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Vermicomposting with Cow Dung, Banana Plant and Vegetable Waste

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Abstract - *Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to convert the organic waste into compost rich in nutrients. Nowadays, farmers mostly use chemical fertilizers for agricultural purposes, which pollute the soil and decrease their fertility and also contaminate the groundwater. Vermicompost has been proposed to be used in the place of chemical fertilizers for overcoming the problems and to utilize organic waste. Vermicompost has better water holding capacity, which also increases the fertility of the soil. Vermicomposting technology can be characterized as environmentally friendly and sustainable. The objective of the topic is to study various techniques adopted by people in the industry as well as in researches and develop vermicompost using organic wastes by optimizing the methods as obtained from the study. To do certain tests in order to check the stability of obtained vermicompost.*

Key Words: Eisenia Fetida, cow dung, banana plant stem, vegetable waste

1. INTRODUCTION

Recycling of organic waste through vermicomposting is very popular globally due to its ability to convert the waste to manure as a substitute for chemical fertilizers. Banana is grown in about 120 countries in the world which generates about 86 tonnes of crop waste per hectare. In India, it is cultivated in 4.6 lakhs hectare area with a production of 14.2 t and productivity of 30.5 t/ha. The whole plant (leaves, stem, and rhizome) of banana, after harvesting of the fruits, is left in the field which takes several months to degrade naturally. Such banana plant-derived wastes can also be utilized for recycling through vermicomposting. Earthworms, in vermicomposting, are used to derive a stable compost rich in available plant nutrient elements and plant growth hormones than traditional composting. Among the several epigamic earthworms Eisenia Fetida is most favored for vermicomposting due to its wide range of tolerance towards different environmental variables. In vermicomposting, earthworms have a crucial role, as they influence the activity of microorganism through fragmentation and ingestion of the organic matter. The importance of earthworm microbial communities is well documented in the vermicomposting of lignocellulosic materials.

1.2 COMPOSTING

Composting is a microbiological conversion of organic residues of plant and animal origin to manure rich in humus and nutrients by various micro-organisms including bacteria, fungi, and actinomycetes in the presence of oxygen (Fig. 1). During the process, it releases by-products such as carbon dioxide, water and heat.

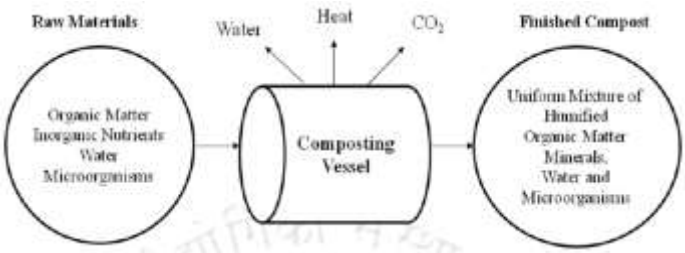

Figure-1: Composting Process

1.3 Vermicompositing

Vermicomposting has been arising as an innovative eco technology for the conversion of various types of wastes into vermicompost. Vermicompost is humus like, finely granulated and stabilized material which can be used as a soil conditioner to reintegrate the organic matter to the agricultural soils. Industrial wastes remain largely unutilized and often cause environmental problems like ground and surface water pollution, foul odors, occupying vast land areas etc. Non-toxic and organic industrial wastes could be potential raw material for vermitechnology. In the last two decades, vermitechnology has been applied for the management of industrial wastes and sledges and to convert them into vermicompost for land restoration practices. The success of the process depends upon several process parameters like quality of raw material, pH, temperature, moisture, aeration etc., type of vermicomposting system and earthworm species used.

2. METHODOLOGY

2.1 Collection of material:

The partially decomposed material was mixed with cow dung in three different ratios (Table 1). The experiment was conducted in the bed of size (length 6, width 2 and height 2) ft. The bed was filled with Banana plant stem, cow dung, and vegetable waste according to the different treatments. Healthy, juvenile earthworms of Eisenia Fetida were released in the bed at the rate 40.

Table-1: Description of materials used and their ratio in the experiment

Sample	Ratio
Cow dung	1
Cow dung and banana plant stem	3:2
Cow dung , banana plant stem and vegetable waste	3:1:1
Cow dung and vegetable waste	3:2

2.2 Earthworms

Earthworm are several types which are used in carbon-based composting but the some worms are mostly use for vermicomposting mainly Eisenia Fetida which have high conversion rate about 55-60 days. Efficient epigamic species such as E. Fetida were compared with local earthworm species such as Perionyx sansibaricus, Pontoscolexcorethrurus and Megascolexchinensis for their composting efficiency. The efficiency was assessed in terms of the time taken for vermicomposting, quality of the compost and biomass potential of the earthworms at compost maturity. In this project Eisenia Fetida are use which are high conversion rate.

2.3 Cow Dung

Cattle dung offers food for a varied range of animal and mildew species, which pause it down and recycle it into the nutrition chain and into the topsoil. In areas where cows (or other animals with parallel dung) are not native, there are frequently also no native species which can breakdown their dung, and this can lead to infiltrations of pests such as flies and scrounging worms In Australia, slurry beetles from away have been presented to help reprocess the cattle dung rear into the soil. (See the Australian Dung Insect Scheme and Dr. George Bornemissza).[9] Cattle have a usual dislike to feeding round their own dung. This can main to the construction of bigger unglazed patches of extremely manured sward. These environment patches, termed "islets", can be helpful for many parkland arthropods, counting spiders (Araneae) and microbes (Hemiptera). They have an significant function in continuing biodiversity in heavily utilized grasslands.

2.4 Banana Plant Waste

Banana is one of the world's utmost important fruit crops that is broadly cultivated in humid countries for its valued requests in food production. Its enormous by-products are an outstanding foundation of highly valued raw materials for additional industries by reutilizing agricultural waste. This stops an ultimate loss of massive amount of untapped biomass and environmental matters. This analysis discusses widely the advance in the utilization of banana by-products such as peels, leaves, pseudo stem, stalk and inflorescence in several food and non-food applications helping as coagulating agent, skin color and flavor, another source for function and micronutrients, nutraceuticals, cattle feed, normal fibers, and sources of accepted bioactive compounds and bio-fertilizers. Forthcoming prospects and tests are the significant key factors deliberated in suggestion to the sustainability and possibility of applying these by-products. It is significant that entirely available by-products be twisted into highly profitable outputs in instruction to withstand this renewable source and provide other income to small measure farming industries without cooperating its class and care in competing with further commercial crops. Banana is one of the initial crops cultivated in the antiquity of human farming. Banana by-products have remained used for wraps foods, clothes and used in many ceremonial times and the practice expands finished cultural divergence. Modern agriculture usually group's banana into fruit crop or cash crop produces alongside through several other crops such as oil palm, sugarcane, pineapple, mangoes and rice. Similarly, about of these commodities do produce massive amount of cellulostic discarded termed as cultivated waste or biomass. Origination in managing such a huge amount of agricultural waste and biomass is a continuous contest and current trends kindness the consumption of this biomass designed for value additional purposes to satisfy the need in the zones such as renewable dynamism, fiber mixtures and textiles, food replacements and livestock feedstuff.

2.5 Vegetable Waste

Vegetable wastes occur throughout the supply chain and vary widely depending on its processing. Globally, more than 30 % of the loss occurs at the retail and consumer levels, of which the post-harvest and processing level wastages account for the major share. The wastes so generated pose an environmental threat and call for the development of a pollution-free model. Studies on the characterization of unutilized, rotten, and discarded fractions of the vegetable wastes indicate their potential candidature for reprocessing. Generation of renewable dynamism by bioconversion of potato wastes is ahead significance as it has verified to be a capable means of applying the fresh vegetable residues. Researchers and industries are nowadays fully engaged in an amount of projects including the technology of ''waste to fuel'' with an understanding to overcome the dumping problems. The present item deals through the studies directed on vegetable wastes for manufacture of several types of biofuel.

2.6 Methods of Vermicomposting

2.6.1 Bed method: In bed method, the open bed is constructed which are uses 1st class bricks, and the bottom of the bed is fixed to restrict the worms. The bed method is easy to maintain so that is why we used the bed method. Vermicompost was developed in four different ratios that are why four beds are required for sample and size of the bed is (6x2x2) ft. The bed was constructed on the pucca / kachcha flor using 1st class bricks. This size bed is used for small-scale vermicomposting for personal requirements (5-10 tonnes of vermicompost annually). This method is easy to maintain and practice. The tops of the beds were covered with thin mesh, to allow gaseous exchange.

2.6.2 Pits below the ground: Pits made for vermicomposting are 1 m deep and 1.5 m wide. The length varies as required.

2.6.3 Heaping above the ground: The waste material is spread on a polythene sheet placed on the ground and then covered with cattle dung. Sunitha et al. (1997) compared the efficacy of pit and heap methods of preparing vermicompost under field conditions. Considering the biodegradation of wastes as the criterion, the heap method of preparing vermicompost was better than the pit method. Earthworm population was high in the heap method, with a 21-fold increase in Eudriluseugenae as compared to 17-fold increase in the pit method. Biomass production was also higher in the heap method (46-fold increase) than in the pit method (31-fold). Consequent production of vermicompost was also higher in the heap method (51 kg) than in the pit method (40 kg).

2.7 PLANT GROWTH AND DEVELOPMENT

Beginning second week after transplanting, the impact of substrate medium on plant growth/development, yield and nutrient uptake in strawberry was studied. Biweekly, the following parameters were measured: the number of runners (stolons), leaf number, fruit number, fruit fresh weight, yield, fruit size, marketability (score 1–4; 1 – extra quality; 2 – good quality; 3 – medium quality; 4 – non marketable).

2.8 PHYSICAL PARAMETERS OF VERMICOMPOST

2.8.1 Determination of pH

It is defined as the negative log to the base 10 of the H+ ion concentration. The pH of the sheet materials was determined Potentiometric method using a digital pH meter. Thirty gm of air-dried sample passed through a 2mm sieve was transferred to a clean 100ml beaker to in which 60ml of distilled water was added. The contents were stirred intermittently and the sample suspension was again stirred just before taking the reading. The electrodes were immersed into the beaker containing sample water suspension and meter readings both in the supernatant solution and suspension were recorded.

2.8.2 Determination of Electrical Conductivity (EC)

Electrical conductivity is the quantity of complete amount of soluble salts existing in the sample and is expressed asmillisimens/cm (mS/cm). To 5 gm of the trial sample, 50 ml of distilled water was added, enthused well and the suspension was permissible to settle for 8 hrs. The electrode of the conductivity cell was deep into the sample solution and the EC was read and expressed in millisimens/cm (mS/cm).

3. CONCLUSIONS

I. Vermicomposting involves harnessing the services of epigamic earthworm species which consume the surface litter for the conversion of organic wastes into vermicompost, to produce excellent organic compost.
II. Earthworms consume various types of organic waste mainly cow dung under favorable conditions; these include agriculture waste like banana waste, and vegetable waste.
III. Composting which harnesses these appearingFetida worms is a faster way of organic decomposition than clean vermiculture method using profound burrowing worms.
IV. The SOUR test appeared to be proper for the evaluation of process usefulness, as it could differentiate among the two process plans.
V. The present-day findings highlight the assumed to use of organic medium i.e. Sawdust on top of the widely used coco soil as substrate medium in strawberry culture. The presentation of plants grown on Pum-Saw (50-50), followed by the Coc-Saw (50-50) and then by Coc-Pum (50-50) is markedly influenced by the media and the alteration of physicochemical properties (such as porosity, water content and air capacity) of raw material and hence the air and water balance in the root environment. Further research study is necessary for the complete exploitation of the putative use of sawdust in substrate mixtures as pure or composted material and of its ability to improve physicochemical properties as substrate.

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