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Recuperating Waste into Valuable Organic Manure Using "Environment's Plowman"

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Application of chemical fertilizers reduces land productivity and crops become dependent on periodic inputs of the chemical fertilizers. Land, need to be prevented from degradations. Green manures are effective alternatives to chemical fertilizers in the management and preservation of soil fertility and productivity, adding organic matter and nutrients to the soil. soil fertility can be improved and maintained initially through use of organic inputs like well decomposed organic manure/Vermicompost .The best alternative of the present day's environmental degradation is to make proper use of the available unutilized organic biodegradable wastes in order to convert them into compost within a short period. Vermicompost could be used as an excellent soil amendment for main fields. Edwards (1988) reported that vermicompost could promote early and vigorous growth of seedlings. . Huge quantity of wastes can be converted into nutrient rich bio-fertilizer.Integrated application of NPK fertilizer along with vermicompost in field crops not only influences growth and production of plants. It also enhances the root formation, elongation of stem and production of biomass, vegetables, ornamental plants etc.

Key words: Solid waste, Earthworm, Water, Compost, Chamber.

Vermicomposting is an eco-friendly, economical, efficient novel technology that can be applied to utilize agricultural and other organic wastes. This technology also provides opportunities for self-employment for rural people, by utilizing the available agricultural resources. Vermicomposting technology is getting familiarized in this decade. A number of organic wastes discarded as unusable, which contain essential nutrients can be exploited to improve the physical, chemical and biological properties of soil. The digested product of earthworm known as castings, which is rich in nutrients such as phosphorous, potassium, calcium and magnesium, increases the soil fertility. Waste degradation and composting by earthworms is proving to be economically & environmentally preferred technology over the conventional composting technologies as it is rapid and nearly odorless process, reducing composting time by more than half and the end product is both 'disinfected', 'detoxified' and 'highly nutritive'.Visvanathan et al., (2005) found that most earthworms consume, at the best, half their body weight of organics in the waste in a day.

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MATERIAL AND METHODS

Methods of Waste Collection

The research work has been done in Nurseries (Cashew ,Mango and Vegetables) Vriddachalam Taluk, Cuddalore District. The Plant waste samples were collected separately in random manner.

Requirements for Vermicomposting

Organic wastes, Multiplication of earth worms, Structure for composting, Method of Composting

EXPERIMENTAL

Vermicomposting can be done either in pits or concrete tanks or well rings or in wooden or plastic crates appropriate in a given situation. Preparations of Concrete tanks. The Tank should have proper drainage holes at the base in order to remove excess of water. Spread a thin layer of surface soil (1-2 inch) at the bottom of the tank. Soil Provide good bedding material for the Worms. Over the soil or sand layer spread a layer (15-20 comes) of organic waste on top of the soil. Prepare cow dung slurry (15kgs) and add the slurry as a layer on top of the mixture.Cow dung have sufficient microorganism which are the necessary starters for the decomposition process.Allow the material to decompose for 20 days. After 20 days, put the earthworms (100) on top. They will find the cracks and enter the material.Cover the Pit with gunny bags to prevent birds from eating the worms. Maturity could be judged visually by observing the formation of granular structure of the compost at the surface of the tank.After 2 months, remove the gunny bags and heap the material in a cone shape on the floor. Leave the heap undisturbed for 2-3 hours, to let the worms move slowly to the bottom.Harvesting: scrapping layer wise from the top of the tank and heap under shed. This will help in separation of earthworms from the compost. Sieving is done to separate the earthworms and cocoons.

Manure

Bio organic manure is a high quality 100% natural product that enriches the soil and helps in providing you with healthy fruits, vegetables, flowers, crops, cereals, plants, and gardens etc. Across the world, prolonged use of chemical fertilizers has depleted the fertility of the soil & resulted into reduced crop yields & nutrient deficiencies. Farmers, the world over have realized this and are now switching over to organic farming. Bio-organic manure is the unique answer to your soil health. Humus is the fuel that enhances the soil life. It improves the biological & physical properties of the soil & also the growth of beneficial microbes. Improved soil health results to the healthy growth and development of the plants.

Earthworms Species Suitable for Vermicomposting

Long-term researches into permaculture have indicated that the Tiger Worm (Eugenia fetid), Red Tiger Worm (E. Andrei), the Indian Blue Worm (Per onyx excavates), the African Night Crawler (Euripus Eugenie), and the Red Worm (Lubricous rubella's) are best suited for vermin-composting of variety of organic wastes (Graff, 1981; Beetz, 1999; Sinha et. al, 2002).Among these Eisenia fetida can consume organic matter at the rate equal to their body weight every day. Earthworm participation enhances natural biodegradation and decomposition of organic waste from 60 to 80 %. And as the worms double their population every 60-70 days, the process becomes faster with time. Given the optimum conditions of temperature (20-30 °C) and moisture (60-70 %), about 5 kg of worms (numbering approx.10,000) can vermiprocess 1 ton of waste into vermi-compost in just 30 days.

Environmental Condition

Five Rudimentary Conditions To Successful Vermicomposting Living Environment, Feeding, Moisture, Aeration, Temperature

Structure of the tank&particle size

Good structure prevents the loss of porosity (air space) in the tank. As the amount of surface area increases with the decrease in particle size, the rate of aerobic digestion also increases and decomposition proceeds more quickly.Composting will proceed more quickly if you have larger, relatively uniform particles.

Temperature

Higher temperature results in faster breakdown of organic materials. Excessively highly temperature can inhibit microbial activity. Normal temperature is 55- 85 F.

Aeration

Holes must be drilled through the sides

of the tank. Make holes very small or cover with screening to avoid fruit flies. Composting is an aerobic process, which means that an adequate supply of oxygen is essential for the composting process. The microorganisms primarily responsible for the rapid decomposition of organic material require oxygen to convert organic waste to compost. If the oxygen content falls below 5%, these aerobic (oxygen needing) organisms begin to die off..

Moisture

Wateris required by all living things, including decomposers. The compost pile should be moist, but not too wet. A bad odor may indicate that excess moisture is inhibiting decomposition. The bedding used must be able to hold sufficient moisture if the worms are to have a livable environment. The ideal moisture-content is 45-60%.Most wastes do not contain enough moisture. Composting process slowed down unless water is added. Excess water causes problems in compost piles: Leachate generation, anaerobic conditions, rotting, and obnoxious odours Loss of moisture occurs through evaporation. It can be controlled by adjusting the size and shape of the compost pile.

Food source

Regular input of feed materials for the earthworms is most essential step in the vermicomposting process. However earthworms feed mainly on dead and decaying organic waste.

pH

Worms can survive in a pH range of 5 to 9, but a range of 7.5 to 8.0 is considered to be the optimum.

Be Aware of Acidity

If acidic food is added to the pit (e.g.: citrus fruit residues)it will become acidic, which could eventually impairment the worms. In addition to neutralizing the acidity, adding egg shells or lime provides calcium for the worms, which will help them craft their cocoons. But most organic substances are naturally well-buffered with regard to pH change slight tendency towards acidification as compost matures, due to production of carbonic acid

EC (Electrical Conductivity)

The increased EC during the period of the vermicomposting due to the degradation of organic matter

Harvesting

When raw material is completely decomposed it appears black and granular. Watering should be stopped as compost gets ready. The compost shout be kept over a heap of partially decomposed cow dung so that earthworms could migrate to cow dung from compost. After two days compost can be separated and sieved for use.

Sunlight

Earthworms have an aversion to bright lights. One hour's exposure to ultraviolet rays from strong sunlight causes partial-to-complete paralysis and several hours are fatal. A worm breathes when oxygenfrom the air or water passes through its moist skin into the blood capillaries. If the body covering dries up, the worm suffocates.

Precautions

1. The composting area should be provided with sufficient shade to protect from direct sunlight.
2. Adequate moisture level should be maintained by sprinkling water whenever necessary.
3. Take preventive measures to ward off predatory birds, ants or rats.

RESULTS AND DISCUSSION

Vermicompost samples were collected undestructively at 15, 30, 45,60,75 and 90 days for analyses of organic carbon (OC) and major nutrients-total nitrogen (N), available phosphorus (P), exchangeable potassium (K), calcium (Ca), and magnesium (Mg).The temperature (°C), moisture (%), pH, and electrical conductivity (EC)were recorded. Temperature was noted daily using a thermometer, and moisture content was measured gravimetrically. The pH and EC of samples were recorded by a digital pH meter and conductivity meter, respectively. The OC of the samples was measured by Walkey-Black method; the N was estimated by the Kjeldahl method, and the P and K contents of the samples were analyzed by calorimetric method and flame photometric method, respectively. The Ca and Mg contents of the samples were also analyzed using atomic absorption spectrophotometer. The C 6" N ratio was calculated from the measured values of C and N.

Thus, vermicomposting was proved to be a better technology than that of sole composting and may be preferred for the management and nutrient recovery from the waste. Vermicompost

Table 1. Degradationof Nursery(Cashew, Mangoand Vegetable)waste by Vermicomposting Vs. conventional Composting Systems in systematic and spontaneous ways

Waste Material	Vermicomposting with Earthworms (Degradation in %)		Conventional composting Without Worms (Degradation in %)	
	systematic	Spontaneous	Systematic	spontaneous
After 15 Days	15	15	0	0
After 30 Days	35	15	0	0
After 45 Days	40	18	15	10
After 60 Days	100	70	15	10
After 75 Days	100	70	20	10
After 90 Days	100	80	35	12

Table 2. Nutrients analysis

Nutrients	Percentage (%)
Nitrogen	1.5-2.5
Phosphorus	1.2-1.8
Potash	1.5-2.4
Calcium	0.5-1.0
Magnesium	0.2-0.3
Sculpture	0.4-0.5
Iron	0.8-1.5
Copper	22-36 ppm
Zinc	500-1000ppm

is not only to manage the solid waste system by producing wealth from it but also to save the environment from pollution. Studies have established that vermicomposting of wastes by earthworms significantly reduce the total emissions of greenhouse gases in terms of CO_2 equivalent, especially nitrous oxide (N_2O) which is 296-310 times more powerful GHG than CO_2. Our studies showed that on average, vermicomposting systems emitted 463 CO_2-e / m2 / hour respectively. This is significantly much less than the landfills emission which is 3640 CO2-e /m2/hour. Vermicomposting

Fig. 1. Integrated application of NPK fertilizer along with vermicompost in field of cashew Growth

Fig.2. In the field of Cabbage

Fig. 3. In the field of Tomato

emitted minimum of N_2O – 1.17 mg / m2/ hour, as compared to Aerobic Composting (1.48 mg / m2/ hour) and Anaerobic Composting (1.59 mg / m2/ hour). Hence, earthworms can play a good part in the strategy of greenhouse gas reduction and mitigation in the disposal of global Solid waste. (Sinha and Chan, 2009).

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