INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

Volume-1, Issue-3 Sept-Nov-2011 *www.ijpaes.com* *ISSN 2231-4490*

VERMICOMPOSTING IS VALIANT IN VANDALIZING THE WASTE MATERIAL

G.Subbulakshmi[1*], R.Thiruneelakandan[2]

[1*]Department of Chemistry, Dhanalakshmi Srinivasan Engineering College, Perambalur – 621 212.

[2]Department of Chemistry, Anna university of Technology,Thiruchirapalli

ABSTRACT: Management of solid waste has become one of the biggest problems we are facing today. The rapid increase in the volume of waste is one of the aspects of the environmental crisis, accompanying recent global development. Most common practices of waste processing are uncontrolled dumping which causes mainly water and soil pollution. Besides dumping or sanitary land filling, the final disposal of solid waste can be carried out by other methods like incineration and composting. Vermiculture is another bio-technique for converting the solid organic waste into compost. Composting is the process which converts organic waste into useful manure by aerobic conversion. The active organisms in conventional vermicomposting are earthworms. The vermicomposting improves the soil structure, enhancing soil fertility, moisture holding capacity and in term increase the crop yield. It becomes an important tool of waste recycling the world over.

Keywords: Solid waste, Earthworm, Mulching material, Water, Compost, Chamber.

INTRODUCTION

Under present day condition, it becomes very essential to protect environment from further degradation, develop appropriate technologies for use in recycling various organic waste and to harness energy thus minimizing environmental stress. Vermitechnology is a promising technique that has shown its potential in certain challenging areas like augmentation of food production, waste recycling, management of solid wastes etc. The word Vermiculture biotechnology implies a modern technique of harnessing the ecosystem for effective utilization of the organic waste with the help of earthworms, which results into generation of useful organic manure. It helps to avoid the environmental pollution and expenditure of resources to treat the organic waste. A large volume of organic matter generated from agriculture activities, dairy farm, industrial establishments, animal shelters and household activities are dumped to putrefy without proper utilization. Vermicompost is considered superior to other types of compost because of its quality.

VERMICOMPOST

Vermicompost is a natural fertilizer. It is made from bio wastes and farmyard wastes by introducing earth worms in to it. It is a good substitute for chemical fertilizers. It contains Nitrogen: Phosphorous: and Potassium in adequate quantities. Most of the micro nutrients that plants are not getting from chemical fertilizers are available in vermicompost. The large quantities of bio waste can be efficiently converted in to compost through vermicomposting. It has good demand in organic farming.

Earth worm: A Soil conditioner

Earthworms are small, soft, cylindrical bodied invertebrates that play a vital role in soil ecosystem maintenance. Earthworms are an important organism in the soil doing great service for mankind for millions of years now. A newer branch of biotechnology called 'Vermiculture Technology' is emerging by the use of earthworms to solve various environmental problems from waste management to land (soil) improvement. Earthworms when present in soil inevitably work as 'soil conditioner' to improve its physical, chemical and biological properties and also its nutritive value for healthy plant growth. This they do by soil fragmentation and aeration, breakdown of organic matter in soil & release of nutrients, secretion of plant growth hormones, proliferation of nitrogen-fixing bacteria, increasing biological resistance in crop plants and all these worm activities contribute to improved crop productivity.

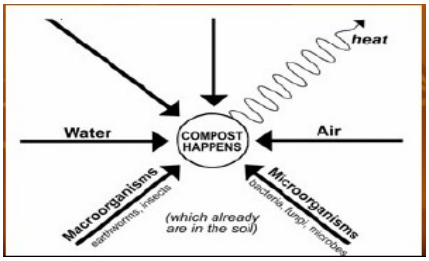

Figure:1

WHY COMPOST WITH WORMS?

Worm composting is a method for recycling waste into a rich, dark, earth-smelling soil conditioner. The great advantage of worm composting is that this can be done indoors and outdoors, thus allowing year round composting. It also provides apartment dwellers with a means of composting. In a nutshell, worm compost is made in a container filled with moistened bedding and red worms. Add your waste for a period of time, and the worms and micro-organisms will eventually convert the entire contents into rich compost.

Composting Champion: Red Wigglers (Eisenia fetida)

HUMUS – THE SOIL'S GLUE:

Humus is an important by-product of compost. Humus results from decomposition of all the organic matter you place in your compost. Humus acts like glue that holds all the soil particles together, and it helps prevent erosion and increases a soil's moisture holding ability.

MATERIALS AND METHODS

Materials Required for Vermicomposting:

Dry organic wastes, Dung slurry, Rock phosphate, Earthworms, Waste

Experimental Set up

Structure for composting

Figure:1

Suitable organic wastes

Figure:2

Multiplication of earth worms

Figure:3

Bedding

Cow dung Slurry

Suitable method of composting

Figure:4

Introduction of worms in to beds

Figure:5

Covering

Figure:6

Watering

Figure:7

Compost ready for turning

Figure:8

sieved

Figure:9

Finished compost

Figure:10



Figure:11 Applying manure to the Soil

Images of gradual change of MSW to Vermicompost

Method of preparation

Preparation of Tank

Vermicompost can be made in concrete tanks, wooden boxes, and plastic basins or in mud pots. Depending on the availability of raw material and land it may vary. If it's for farm waste composting you can make a tank of 10 feet length, 3-6 feet breadth and 3 feet height. Brick or stone pieces have to be placed on the base of the tank. Spread a layer of organic waste. Sprinkle rock phosphate on top of the material.

Table-1: Preparation of vermi bed

LAYER	INGERIDENTS
5th Layer	Wet cow dung
4th Layer	Agriculture wastes, farm waste, animal droppings
3rd Layer	Agriculture wastes, farm waste, rock phosphate (application of earthworm over this bed)
2nd Layer	Coarse sand
1st Layer	Broken bricks

Collection of Waste

All types of decomposable wastes can be used here. It can be kitchen wastes, farm wastes, bio wastes of agro based industries, market wastes; live stock wastes etc.

Filling the Pit

Cow dung is used to line the bottom of the tank up to one or two inches and then spread the bio wastes up to 30 cm thickness. This layer is now moistened with cow dung slurry and water and spread a second layer of bio waste. This has to be repeated till the bio waste reaches 45- 60 cm over the ground level. The moisture level should be maintained by sprinkling water. The bio waste: cow dung ratio must be 60: 40.

Introduction of worms in to beds

The optimum number of worms to be introduced. Raw materials will be spread again over the earthworms gently. In continuation, wet cow dung with moisture will be covered over the level. Leaf dust of neem, rhizome dust and neem cake can be used in the management of enemies. After a period of 10 days the organic layering is mixed well gently without injuring the earthworm.

Covering

Cover the tank with wire mesh or gunny bags to prevent earthworms from birds.and rats. Take proper control measure against ants too. The compost must be protected from the rain and sun by making a shed having roof and the sides are opened. Keep it covered for three months.

Harvesting of Vermicompost and storage:

Watering has to be stopped 7 days prior to harvest so that worms settle at the bottom layer. The layer will be obtained as black color. It is the indication that the conversion of the raw materials and castings into compost. Matured compost, a fine loose granular mass will be removed from pit, sieved, dried for 12 hours in shade and packed in fertilizer bags for storage. This matured compost has rich nutrient value. Compared to ordinary soil, the worm castings contain five times more nitrogen, seven times more phosphorus and 11 times more potassium. They are rich in humic acids and improve the structure of the soil.

Harvest of worm biomass:

The worms and its cocoon are to be collected by sieving and used for subsequent Vermicomposting.

Why is rock phosphate addeded to compost?

Enriched Vermicompost with rock phosphate may enhance multiplication of beneficial microbes and the phosphate solubilising organism present and are expected to react with rock phosphate and convert the insoluble phosphate to plant available forms.Such vermicompost will have an added advantage in crop Production.

Table 2 : Feeding Process

What to feed worms	What not to feed worms
Vegetable scraps, Fruit and peels,Tea bags, coffee grounds, coffee filters, etc.	Meat, fish, cheese or butter, Greasy, oily foods,Cat litter and cat feces

Environmental conditions must be maintained in the composting process:

Biological conditions : Earthworms, Insects other soil invertebrates.
Physical conditions : particle size, temperature, mixing, pile size and shape

Chemical conditions : energy sources for microorganisms, balanced amount of nutrients water content, adequate oxygen, pH range

Pile size and shape
Smaller piles may not have enough mass to hold the heat of decomposition. Pile should have moderate size.
Temperature
Higher temperature result in faster breakdown of organic materials. Excessively highly temperature can inhibit microbial activity.Normal temperatureis 55- 85 F.
Aeration
It is important to construct the bin to allow adequate airflow. Holes may be drilled on the upper sidewall of the bins for air circulation.

Moisture:

The decomposition process will slow down with either too much or too little water. The optimum moisture content for compost is about 40 to 60 percent.

Acidity (pH)
The decomposition of organic matter produces organic acids that lower the pH of the bedding soil. The best way to deal with this is to add several cups of ground limestone to the bedding.
Particle size

Small particle size promotes rapid decomposition due to increased surface area-to-volume ratio.However: If all particles are small, they pack together and create dense, anaerobic compost Particles should have enough surface area to promote microbial activity, but have enough air spaces to permit gas exchange with the atmosphere.

RESULT AND DISCUSSION

Vermicompost samples were collected at 0 ,15, 30, 45, and 60 days. which were processed for analysis of major nutrients 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 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:N ratio was calculated from the measured values of C and N. Nutrient content from vermicomposting compared with Farm yard manure.

Table 3: Nutrient Values obtained by vermicomposting- Lab Analysis

Nutrients	Vermicompost	Farm yard manure
N	1.6	0.5
P	0.7	0.2
K	0.8	0.5
Ca	0.5	0.9
Mg	0.2	0.2
C:N ratio	15.5	31.3

Prons of Vermicomposting:

1. Improves soil quality by adding nutrients.
2. It helps hold moisture in the soil making your plants more drought-tolerant.
3. Suppression of plant diseases and pests.
4. Compost adds macronutrients (nitrogen, phosphorous and potassium) and micronutrients (calcium, magnesium and boron) to the soil.
5. Vermicompost is an ecofriendly natural fertilizer prepared from biodegradable organic wastes and is free from chemical inputs.
6. It does not have any adverse effect on soil, plant and environment.
7. It increases the water holding capacity of soil. This reduces irrigation up to 30%.

DRAWBACKS OF COMPOSTING:

1. Emissions of ammonia, carbon dioxide, methane and nitrous oxide, especially in the early stages.
2. Run-off from the compost piles must be controlled to prevent movement of nutrients into ground or surface waters.
3. Aeration and moisture must be managed throughout the composting process.

CONCLUSION:

Composting is an effective way to manage organic wastes.It promotes environmental sustainability by converting a waste to a value-added product that improves our environment. Composting is a mix of the art of the gardener, the science of horticulture, and the discipline of waste engineering…COMPOST HAPPENS! The data clearly indicates that vermicompost may be an efficient plant growth media for sustainable plant production, if applied with some combinations of NPK.

REFERENCES

1. S. Suthar and S. Singh, "Vermicomposting of domestic waste by using two epigeic earthworms (Perionyx excavatus and Perionyx sansibaricus)," *International Journal of Environment Science and Technology*, vol. 5, no. 1, pp. 99–106, 2008.
2. R. M. Venkatesh and T. Eevera, "Mass reduction and recovery of nutrients through vermicomposting of fly ash," *Applied Ecology and Environmental Research*, vol. 6, pp. 77–84, 2008.
3. S. Bansal and K. K. Kapoor, "Vermicomposting of crop residues and cattle dung with *Eisenia foetida*," *Bioresource Technology*, vol. 73, no. 2, pp. 95–98, 2000.
4. A. Singh and S. Sharma, "Composting of a crop residue through treatment with microorganisms and subsequent vermicomposting," *Bioresource Technology*, vol. 85, no. 2, pp. 107–111, 2002.
5. Ackerman, F., 2000: Waste Management and Climate Change. *LocalEnvironment,* **5**(2), pp. 223-229.
6. Beck-Friis, B.G. 2001: *Emissions of ammonia, N2O, and CH4 during composting of organic household waste.* PhD Thesis, SwedishUniversity of Agricultural Sciences, Uppsala, 331 pp.

7. Bernache-Perez**,** G., S. Sánchez-Colón, A.M. Garmendia, A. Dávila-Villarreal, and M.E. Sánchez-Salazar, 2001: Solid waste characterization study in Guadalajara Metropolitan Zone, Mexico. *Waste Management& Research*, **19**, pp. 413-424.

8. Bingemer, H.G. and P.J. Crutzen, 1987: The production of CH4 from solid wastes. *Journal of Geophysical Research*, **92**(D2), pp. 2182-2187.

9. Chirashree Ghosh: Integrated Vermi-Pisciculture – analternative option for recycling of solid municipalwaste in rural India. *Bioresource Technology*, **93**:71-75 (2004).

10. Norman Q. Arancon, Clive A. Edwards, R. Atiyeh and Metzger, J.D.: Effects of vermicomposts produced from food waste on the growth and yields of greenhouse peppers. *Bioresource Technology,* **93**:139-144 (2004).