

Vermicomposting is best solution for disposal of organic waste as renewable source for organic farming, gardening, tree plantation and other organizations

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ABSTRACT

Now a day's disposal of organic wastes in urban, suburban and rural area is a burning issue, besides this also enhanced large scale problem in the residential colonies as well as in the large institutions, industries and other organizations. Solution to this is the vermicomposting which is pollution free, fast growing cost effective and efficient nature, Safe, economic, ecofriendly, beneficial and useful by destroying waste materials; and plays important role for the sustainable development of agriculture by maintaining natural balance of nitrogen, phosphorus, potassium, magnesium and iron etc in the soil. This experimental study was conducted in the campus which has a continuous source of organic waste of dead organic matter, plant litter, papers, grass, leaves of different trees etc. It is found that whatever the organic matter produced in the campus is converted into the worm casting through vermicomposting project which resulted into zero garbage in the campus and vermicompost produce used for garden and tree plantation of the campus. This study is going conducted from June 2016 to April 2017.

Key words: Waste management, Vermicomposting, tree plantation, Organic waste, *Eisenia foetida*.

INTRODUCTION

In the 1996 Summer Olympics in Sydney, Australia, People in the U.S. have commercial vermicomposting facilities, where they raise worms and sell the castings that the worms produce. Then there are just people who own farms or even small gardens, and they may put earthworms into their compost heap, and then use that for fertilizer. In India, about 320 million tones of agricultural waste are generated annually [1] of which vegetable waste alone is in major proportion. The waste from the vegetable market is collected and dumped into the municipal landfills, causing a nuisance because of high biodegradability [2]. This result in loss of potentially valuable materials that can be processed as fertilizer, fuel and fodder [3]. The biological treatment of these wastes appears to be most cost effective and carry a less negative environmental impact [4, 5].

Vermicomposting is the process of transforming organic waste into worm castings, playing double role as on one hand it reduces organic waste, pollution and pollutants and on the other hand it's conversion to casting is very beneficial to the agriculture, horticulture and gardening as it increases the fertility of the soil and contain N, P, K, Ca, Mg and Fe. Improvement of soil through vermiculture has now become a popular part of organic farming. Vermicompost is accepted as humus biofertilizer, soil fertility booster, soil activator and soil conditioner with required plant nutrients, vitamins, enzymes, growth hormones and beneficial microbes like nitrogen fixing, phosphate solubilising, denitrifying and decomposing bacteria. The recent realizations to maintain ecological balance for sustenance of agricultural production, farmers and scientists alike are aiming at finding an alternative to chemical agriculture. India has a long tradition of agriculture with a rich heritage of ecofriendly agriculture technologies. A possible way to utilize this waste is by vermicomposting biotechnology [6,7].

MATERIALS AND METHODS

Vermiculture is the science of worm composting. Worms can eat biodegradable organic waste equal to their body weight each day, leaving castings as the byproduct. Worm castings are called worm compost. Two cement tanks constructed to a height of 3 feet and a breadth of 4 feet and the length 12 feet with 3 feet distance between them as it allows free movement for harvesting and other labor work. The bottom of the tank is made to slope like structure to drain the excess water from vermicompost unit. A small sump is necessary to collect the drain water.

Segregation of decomposable and indecomposable, dry and wet material obtained through cleaning and sweeping of campus, which includes leaf litter, papers, cardboards, grass cuttings, cafeteria waste etc and allowed it to partial decompose for 10 days. This composition includes 40% green wet waste, 40% dry waste and 20% other materials like cattle dung, coir waste, saw dust, sugarcane trash and soil, Introducing the Vermi Worms, Red wriggler *Eisenia foetida*. After 10 days upon putting the substrates into the vermi beds, we introduce the vermi worms into the substrate. We used the Red wriggler *Eisenia foetida* in our vermicompost. Aerobic decomposition lasts for 25-28 days depending on the materials used and the ratio of the worms to the substrate. In our case, we have a total of 300 to 500 kilograms of substrate each bed enough to feed a 5-6 kilogram of worm for four weeks. Within the period, we moistened the substrate regularly to provide the right moisture (60 - 80%) for the worms to grow and multiply. Compost samples (at maturity) were collected for nutrient analysis. All the samples characterization was conducted in triplicate to obtain mean values. The physicochemical parameters were measured by standard methods. Total nitrogen, phosphorus and other nutrients were determined according to the standard methods of the American Public Health Association (APHA, 1998).

RESULT AND DISCUSSION

In recent years, earthworms have been identified as one of the major tools to process the biodegradable organic materials [8, 9]. The utilization of waste materials through the earthworm has given the concept of vermicomposting. Vermicompost is the product of composting using various worms, usually red wigglers, white worms, and other earthworms to create a heterogenous mixture of decomposing vegetables or food waste, bedding materials, and vermicast. Vermicast, also called worm castings, worm humes or worm manure, is the end product of the breakdown of organic matter by an earthworm. These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than do organic materials before vermicomposting [10].

Harvesting of Vermicast started 25 days or four weeks after stocking of worms. Prior to harvest, we refrained from watering the substrate for the last three days to ease the separation of castings from worms and likewise preventing the castings to become compact. We had the first harvest of the vermicast or the worm manure; we actually harvested a total of 300 kilograms or three sacks of organic fertilizer and 10 kg of extra worms from the first vermi tank. The succeeding month wise harvest is

illustrated in the *Table 1*. The composting requires sufficient amount of oxygen for aerobic activity as too little aeration leads to anaerobic conditions whereas excessive cooling may prevent the thermophilic conditions at too much of aeration [11]. In order to achieve these aerobic conditions shade of the vermicompost tank is at the sufficient height for free aeration from all sides. Containing water-soluble nutrients, vermicompost is an excellent, nutrient rich organic fertilizer and solid conditioner [12]. In the present study water-soluble nutrients rich fertilizers analyzed are nitrogen, Phosphorus, potassium, Calcium, magnesium and iron found in higher quantities. The earthworms consume the soil organic matter and convert it into humus within a short period of time and increase the soil fertility. [13]. The content of the earthworm castings, along with the natural tillage by the worm burrowing action, enhances the permeability of water in the soil. Worm casting can hold close to nine times their weight in water.

Worm casting contains 5 times the available nitrogen, 7 times the available Potash, and 11/2 times more calcium than found in upper layer of the soil. The vermitech approach utilizes waste management process by involving earthworms [14].

Table 1 : Month wise production of vermicompost and worm.

Size Of Tank	Month	Waste Material	Worm Required	Harvesting Time	Worms Obtained /Month	Extra Worms Obtained	Vermicopost Production/M onth
12'X4'X3'	June 2016	400 kg	5 kg	28 days	15 kg	10 kg	300 kg
	July 2016	500 kg	6 kg	26 days	18 kg	13 kg	450 kg
	Aug 2016	400 kg	5 kg	28 days	15 kg	10 kg	300 kg
	Sept 2016	300 kg	4 kg	27 days	13 kg	09 kg	260 kg
	Oct 2016	400 kg	5 kg	28 days	15 kg	10 kg	300 kg
	Nov 2016	500 kg	7 kg	26 days	20 kg	14 kg	400 kg
	Dec 2016	400 kg	5 kg	28 days	15 kg	10 kg	300 kg
	Jan 2017	300 kg	4 kg	27 days	12 kg	08 kg	250 kg
	Feb 2017	400 kg	5 kg	28 days	15 kg	10 kg	300 kg
	Mar 2017	350 kg	5 kg	28 days	14 kg	109kg	260 kg
	Apr 2017	400 kg	5 kg	28 days	15 kg	10 kg	300 kg

Many workers demonstrated that worm casting have good aeration, porosity, drainage and moisture holding capacity. The technical feasibility study of adopting vermicomposting was conducted to convert Organic wastes and industrial sludges to biofertilizer. Two reactors were loaded with appropriate proportion of fruit Waste and industrial sludges with the microorganism *Pleurotus* and earthworms. The initial (before vermicomposting) and final (after vermicomposting) wastes with industrial sludges were subjected to physical and chemical composition [15].

Slow rate of decomposition and mineralization of organic matters are major limiting factors in adequate nutrient availability to the plant in the Darjeeling tea soils, indicating the organic carbon was higher in tea waste and weed biomass, ranging from 29.10 to 32.65%, while it was lower in *Eupatorium sp.* ranging from 22.75 to 24.8%. At harvest, pH and organic carbon of vermicompost went down ranging from 4.81 to 7.13 and 17.5 to 21.70% respectively. The C: N ratio was recorded narrow in all the treatments angling from 11:1 to 13:1 than the pre-inoculation stage. Highest total Nitrogen content (1.84%) in the final produce was recorded in tea waste + cowdung with *Eisenia foetida* followed by *Eupatorium* + cowdung with local worm (1.75%), and tea waste + cow dung with *Eudrillus euginae* (1.67%). Highest Phosphorus (1.04%) and Potassium (1.46%) contents were recorded in *Eupatorium* + cowdung with local worms [16].

The present report noted the chemical composition of nitrogen 2.5%, Potassium 1.5%, Phosphorus 1.5%, Calcium 1.3%, Magnesium 0.6% and Iron 0.4 % as shown in Table 2, which is more than the fruit and industrial waste vermicomposting because in the present study cattle dung, coir waste, saw dust, sugarcane trash and soil is added to the decomposable organic waste and These observations were in conformity with those obtained by Fares *et al* (2005). Cow dung and coconut leaf litter High concentration of P, K, Ca and Mg were found in vermiwash. Vermiwash from pure cow dung showed highest in N, P, Ca, Mg and indoleacetic acid (IAA) concentration.[17].

Table 2: Characteristics of nutrients in vermicompost.

MINERALS	PERCENTAGE
Nitrogen (N)	2.5
Phosphorus (P)	1.5
Potassium (K)	1.5
Calcium (Ca)	1.3
Magnesium (Mg)	0.6
Iron (Fe)	0.4

Also, the presence of large number of microflora in the gut of earthworm might play an important role in increasing P and K contents in the process of vermicomposting [18]. Available plant nutrients that present in these vermicompost are valuable and have the potential to be used as nutrients solution in hydroponics culture (Quaik *et al*, 2012).

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