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Organic waste management in Bongaigaon Polytechnic Institute, Assam through Vermicomposting

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Abstract : Vermicompost is an eco-friendly method to reprocess organic wastes and to produce valuable compost through interaction between earthworm and microorganism. Earthworm consume organic waste and excrete it in digested form. This process reduces wastes in landfills and enriches the soil, improving its structure, aeration, and nutrient content than the rate of destruction achieved by other technologies. Here, earthworms of the species *Eisenia fetida* were introduced and the process was allowed to proceed for 62 days using Bin methods. Worms work indefatigability, eating up to half their body weight in scraps daily and converting it into compost, rich in Phosphorus, Nitrogen, and Potassium. During the experiments of composting process the different physico-chemical features such as temperature, moisture content, pH, Nitrogen, Phosphorous and Potassium were analysed. This research contributes to our understanding of vermicomposting as an effective waste management technique in Bongaigaon Polytechnic Institute, Assam. From the present study, it can be concluded that earthworm are potentially important that are capable of transforming wastes to value added product.

Keywords**: - *Eisenia fetida*, Vermicomposting, pH, Nutrient content, Organic Wastes.**

I. INTRODUCTION

Unwanted and useless resources are produced as a result of population growth worldwide. Waste generation is reportedly growing at a pace of 1% per year, which might result in 260 million tons of waste by 2047. Approximately 40–60% of this waste mass is organic garbage. It consists of agricultural waste, sewage sludge, food waste, garden yard trash, livestock manure and more. Vermicomposting, including the utilization of earthworms, is a strategy to alter organic waste in an environmentally benign manner while addressing disposal issues and reducing pollution. It provides an affordable and sensible option.

The substance that covers the ground's surface and supports plant life is called soil. Soil is essential to most life on Earth. Degradation of the ecosystem, especially soil fertility, has resulted from the extensive use of chemical fertilizers. Global acceptance of chemical fertilizers was based on their ability to raise crop yields. However, over fertilization can contaminate the air, water, and soil. Fertilizers can enter the food chain when they are used excessively because they are absorbed by plants through the soil. Thus, it's imperative that we recognize the need for organic farming in order to combat any potential dangerous land degradation in the future and, more importantly, to prevent humanity from suffering greatly. Vermicompost is nutrient-rich and entirely organic. It doesn't harm the environment and aids in maintaining soil fertility. Landfill building is decreased by processing or turning kitchen garbage and other organic matter into beneficial compost. One of the significant Species for the breaking down organic waste is the Earthworm. Therefore, by enabling us to maintain biodiversity in our soils and efficiently reuse resources, vermicomposting promotes a circular economy importance.

Earthworm consume organic waste when the right substances are met, which lowers the volume of waste by 40-60% Earthworm activity produces vermicompost, which is rich in macro and micronutrients, vitamins, growth hormones, enzymes like protein, lipase, cellulose, and chitinase, and immobilised microflora..Using earthworms to aid in the vermicomposting process, this study aims to manage the organic waste generated in our Bongaigaon Polytechnic hostels. Furthermore, to examine the physiochemical parameters, such as nutrient contents, pH levels, and C/N ratio, and to facilitate the breakdown of organic waste materials including cow dung, banana trunks, banana leaves, dry leaves, and food waste into nutrient-rich compost.

II. ADVANTAGES OF VERMICOMPOSTING:

- Improves Soil Aeration.
- Increase the soil organic matter.
- Improves water holding capacity of soil and enhances plant growth and crop yield.
- Suppression of soil –born plant diseases.
- Provides plant with essential nutrients.

III. MATERIALS AND METHODS

Waste collection and Feeding material

Wastes are collected from Bongaigaon Polytechnic Hostels containing kitchen waste such as bread, banana peels, egg shells, fruits and vegetable wastes. Banana leaves and dry leaves were collected in an around the campus and added. Banana stems were cut into shreds and added. All are biodegradable waste and arranged in a layer basis and this acts as a feeding material. Also, soil is added approximately 10%.

Method of Preparation

There are mainly two methods of vermicomposting preparation that is bin and pile. We have used bin method of height 1 foot, length 6 foot and width 3 foot. Some holes (around 20 holes) with 1 cm in diameter are provided in bottom and sides for proper draining and aeration. Before feeding the worms by wastes it is necessary to apply worm's bed. This is the lower most layer of earthworm feed substrate. A height of 25 cm bedding is prepared with a mixture of shredded newspaper, cardboard, saw dust and animal manure. The selected bedding material will minimize the oxygen blockage thereby, maintaining the right amount of moisture in the bin.

Selection of Earthworms

The selection of suitable earthworm species is an important step for the process of vermin composting. As per study, there are mainly two types of earthworms that is burrowing and non-burrowing types. Non-burrowing earthworms are the most efficient in compost making. They convert the organic waste into vermicompost faster than the burrowing earthworms. They can tolerate temperature ranging from 0 to 35° C. Non-burrowing type red earthworm species like *Eisenia fetida* are collected from nearby district which is preferred for vermin composting process due to its ability to consume 90% of organic waste and 10% of soil.

Important Parameters to be considered in Vermicomposting:

Potential Hydrogen (pH):

pH content is the essential parameter in vermicomposting process. For survival of earthworm acidic content in the bin should be as low as possible. So, pH value was continuously monitored with the help of pH meter and the optimum range of Potential Hydrogen 6.5 to 7.5 has been maintained.

Temperature:

Temperature is the main factor in vermicomposting process for the growth of earthworms. Decrease in temperature below 10°C may result in death of earthworm and increase in temperature may result in reducing the reproduction rate as well as the total activity of earthworm. As per the climatic condition in our locality, the maximum temperature attains around 35°C. So, it is convenient for vermicomposting process. Thermometer is also used to measure temperature.

Moisture content:

Earthworms contain 70 to 90 % water in their bodies and they breathe from their skin. The drop in moisture content below 60% can reduce the earthworm breathing rate. So, the optimum level of moisture content is maintained 70 to 80 % by Sprinkling of water on daily basis and by covering gunny bags.

C/N ratio:

Carbon to Nitrogen ratio is overall good predictor of plant available Nitrogen.. It greatly depends on the parent material used. The raw material must be combined in such a way that the ratio of Carbon to Nitrogen remains in the range of 25 to 30. After decomposition, the ratio of C/N should be less than 20.

Setting up of Bin:

a) Set up bin and let the food waste to decompose partially for 7 days before adding earthworms.
b) Protect the bin from direct Sunlight with the help of shade.
c) Add food waste and start slightly so that they do not over feed them.
d) Add waste daily /weekly basis as per quantity of worms.
e) For the first night, use porch light at the worm bin.
f) Cover the bottom of the bin with a layer of shredded newspaper.
g) Apply food waste in a fairly even layer across the bin.

Length of the Bin – 6 feet, Width of the Bin -3 feet, Height of the Bin - 1 feet

Surface area of the Bin – 54 feet^2.

Table -1: Organic Waste generated per month in Bongaigaon Polytechnic Hostel :

Month	Organic Waste generated in kg.
November /2023	15
December /2023	18
January/2024	20
February /2024	12

Total Organic Waste generated = 65 kg

Organic waste generated from Hostels along with cow dung, soil, dry leaves, banana stem were added to the surface area of the bin and as a whole the total mass is approximately 73 kg.

Weight of each earthworm taken = 0.35 to 0.6 g

Length of each earthworm taken= 3.5 to 6 cm

Number of earthworms laid = 2200 pieces

Figure 1: Vermicomposting using bin method in Bongaigaon Polytechnic Institute

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IV. RESULTS AND DISCUSSION

After 62 days, we generated approximately 23 kg of vermicompost in the current study . Also, the physic-chemical characteristics analysis of vermicomposting was conducted to determine the pH, Total Nitrogen, Total Phosphorous, Total Potassium and C/N ratio. The nutrient composition was examined. The key finding of the parameters available in vermicompost is shown in the tabular form:

Table-2: Observations

Sl.No	Parameters	Vermicompost
1	Nitogen (N)	2.30%
2	Phosphorous (P)	1.73%
3	Potassium (K)	1.20%
4	C:N Ratio	15:1
5	pH	6.6

Calculation of Dry moisture content :

An experiment *was* carried out to calculate the dry moisture content of the vermicompost.

A sample of 20 grams were taken and dried for one day at a temperature of about 105° C using oven drying method. Initial and final moisture were calculated using the below stated equation

$$\% \text{ Moisture content}, w = 1 - \frac{\text{moisture conent after drying in grams}}{\text{moisture content before drying in gram}} \text{ x } 100$$

$$= 1 - \frac{12.34}{20} \quad = 38.3\%$$

Productivity of vermicompost:

= (Harvested vermicompost /total mass of feed in kg) x 100

= 25/73 x100

=34.24 %

V. CONCLUSION

Vermicomposting improves soil fertility rate and plant growth, and it is an excellent application in agriculture. However, it is preferable to investigate the long-term consequences of its use. Nonetheless, this method facilitates the management of organic leftovers, allowing for waste disposal.

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