Nitrogen (TKN), Carbon to nitrogen(C: N) ratio along with the bacterial population of the resultant composts.

2. Materials and Methods

2.1 Collection of Waste and Earthworm

A substantial amount of horticultural waste is generated from tree trucks and branches during the pruning process as part of periodic maintenance of trees and plants. Horticultural debris Collected from landscape maintenance contractors. The District does not collect waste that has been cut by private contractors. About 20 metric tons (MT) waste from horticulture generated in the District also ends up dumped unprocessed at the already overflowing landfill. The biomass decomposes gradually thereby steadily releasing nutrients to the soil. The earthworms Eudrilus Eugenia were collected from IIHR (Indian Institute of Horticulture and Research) vermiform in Bangalore.

2.2Experimental Procedure

The experiment was carried with Horticulture waste + cow dung + soil+ Earthworm (Eudrilus Eugenia -1 kg). The research were undertaken to study the role of and Eudrilus Eugenia respectively on the quality of vermicompost produced. 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. Vermicompost and vermiwash influence on plants such as marigold and mango Graft has been examined.

2.3 Vermicompost Technology

Horticulture Wastes and Eudrilus Eugenia 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 Horticulture 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 Eighth weeks the samples were taken and were analyzed 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.

2.4Vermicomposting Products

The process of vermicomposting produces earthworms as products by a process called vermiculture. Furthermore, Vermicompost which is also termed vermicasts is produced together with vermiwash. The Vermicompost and vermiwash can be utilized as bio-fertilizers.

2.5 Vermicompost (Bio- Humus or Organic Manure)

Vermicompost is an odorless, dark brown bio-fertilizer obtained from the process of vermicomposting. The Vermicompost obtained are also termed vermicasts as they are expelled as casts from the earthworm gut. Various types of organic waste have been reported to produce Vermicompost and a range of nitrogen (N), phosphorous (P) and potassium (K) content were obtained.

Table 1 Content of Bio-humus

BIO-HUMUS	Microorganism(Fungus & Bacteria)
	Organic Compounds
	Ferments
	Soil Antibiotics
	Vitamins
	Natural Plant growth and Development Hormones
	Large number of Humus Substances(Humic acid , Fulvic- acid, Humins)

2.6 Vermiwash

Vermiwash is a liquid that is collected after the passage of water through a column of worm action and is very useful as a foliar spray. It is a collection of excretory products and mucus secretion of earthworms along with micronutrients from the soil organic molecules. These are transported to the leaf, shoots and other parts of the plants in the natural ecosystem. Vermiwash, if collected properly, is a clear and transparent, pale yellow colored fluid. Vermiwash, a foliar spray, is a liquid fertilizer collected after the passage of water through a column of worm activation. 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 .Vermiwash seems to possess an inherent property of acting not only as a fertilizer but also as a mild biocide.

2.7Benefits 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.

3.0 Result and Discussion

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 2 Physicochemical analysis of Horticulture 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

Earthworms play an important role in maintaining soil fertility through vermicomposting. In the present study, The lowering of pH due to production of CO_2 which was an acidic gas and when it came in contact with water it might had 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 execratory substance, growth stimulating harmones 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.

3. Organic farming

Organic farming system is gaining increased attention for its emphasis on food quality and soil health. Vermicompost and vermiculture associated with other biological inputs have been actually used to grow vegetables and other crops successfully and have been found to be economical and productive. organic farming helps to provide many advantages such as; eliminate the use of chemicals in the form of fertilizers/pesticides, recycle and regenerate waste into wealth; improve soil, plant, animal and human health; and creating an ecofriendly, sustainable and economical bio-system models

3.1Basic concept of Organic Farming

The basic concepts at the back organic farming are:

- It concentrates on edifice up the biological fertility of the soil.
- Crops take the nutrients they need from the steady turnover within the soil nutrients produced in this way are released in harmony with the needs of the plants.
- Control of pests, diseases, and weeds is achieved largely by the use of bio-pesticides.
- Organic farmers reuse all wastes and manures within a farm.

4. APPLICATION OF VERMICOMPOST &VERMIWASH TO CROPS

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

Table 3 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/m2

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 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.

Figure2 Growth of Pumpkin using Vermicompost as a fertilizer

Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flower and fruit crops. Compared to inorganic fertilizer, organic manure is readily available to the farmers and the cost is also low. Various reports suggested that worm worked waste and their excretory products can induce excellent plant growth (Kaur et al, 2015).

4.1Growth of Jasmine Grafts

This Study reveals that the influence of vermicomposts prepared from Horticulture waste on the growth of Jasmine grafts. Substance resulting from composting usually has a more heterogeneous appearance .This organic fertilizer is therefore increasingly considered in horticulture as a promising alternative to chemical fertilizers in potting media. Therefore, the objective of this study is to assess the effect vermicompost the growth and production of Jasmine Plant.

Table 4 Preparation of potting mixture – Treatment details

Treatment	Different potting mixture
T1	Control (potting mixture containing sand, soil and chemical fertilizer in 1:1:1 ratio)
T2	Potting mixture containing sand, soil and vermicompost in 1:1:1 ratio
T3	Potting mixture containing sand, soil and vermicompost in 1:1:2 ratio
T4	Potting mixture containing sand, soil and vermicompost in 1:1:3 ratio

Figure 3 Growth of Jasmine Grafts using different ratio of vermicompost

It is a well known fact that organic fertilizers provide nutrients to the plants in adequate amount for optimum growth of plant and may increase the uptake of nutrients, assimilation capacity and the hormonal activity. As for plant growth, vermicompost helps to speed up the growth cycle right from germination leading to increased yield.

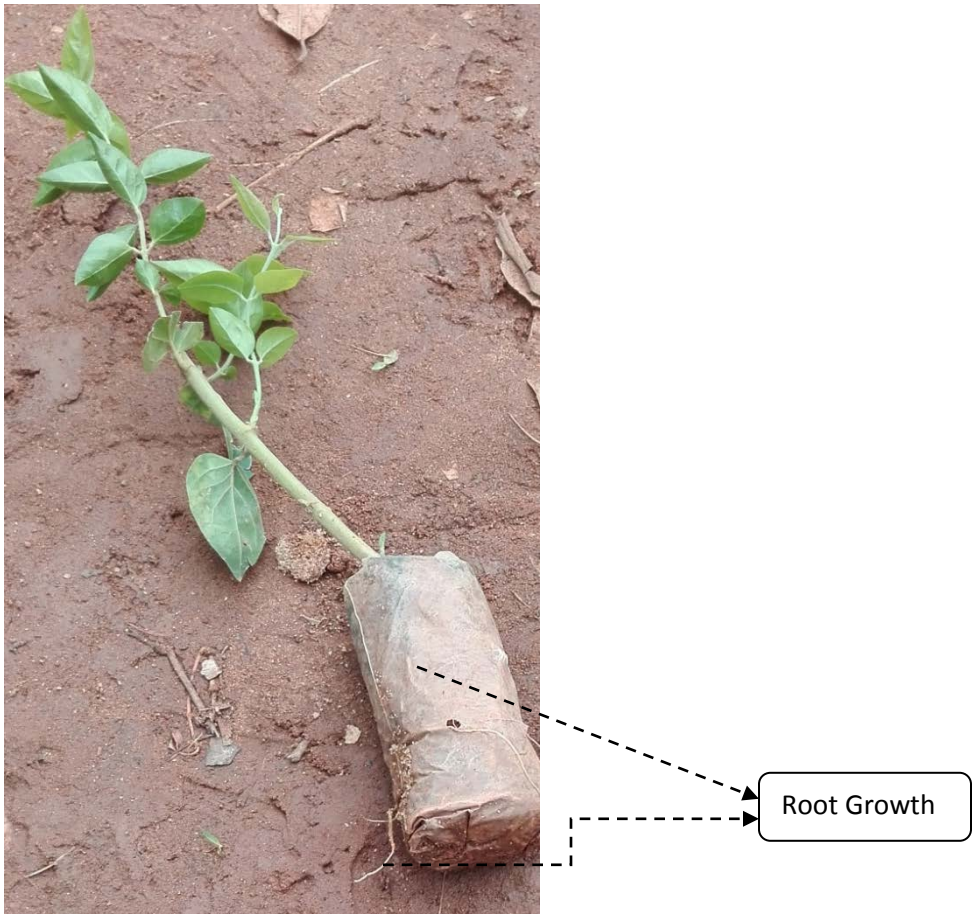

Figure 4 Growth of Jasmine Grafts Root penetration using Organic manure

Results showed that the addition of vermicompost, in appropriate quantities, to potting media has significantly positive effects on growth. It was concluded that addition of vermicompost, in appropriate quantities, to potting media has synergistic effects on growth of Jasmine grafts.

5.CONCLUSION

Vermiculture is the best way of disposing waste coming from Horticulture waste. Through this process no chemicals; no any reaction needed to convert these wastes into manure. On analysis of the data the following conclusions were made; the results from the Vermicompost analysis had revealed that the Horticulture waste can be converted into usable form with its nutrient release. The compost which is rich in microorganism enhances the plant growth hormones. This is an eco friendly and cost effective method. It is an ideal method for the management of solid waste. To conclude hold promise to play a significant role in protecting environment as it uses waste as raw material and in building up of soil fertility and improving soil health for sustainable agriculture.

References

[1]. Pratap Vyankatrao Naikwade., Response of fodder maize to the application of various organic manures prepared from Ipomoea muriatic.,Weed Journal of Organics.Vol.1 No.1, 2015, page 31-38.

[2]. Reshid Abafita Abawari., Evaluation of vermicompost on maize productivity and determine optimum rate for maize production.,World journal of Biology and Medical sciences. Vol. 3 No.1, 2016, page 9-22.

[3].Sonukumari.,Solid waste management by vermicomposting.,International Journal of Scientific & Engineering Research.Vol. 4, No. 2, 2013, page 1-5.

[4].Mistry., Vermicompost, a best superlative for organic farming: a review., Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences.vol. 2, No. 3, 2015, page 38-46.

[5].Ravimycin.,Effects of Vermicompost (VC) and Farmyard Manure (FYM) on the germination percentage growth biochemical and nutrient content of coriander (Coriandrum sativa L.).,International Journal of Advanced Research Applicable in Biological Sciences. vol. 3, No. 6, 2016, page 91-98.

[6].Amita Chattopadhyay., Effect of Vermiwash and Vermicompost on an Ornamental Flower, Zinnia sp., Journal of Horticulture.vol. 1, No. 3, 2014, page1-4.

[7].Ali Salehi Sardoei.,Vermicompost effects on the growth and flowering of marigold (Calendula Officinalis).,European Journal of Experimental Biology.vol. 4, No. 1,2014, page 651-655.

[8].Babita Devi.,Studies on Yield Potential of Vermicompost by using Eisenia foetida in Different Solid Waste Materials., International Journal of Current Microbiology and Applied Sciences.vol. 6, No. 2, 2017, page 82-85.

[9]. Hemlatha., Vermi-composting of fruit waste and industrial sludge., International journal of advanced engineering technology.vol. 3, No. 2, 2012, page 60-63.

[10]. Saeed Samsami .,Effect of Vermicompost on Yield and Yield Components of Two Corn Cultivars., International Journal of Environment., Agriculture and Biotechnology. vol. 1,No. 3,2016, page 445-447.

[11]. Kaur, P.,Bhardwaj M.,Babbar I.,Effect of Vermicompost and Vermiwash on Growth of Vegetables., Research Journal of Animal, Veterinary and Fishery Sciences. . vol. 3,No. 4, 2014, page 9-12.

[12]. Manyuchi M.M ., Whingiri, E .,Effect of vermicomposting period, substrate quantity, cow dung Composition and their interactions on Eisenia Foetida during vermicomposting., International Journal of Current Microbiology Applied Sciences. vol. 3, No. 8, 2014, page 1021-1028.

Author 1 : Dr.G. Subbulakshmi is presently working as assistant professor, Chemistry Department at Jain University, Bangalore. She has completed her Ph.D in the field of solid waste management. Her Area of interests included Environmental chemistry & Biotechnology.

Author 2: Dr.R.Thiruneelakandan is presently working as assistant professor and HOD Chemistry Department at BIT Campus- Anna University Technology, Tiruchirapalli.

Author 3: Patatri Pramanik is pursuing B,Sc, [CMBT- Specizalaitation in Chemistry, Biotechnology, Microbiology] Jain University, and Bangalore.