Int. J. Curr. Res. Biosci. Plant Biol. (2018) **5(6)**, 95-98

EXCELLENT PUBLISHERS

International Journal of Current Research in
Biosciences and Plant Biology
Volume 5 • Number 6 (June-2018) • ISSN: 2349-8080 (Online)
Journal homepage: www.ijcrbp.com

Short Communication

doi: https://doi.org/10.20546/ijcrbp.2018.506.010

Vermicomposting of Source Separated Kitchen Vegetable Waste Collected from Salem City, Tamil Nadu, India

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Article Info

Date of Acceptance:
13 May 2018

Date of Publication:
06 June 2018

Keywords

Eisenia fetida
Kitchen vegetable waste
Nutrients
Vermicompost

ABSTRACT

In the present study, kitchen vegetable waste collected from households of Salem, Tamil Nadu has been used for vermicomposting in combination with cowdung (3:1) for 60 days using the earthworm, *Eisenia fetida*. The vermicompost produced showed 1.16%, 1.02% and 0.81%, nitrogen, phosphorus and potassium respectively. The microbial population increased from day 0 to 60th day in all the vermibeds. The total bacterial population of 43, 61, 71, 115 and 145 CFU × 10^6 g^{-1} were recorded during vermicomposting of kitchen vegetable waste on 0, 15, 30, 45 and 60 days respectively. On 60th day total fungal and actinomycetes recorded in vermicompost were 135 CFU × 10^3 g^{-1} and 79 CFU × 10^4 g^{-1} respectively. The vegetable kitchen waste in combination with cowdung (3:1) is suitable for vermicomposting with *Eisenia fetida* to produce nutrient rich vermicompost.

Introduction

Due to the side effects of chemical fertilizer, during 1989-90 there has been 3-4% decrease in fertilizer nitrogen consumption in Europe and USA (Prasad, 1999). In order to reduce the side effects of fertilizer nitrogen by chemicals in India an integrated nutrient management encompassing soil testing and balanced use of chemical fertilizers in conjunction with organic manures and biofertilizer by implementing fertilizer control order of 1985 has been adopted. After considering the skewed pattern of fertilizer use in various locations in India, the Central Government is promoting balanced and integrated use of fertilizers through various initiatives. As a result of this effort, NPK consumption ratio has now improved to 5.7 : 2. 2 : 1 during 2004-2005 from 7: 2.7 :1 during 2000-01 (National Portal of India: Agriculture, 2005). Vermicompost has been shown to have high levels of total and available nitrogen, phosphorous, potassium (NPK) and micro nutrients, microbial and enzyme activities and growth regulators (Edwards, 2004; Karmegam and Daniel, 2009; Prakash and Karmegam, 2010). Vermicompost, an organic soil conditioner is known to enhance the plant growth and yield (Zaller, 2007; Karmegam and Daniel, 2008). The utilization of vermicompost and vermicasts as substitute for peat in horticultural potting media and carrier media in air-layering for ornamental plant has been reported (Zaller, 2007). The methods used in municipal solid waste disposal in the majority of cities and towns in the India are non-systematic and unscientific, involving dumping in low lying areas in the outskirt of the towns. In an attempt to streamline waste management, the Ministry of Environment and Forest (MOEF) has promulgated the ‘‘Municipal Wastes (Management and Handling) Rules, 2000” under Environment (Protection) Act, 1986, addressing all aspects of waste management from collection, transportation, storage, recycling, and processing to final disposal. The rules emphasize integrated solid waste management from door-to-door collection to processing of organic waste and scientific disposal of inert materials (Lal and Rajnikant, 2010). These wastes need to be recycled to avoid environmental pollution and loss of nutrients, and also to get valuable end product vermicompost for agricultural purposes. In the present study, vermicomposting technology has been employed to process the house hold wastes (kitchen wastes) employing the earthworm, *Eisenia fetida*. *Eisenia fetida* is an earthworm species widely used for vermicomposting of various organic residues throughout the world. In India, *Eisenia fetida* has been successfully utilized for vermicomposting of leaf litters (Karmegam and Daniel, 2000), municipal solid waste (MSW) (Kaviraj and Sharma, 2003), paper waste (Prakash et al., 2008), silkworm litter (Rajasekar and Karmegam, 2009) and beverage industry sludge (Singh et al., 2010). However, the study on vermicomposting of kitchen wastes in Salem (Tamil Nadu, India) is lacking. Hence the present study has been carried out to find the vermicomposting of source separated kitchen vegetable wastes using the earthworm, *Eisenia fetida*.

Materials and methods

For the collection of total and kitchen vegetable wastes, efforts were made to collect wastes from door to door and segregated as dry and kitchen vegetable wastes from Peramanur area, Salem, Tamil Nadu. Also efforts were made to collect the kitchen vegetable wastes to the maximum extent. The dry wastes comprised of, in general, papers, plastic, empty glass bottles, etc. are segregated, while the kitchen vegetable wastes were weighed after collection from each house and there after pooled and allowed for predigestion for 15 days The cowdung was collected from nearby cattle sheds in fresh form and allowed to stabilize for one week and used for the study. The pre-decomposed organic substrates were mixed with cowdung in 3:1 ratio on dry weight basis, transferred to vermibeds and moistened to hold 60-70% moisture content. The vermicomposting studies were carried out for 60 days using *Eisenia fetida* in three replicates twice under controlled conditions. The vermibeds without earthworms were also maintained as control. The microbial population count, i.e., bacteria, fungi and actinomycetes and the characteristics of vermicomposts were analysed as described in Prakash and Karmegam (2010).

Results and discussion

It is seen from the table that the main elements, namely nitrogen, phosphorus and potassium were 1.16%, 1.02% and 0.81%, respectively (Table 1). Such elements are present in the vermicompost so, they are prepared from the kitchen waste. They are quite beneficial as sufficient quantities of these elements are present. The data so obtained, may be seen from the table, are quite in agreement with the various parameters of the vermicompost obtained at ICRISAT, Hyderabad (Nagavallemma et al., 2004). The total microbial populations *viz*., during vermicomposting of kitchen vegetable wastes in combination with cow dung are shown in Table 2. The microbial population increased from day 0 to

60^{th} day in all the vermibeds. The total bacterial population of 43, 61, 71, 115 and 145 CFU × 10^6 g^{-1} were recorded during vermicomposting of kitchen vegetable waste on 0, 15, 30, 45 and 60 days respectively. The trend of increase of fungal and actinomycetes population was parallel to that of bacterial observed during vermicomposting of wastes. On 60^{th} day total fungal and actinomycetes recorded in vermicompost were 135 CFU × 10^3 g^{-1} and 79 CFU × 10^4 g^{-1} respectively.

Table 1. Physico-chemical characteristics of vermicompost prepared from the kitchen waste.

Parameter	Values obtained
pH (at 25ºC)	7.39
Conductivity (mS/cm)	5.80
Bulk density (g/cc)	0.80
Calcium as Ca (%)	1.34
Sodium as Na_20 (%)	0.29
Potassium as K_20 (%)	0.81
Magnesium as Mg (%)	0.47
Organic Matter (%)	24.01
Total Nitrogen as N (%)	1.16
Total Phosphorus as P_20_5 (%)	1.02
Zinc as Zn (ppm)	142.07
Chromium as Cr (ppm)	5.88
Manganese as Mn (ppm)	161.67

Table 2. Total microbial population dynamics during vermicomposting of kitchen vegetable waste with *E. fetida*.

Vermicomposting days	Total microbial population*		
	Bacteria (CFU× 10^6 g^{-1})	Fungi (CFU×10^3 g^{-1})	Actinomycetes (CFU×10^4 g^{-1})
0	43.17	70.00	39.00
15	61.00	82.00	46.17
30	71.33	111.67	53.67
45	115.00	126.00	63.67
60	145.00	135.00	79.50

* Values are log transformed mean of six replicates.

According to Nagavelamma et al. (2004) vermicompost when analyzed for microbial diversity and their population have indicated the presence of bacteria, fungi and actionomycetes. Several authors have noted that the earthworms play a major role in affecting population of microorganisms, especially causing changes in the soil microbial community (Coleman, 1985; Parmelee et al., 1998). Nagarvallemma et al. (2004) recorded higher microbial populations in the partially decomposed dry organic waste material for vermicomposting than the vermicompost itself. These studies reported that partially decomposed organic waste material per gram of samples had bacterial, fungal and actionomycetes counts as $89x10^6$, $11x10^4$ and $2x10^4$, while vermicompost contained slightly less counts as $54x10^6$, $8x10^4$ and $1x10^4$, respectively. The fungal isolates from the samples were identified up to the species levels. Much diversity was observed between the two types of samples collected. *Aspergillus*, *Fusarium*, *Mucor* and *Cladosporium* were the common genera in both the samples. However, some other genera, namely *Alternaria*, *Penicillium* and *Thermomycetes* were isolated from the predigested dry organic waste material for vermicomposting, while genera like *Absidia* and *Stachbotrys* were recorded in vermicompost. The digestive epithelium of the simple straight tubular gut of earthworms is known to secrete cellulase, amylase, invertase, protease and phosphatease (Rangannathan and Vinotha, 1998). In conclusion, the vegetable kitchen waste in combination with cowdung (3:1) is suitable for vermicomposting with *Eisenia fetida* to produce nutrient rich vermicompost.

Conflict of interest statement

Authors declare that they have no conflict of interest.

References

Coleman, D.C., 1985. Through a red darkly: an ecological assessment of root soil microbial faunal interactions. In: Ecological interaction in Soil (Eds.: Fitter, A.H., Atkinson, D., Read, D.J., Usher, M.B.). U.K. Blackwell Scientific Publications, London.

Edwards, C. A., 2004. Earthworm Ecology. 2nd Edn. CRC Press, Boca Raton. pp.256-292.

Karmegam, N., Daniel, T., 2000. Decomposition of leaf litters using the compost worm, *Eisenia fetida*. Indian J. Environ. Ecoplann. 3(1), 111-116.

Karmegam, N., Daniel, T., 2008. Effect of vermicompost and chemical fertilizer on growth and yield of hyacinth bean, *Lablab purpureus* (L.) Sweet. Dyn. Soil, Dyn. Plant. 2, 77-81.

Karmegam, N., Daniel, T., 2009. Investigating efficiency of *Lampito mauritii* (Kinberg) and *Perionyx ceylanensis* Michaelsen for vermicomposting of different types of organic substrates. Environmentalist. 29, 287-300.

Kaviraj, Sharma, S., 2003. Municipal solid waste management through vermicomposting employing exotic and local species of earthworms. Bioresour. Technol. 90, 169-173.

Lal, M.P., Rajnikant, J., 2010. Municipal solid waste management in the major cities of Madhya Pradesh, India: Problems, issues and challenges. Waste Manag. 30, 2396-2400.

Nagavelamma, K.P., Wani, S.P., Stephance, L., Padmja, W., Vineetha, C., Babu Rao, M., Sahrawat, K.L., 2004. Vermicomposting: Recycling wastes into valuable organic fertilizer. Global Theme on Agri Eco Systems Report No. 8 Patancheru, A. P. ICRISAT pp20.

Parmelee, R.W., Bohlen, P.J., Blair, J.M., 1998. Earthworms and nutrient cycling processes: integrating across the ecological hierarchy. In: Earthworm Ecology (Ed.: Edwards, C.A.). N.Y., USA, St. Lucie Press. pp. 123-124.

Prakash, M., Karmegam, N., 2010. Vermistabilization of pressmud using *Perionyx ceylanensis* Mich. Bioresour. Technol. 101, 8464-8468.

Prakash, M., Jayakumar, M., Karmegam, N., 2008. Physico-chemical characteristics and fungal flora in the casts of the earthworm, *Perionyx ceylanensis* Mich. reared in *Polyalthia longifolia* leaf litter. J. Appl. Sci. Res. 4, 53-57.

Prasad, R., 1999. Sustainable agriculture and fertilizer use. IARI, New Delhi.

Rajasekar, K., Karmegam, N., 2009. Suitability of vermicasts as carrier material for a biofertilizer, *Azospirillum brasilense* (MTCC 4036). In: Vermitechnology I (Ed.: Karmegam, N.). Dyn. Soil, Dyn. Plant 3 (Spl. issue 2), pp. 143–146.

Ranganathan, L.S., Vinotha, S.P., 1998. Influence of pressmud on the enzymatic variations in different reproductive stages of *Edurillus euginiae*. Curr. Sci. 74, 634-639.

Singh, J., Kaur, A., Vig, A. P., Rup, P. J., 2010. Role of *Eisenia fetida* in rapid recycling of nutrients from biosludge of beverage industry. Ecotoxicol. Environ. Saf. 73, 430-435.

Zaller, J.G., 2007. Foliar spraying of vermicompost extracts: effects on fruit quality and indications of late-blight suppression of field-grown tomatoes. Biol. Agric. Hortic. 24, 165-180.

How to cite this article:
Sivakami, T., Jayakumar, M., Prakash, M., 2018. Vermicomposting of source separated kitchen vegetable waste collected from Salem City, Tamil Nadu, India. Int. J. Curr. Res. Biosci. Plant Biol. 5(6), 95-08. **doi:** https://doi.org/10.20546/ijcrbp.2018.506.010