DEVELOPMENT OF COMPOSTING TECHNOLOGY USING LOCALLY GENERATED ORGANIC WASTE IN VIVEKANANDA RAMAKRISHNA ASHRAM, PANCHAVATI, TADAS

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Key words:

Gliricidia sepium, Vermicomposting, Decomposer, Cow dung, Garden waste

Introduction:

Vivekananda Ramakrishna Ashram, Panchavati, Tadas is aiming to build a 'ZERO waste' campus. They are having 75 acres of horticulture land and a byre with 10cows. For proper management of waste and to achieve sustainability in farming, this project focuses on developing a composting technology using locally generated organic waste. By considering all the conditions this project has chosen vermicomposting because it is a simple to construct, manage, economic and environmental friendly process that helps to achieve sustainability in farming and proper waste management.

Vermicomposting involves the physical and biochemical action of the earthworm in converting organic matter (usually waste) into two useful products – the earthworm biomass and a high quality organic amendment, vermicompost. The vermicompost promotes the plants growth up to 50-100% more w.r.t conventional composts and 30-40% more w.r.t chemical fertilizers. It is also rich in Nitrogen, Phosphorous, Potassium and micro-nutrients which enhances the plant growth and plant health and yield of the crop.

Objectives:

To help in achieving zero waste campus theme, managing garden waste and byre waste is equally important. As it is real time problem, our contribution to the project will also help the ashram to build composting yard.

1. Collection of locally produced wastes such as Cow dung, garden waste, *Gliricidia sepium* (commonly called as manure plant).
2. To evaluate the efficiency of various compost produced.

3. To propose the optimum combination of compost for large scale implementation in Ramakrishna Vivekananda Ashram Panchavati Tadas.

Methodology:

The materials used for present work is as follows: Garden waste, Cow dung, *Gliricidia sepium,* Decomposer, Earth Worms (*Eudriluseuginiae*), Vermireacters, pH meter, Conductivity meter, Oven

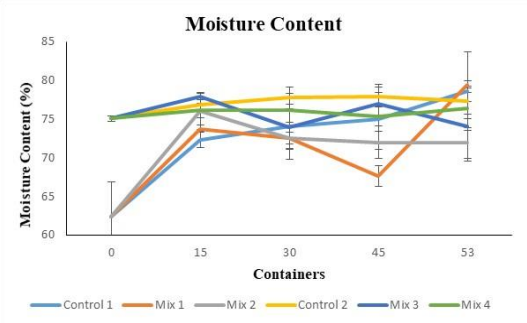
The experiment basically contains of 7L capacity plastic containers. Containers are washed thoroughly before using and sufficient numbers of holes are made at the bottom and sides of the container to allow the excess water to flow out of it. Garden waste selected as bedding material, it is shredded to 25mm down size, to support the faster decomposition. Cow dung is used as worm food source. *Gliricidia sepium*is used in last three sets of the experiment. Experiment is broadly bifurcated into 2 categories:

1. Without *Gliricidia sepium* with the composition is garden waste 60% and cow dung 40%.
2. With *Gliricidia sepium* with the composition garden waste46.36%,*Gliricidia sepium* 13.63% and cow dung 40%.

For the main experiment, 7L containers are selected. The experiments are carried out in six combinations, all in triplicates. The total number of containers used are 18. The combination of bedding material and worm food source are taken as mentioned above. Experiment was setup at 0th day with dry weight of 1100g waste in each container and the composition as mentioned above. For decomposer containers, decomposer is added in 0th day with proportion of 2kg decomposer in 14L water for 1ton organic waste 20g earthworm species *Eudrilus euginiae* are introduced in vermicompost containers after partial decomposition of 15days from setup. Watering and turning is done every alternate day. Moisture content maintained approximately 40-50%. Moisture shall be tested by hand squeeze method. Finally the efficiency of compost is compared by using the parameters like moisture content, pH, conductivity, change in weight and change in volume at every 15 days and Nitrogen, Phosphorous, Potassium and C/N ratio at the end of the composting process.

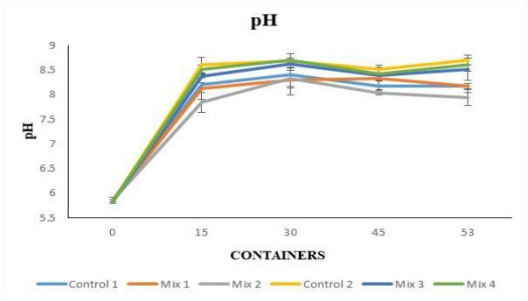
Results and conclusions:

1. Moisture:



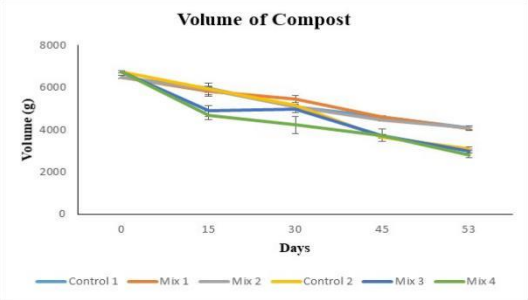
Moisture content of 0th day was around 60 to 75%. 70 to 80% moisture content was maintained throughout the experiment.

2. pH:



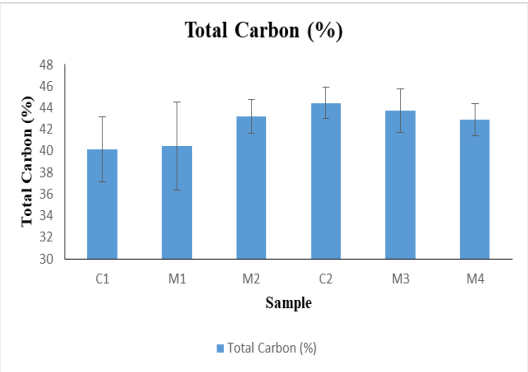
The pH content of the control compost C1 and C2 are in the range of 8.175 and 8.7 respectively. pH of M1, M2, M3 and M4 lies in the range of 7.8 – 8.6. According CPHEEO manual 2016, pH should be in the range of 6.5 – 7.5. The pH is high due to high nitrogenous excretion and bicarbonates present in the mixes.

3. Change in Volume:



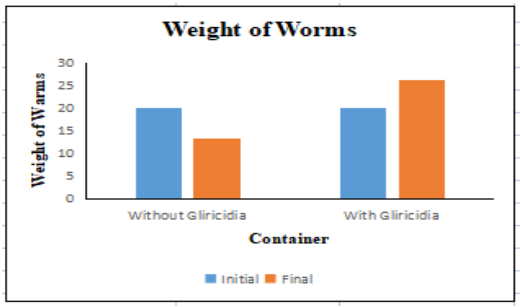
Volume of the compost is gradually decreasing from 0th day to 53rd day. Volume of compost without Gliricidia sepium combination has been reduced to around 4L from 6L i.e 33% volume reduction and with Gliricidia sepium combination has been reduced to around 3L from 5L i.e 40% volume reduction. Gliricidia sepium helps in rapid decomposition of manure

4. Total Carbon:



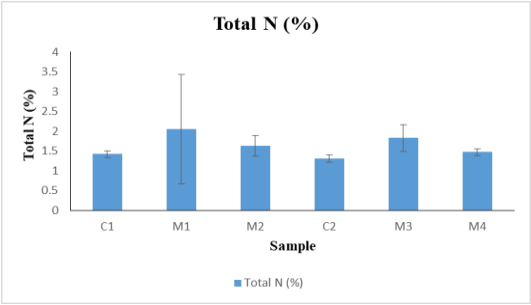
The total carbon content of the control compost C1 and C2 are, 40.1% and 44.45% respectively. Carbon content of M1, M2, M3 and M4 lies in the range of 40 to 43%. According to CPHEEO manual 2016, minimum carbon organic content should be 7.9%. According to compost report interpretation guide. Total carbon (C) is a direct measurement of all organic and inorganic carbon in the compost sample. Unless the sample has a high pH (> 8.3) or is known to contain carbonates, essentially all carbon will be in the organic form. Compost organic matter typically contains around 54 % organic carbon by weight. The carbon content of individual feed stocks may vary from this ratio.

5. Change in the weight of the worm:



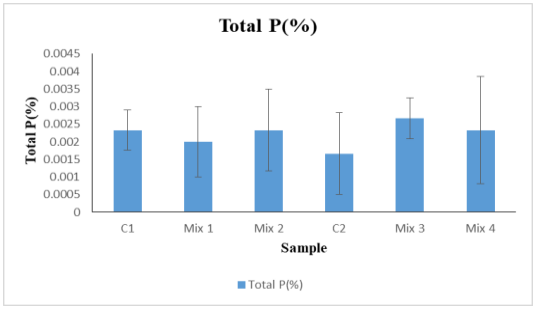
From the graph it is observed that, weight of earthworms (*Eudrilus euginiae*) in the without *Gliricidia cepium* container has reduced to 20 g to 13.2g, while the weight of earthworms (*Eudrilus euginiae*) in the with *Gliricidia cepium* container has increased to 20 g to 26.147g.

6. Nitrogen:



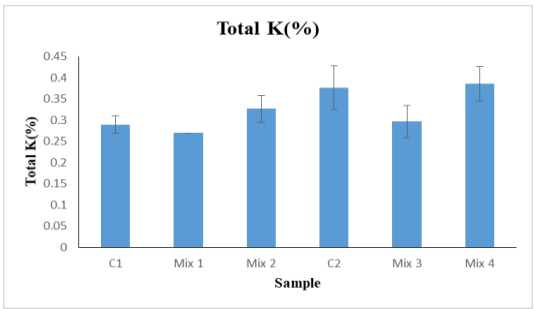
The Total Nitrogen (TN) content of the control compost C1 and C2 are, 1.4% and 1.6% respectively. Nitrogen content of M1, M2, M3 and M4 lies in the range of 1 to 2%. From the results it is clear that the TN content vermicompost is greater than that of the decomposer compost. According CPHEEO manual 2016, minimum TN should be 0.8% by weight

7. Phosphorus:



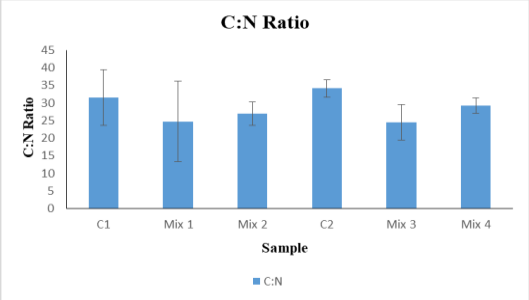
The Total Phosphate (TP) content of the control compost C1 and C2 are, 0.0023% and 0.0016% respectively. TP of M1, M2, M3 and M4 lies in the range of 0.001 to 0.003%. According CPHEEO manual 2016, minimum TP should be 0.4% by weight.

8. Potassium:



The Total Potassium content of the control compost C1 and C2 are, 0.3% and 0.38% respectively. Total Potassium of M1, M2, M3 and M4 lies in the range of 0.25 to 0.4%. According CPHEEO manual 2016, minimum TP should be 0.4% by weight.

9. C/N Ratio:



Carbon Nitrogen ratio of control compost is comparatively higher w.r.t other two set of composts i.e the value of C/N of C1 and C2 are 31.5 and 34.1 respectively. The C/N ratio of M1 and M3 are in the same range while the M2 and M4 are in the same range. According CPHEEO manual 2016, C/N ratio should be <20 i.e less than 20:1.Carbon reduces because heterotrophic bacteria use organic material as source of electron and carbon is oxidized to CO 2 and releases to atmosphere.

From the results obtained, it can be concluded that M3 combination i.e vermicompost with Gliricidia sepium can be selected. Results of the M3 combination are as below.

Sl No	Parameter	Results	Standards (CPHEEO Manual)
1	Moisture Content (%)	74.03	Optimum 60% to 90%
2	pH	8.518	6.7 -7.5
3	Conductivity(µS)	0.782	< 8.2
4	Total Carbon (%)	43.72	< 54
5	Total Nitrogen(%)	1.823	More than 1
6	Total Phosphate(%)	0.003	Minimum 1.0
7	Total Potassium(%)	0.33	0.4
8	C/N Ratio	24.51	Less than 20

As M3 is found as feasible option from the above results and the weight of earthworms has also increased in this combination, composition of M3 can be adopted for large scale implementation in Ramakrishna Vivekananda Ashram Panchavati Tadas. To obtain 500g of compost, 150g *Gliricidia sepium,* 450g garden waste, 400g cow dung shall be used which make 1000g of raw matrial. This combination can be scaled up for waste generated from 75 acres horticulture land, *Gliricidia sepium* which is grown in the farm and cow dung generated from 10 cows. Optimum number and size of vermipits shall be prepared based upon the waste generated.

Scope of the future work:

This project can be carried further with different combinations. Project shall be continued further to get optimum NPK content and C/N ratio. Difference species of worms can be introduced into the compost and performance can be evaluated. Project can be continued to be found microbial count in the compost. Scaling up of project, design of vermipits shall be considered as future scope of this project.