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Management of kitchen waste by using the vermicomposting method in Solapur

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ABSTARCT

Vermicomposting is a process in which earthworms are used to convert organic materials into humus-like material known as vermicompost. A number of researchers throughout the world found that the nutrient profile in the vermicompost is generally higher than traditional compost. In fact, vermicompost can enhance soil fertility physically, chemically and biologically. Physically, vermicompost-treated soil has better aeration, porosity, bulk density and water retention. The chemical properties such as pH, electrical conductivity and organic matter content are also improved for better crop yield. Nevertheless, the enhanced plant growth could not be satisfactorily explained by improvements in the nutrient content of the soil, which means that other plant growth influencing materials are available in the vermicompost's. Although vermicompost's have been shown to improve plant growth significantly, the application of vermicompost's a thigh concentration could impede the growth due to the high concentrations of soluble salts available in the vermicompost's. Therefore, vermicompost's should be applied at moderate concentrations in order to obtain maximum plant yield. This review paper discussed in detail the effects of vermicompost on soil fertility physically, chemically and biologically. Future prospects and economy on the use of organic fertilizers in agriculture sector were also examined.

Keywords— *Vermicomposts, Management of Kitchen Waste*

1. INTRODUCTION

Every home kitchen generates food scraps for disposal. Throwing these scraps in the garbage can create odor problems and adds to the volume of waste going to the landfill. Disposing of kitchen scraps in a garbage disposal is convenient, but it adds to the burden of the waste-treatment system and throws away a potentially valuable resource. Furthermore, garbage disposals are not recommended for homes that rely on a septic system for waste disposal. A viable alternative to disposing of food scraps in the landfill or the sewer system is to compost them. The resulting material is a useful addition to gardens and potted plants. Industrialization and Urbanization is increasing day-by-day. As a result of this the generation of solid waste is a major problem all over the country within the urban as well as rural area. In view of this the management of solid waste produced is of prime need to keep the environment safe and clean.

Information on classification and characteristics of solid waste will enable to decide appropriate decision about the collection and transportation of waste produced. Various disposal methods of solid waste will enable to recommend suitable method of disposal of solid waste with economy and acceptable environmental constraints including reuse and recycle wherever applicable. Content on other types of solid waste such as biomedical waste, Construction waste, E-waste and plastic waste will useful in deciding appropriate method for collection,

transportation and disposal of these wastes. Thus, the knowledge of solid waste management with the concept like recycling, recovering and reuse will lead to proper disposal with acceptability. This will further lead to keeping the natural resources condemnation free.

Due to increasing in population, rapid industrialization and trend of urbanization, the problem of various types of man-made waste products are gradually increasing. There are different types of wastes like solid, liquid and gas, which are needed to be handled and the solid waste management itself covers a vast field. Solid wastes are produced at different sources i.e., institutional, commercial, agricultural and industrial. Utilization of these waste materials for productivity process is important for both economic and environmental reasons. Agricultural waste, city garbage and kitchen waste has been recycled with vermicomposting along with bio-conversion of organic waste material into nutrition rich vermicompost by earth worm activity.

Vermicomposting is an important aspect as it converts waste to wealth by using cheap eco-friendly option with activity of earthworm. Every home kitchen generates food scraps for disposal. Throwing these scraps in the garbage can create odor problems and adds to the volume of waste going to the landfill. Disposing of kitchen scraps in a garbage disposal is convenient, but it adds to the burden of the waste-treatment system and throws away a potentially valuable resource. Furthermore, garbage disposals are not recommended for homes that rely on a septic system for waste disposal. A viable alternative to disposing of food scraps in the landfill or the sewer system is to compost them. The resulting material is a useful addition to gardens and potted plants.

2. VERMI-COMPOSTING

Vermicomposting technology is one of the best options available for the treatment of organics-rich solid wastes. The term vermi composting is coined from the Latin word 'Vermis' meaning to the 'worms. Vermi composting refers to composting or natural conversion of biodegradable garbage into high quality manure with the help of earthworms. Earthworms play a key role in soil biology; they serve as versatile natural bioreactors to harness energy and destroy soil pathogens. The worms do so by feeding voraciously on all biodegradable refuse such as leaves, paper (non-aromatic), kitchen waste, vegetable refuse etc. Earth worms have been used for waste stabilization for many years, especially in Southeast Asian and European countries.

In vermicomposting, the primary agents of decomposition are worms. They convert raw organic wastes to a nearly stable humus-like material. The main process by which organic materials are converted occurs as the wastes pass through a worm's gut and are digested by the worm. Worms stir and aerate the waste pile, so that turning is not required. Worms can stabilize organic materials faster than microorganisms because they grind the material, thus increasing its surface area and speeding decomposition by microorganisms. The material that results from the vermicomposting process is called vermicompost. Material that actually passes through the gut of a worm is called castings. Vermicompost contains a large fraction of castings, but some of the material will have decomposed from micro-organisms alone, without passing through a worm.

The most common composting worm species in North America is Eisenia fetida. Common names for this worm include tiger worm, brandling worm, red wiggler, and manure worm. This worm is a litter dweller; i.e., it likes to live in piles of organic matter such as leaf litter. Earthworms, such as the night crawler, are burrowing worms that live deeper in the earth. They are not composting worms. Worms do not have eyes, but they do have light receptors on their skin. They do not like light, and will quickly dig down into a bin to avoid it. For this reason, it is a good idea to provide a cover for your worm bin.

3. VERMI-COMPOSTING MATERIALS

Decomposable organic wastes such as animal excreta, kitchen waste, farm residues and forest litter are commonly used as composting materials. In general, animal dung mostly cow dung and dried chopped crop residues are the key raw materials. Mixture of leguminous and non-leguminous crop residues enriches the quality of vermicompost.

There are different species of earthworms viz. *Eisenia fetida* (Red earthworm), *Eudriluseugeniae* (night crawler), *Perionyx excavates* etc. Red earthworm is preferred because of its high multiplication rate and thereby converts the organic matter into vermicompost within45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top.

3.1 Types of Vermicomposting

The types of vermicomposting depend upon the amount of production and composting structures. Small-scale vermicomposting is done to meet the personal requirement and farmer can harvest 5-10 tons of vermicompost annually. While, large-scale vermi composting is done at commercial scale by recycling large quantity of organic waste with the production of more than 50 – 100 tons annually

3.2 Methods of Vermicomposting

Vermi composting is done by various methods, among them bed and pit methods are more common.

1. Common Bed method: Composting is done on the pucca/kachcha floor by making bed (6x2x2 feet size) of organic mixture. This method is easy to maintain and to practice

2. Pit method: Composting is done in the cemented pits of size 5x5x3 feet. The unit is covered with that chgrass or any other locally available materials. This method is not preferred due to poor aeration, water logging at bottom, and more cost of production.

3.3 Process of Vermicomposting

- Vermicomposting unit should be in a cool, moist and shady site
- Cow dung and chopped dried leafy materials are mixed in the proportion of 3: 1andarekept for partial decomposition for 15– 20 days.
- A layer of 15-20cm of chopped dried leaves/grasses should be kept as bedding material at the bottom of the bed.
- Beds of partially decomposed material of size 6x2x2 feet should be made(fig.3).
- Each bed should contain 1.5-2.0q of raw material and the number of beds can be increased as per raw material availability and requirement.
- Red earth worm (1500-2000) should be released on the upper-layer of bed (fig.4).
- Water should be sprinkled with can immediately after the release of worms(fig.5)
- Beds should be kept moist by sprinkling of water (daily) and by covering with gunny bags/polythene(fig.6)
- Bed should be turned onceafter30 days for maintaining

aeration and for proper decomposition.
- Compost gets ready in 45-50days (fig.7).
- The finished product is 3/4thof the raw materials used.

3.4 Vermicompost Preparation
Step 1: Buy and Prepare the Bin
Step 2: Find a Spot for the Compost Bin
Step 3: Shred Paper for Bedding
Step 4: Add Food and Wait
Step 5: Add Worms
Step 6: Feed the Bin
Step 7: Harvest the Castings

3.5 Characteristics of Vermicomposting
Harvest the found indeciduous woodlands and mixed forests
- Black, odorless and crumbly substrate
- Balanced nutritional composition for plants
- It contains an above-average number of micro-organisms which revitalize the soil
- Loose yet stable soil structure (clay-humus complexes)

3.6 Source material for the fodder
(a) Animal excrement from:
- Cattle
- Horses
- Sheep
- Pigs
- Poultry
- Goats
- Hares
- Donkeys

(b) Vegetable waste
- Hay
- Grass, silage (retains moisture)
- Weeds
- Leaves
- Foliage, for example from tea or coffee trees (chopped small)
- Cereals
- Coffee pulp
- Bean pods
- Banana and orange peelings

(c) Forest soil, ash
(d) Pre-composted kitchen waste
(e) Fish remains, seaweed

4. CASESTUDY

4.1 Site Visit Detail
Place of visit: Lok Mangal agro-industry, Solapur.
Purpose of visit: To know the process composting in agro-industry
Date of visit: 28/12/2020

4.2 Composting
- Disposal of solid waste by composting.
- Incompostingsolidwasteisconvertedintohumanslikematerialwhichismeasurebythe decomposition of solid waste under aerobic condition
- These humans are having demand as fertilizer for forms

Advantage
- It produces manure which is useful for increasing yield of crop.
- Prevent erosion of soil.
- Improves soil aeration.

Disadvantage
- Method is suitable for small to medium size towns.
- For contouring moisture content separate care has to take.
- Separate mechanism for collection solid waste is needed.

4.3 Composting Process
composting process may begin as soon as the raw material are mixed together during the initial stage of process oxygen and the easy degradable component of the raw material are rapidly consumed by the micro-organisms the temp. of the window or the pile is directly related to the micro-organism activity of the window and is good indicator of what is going on inside the temperature of composting material generally

follow pattern of rapid increase gene ally increase 120–140-degree F. where it is maintaining as activities by composting slow temperature will gradually drop with the compost reaches anticair temperature.

A curing process usually follows the activities composting period during the caring period. The material with continue to slowly decomposed material with continue to slowly decomposed material a continue to break down unit. The last easily decomposing raw material are consumed by the remaining micro-organism.

4.4 Process of composting
4.4.1 Includes Three Stage
- Preparation of solid waste
- Decomposition of solid waste
- Marketing of final product

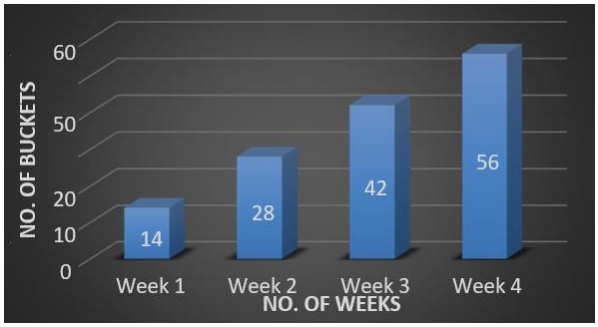
4.4.2 Factors affecting composting
Usually there are five factors affected by composting
- Oxygen
- Carbon nitrogen ratio
- Particle size
- Moisture
- Temperature
- PH
- Bleeding and seeding
- Air-calculation

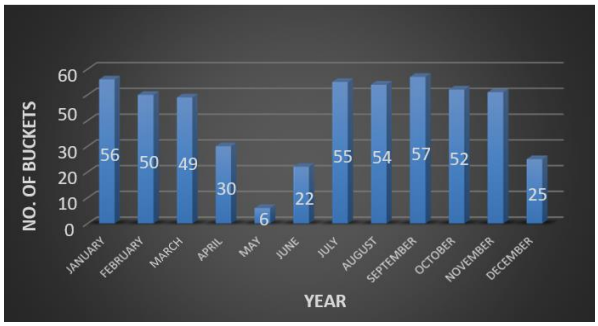
(a) Oxygen: Aerobic composting consumes large amount of oxygen particularly during the initial stage is much strong and odors process. A minimum oxygen concentration of 5% within the narrow stage of composting oxygen levels within the window are piles represented by during the over.
(b) Carbon nitrogen ratio (CN Ratio): Carbon, nitrogen, phosphurus, and the potassium are the primary nutrients required by the micro-organisms. We use carbon nitrogen is essential to protein production and reduction. The ratio of carbon to nitrogen is referred to as the carbon nitrogen ratio.
(c) Practical Size: the rate of aerobic decomposition increases with smaller particle however may reduce the effectiveness oxygen movement within the pile on window.
(d) Moisture: Moisture is necessary to be support the metabolic process of the minerals composting materials should be maintained within the range 40-55% moisture. The limits air movement and leads to aerobic conditions moisture contain generally decreases composting process resist you may need to add additional water to the compost.
(e) Temperature: composting will essentially take place within temperature ranges known as melephilic (50-105 Celsius) and thermopholic 105 although mesophelic

temperature between because they destroy pathogens present in the composting material.

4.4.3 Waste Generation in College Canteen:

As Below Graph





5. CONCLUSION

Vermicompost can be described as a complex mixture of earthworm faces, humified organic matter and microorganisms, which when added to the soil or plant growing media, increases germination, growth, flowering, fruit production and accelerates the development of a wide range of plant species. The enhanced plant growth may be attributed to various direct and indirect mechanisms, including biologically mediated mechanism such as the supply of plant-growth regulating substances, and improvements in soil biological functions. Use of this type of organic fertilizer therefore has great potential; however, some recent studies raise serious doubts about the general applicability of these results and propose a more complex model of action for these types of effects. Stimulation of plant growth may depend mainly on the biological characteristics of vermicompost, the plant species used, and the cultivation conditions. Extensive research on inorganic fertilization and plant breeding, carried out within the framework of conventional agriculture, has allowed agricultural producers to fine-tune nutrient inputs and plant needs in order to maximize yields. However, such detailed knowledge has not yet been attained as regards the interactions between plants and organic fertilizers in sustainable agriculture. Given the complex and variable composition of vermicompost in comparison with inorganic fertilizers and the myriad of effects that it can have on soil functioning, a clear and objective concept of vermicompost is required, and the complex interactions between vermicompost-soil-plant must be unraveled in order to maintain consumer confidence in this type of organic fertilizer.

6. RESULT

Garbageororganicwastesproducedbyvariouscanteen'smakeupth emunicipalorcorporationgarbagewhichtodayresultsinenvironme ntalproblem.Vermicomposting which is an environmental-friendly technique implying no pollution what so ever can convert all such wastes into wealth. Vermicomposting is a sustainable technique for solid waste disposal. The present study results of the laboratory experiment have thus, proved the value of major nutrients. However, the manorial value of the vermicomposting depends upon the raw materials used. Vermicomposting produced from the canteen wastes is not only the having beneficial effects on soil health and growth, quality and yield of crop but also playing vital role in eradication of pollution hazards.

- It helped to reduce volume of agro-waste and to generate additional revenue.
- Theproblemofdisposingtheagrowastemaybesolvedbyconstruc tingsuchasthevermicompostingproduction unit.
- The agro waste converted in vermicomposting which will earn economic benefits.
- No hazardous effluents are generated from a compost production unit using agro wastes.
- There are no pesticide residues, weed seeds heavy metals, sand termite or wax, plant root diseases, etc.
- Vermicomposting can be used for all crops agricultural, horticultural, and ornamental and vegetables at any stage of the crop.
- It will reduce the requirement of more land for disposal of fruits and vegetable wastes in near future.
- It helps to create better environment, thus reduce ecological risk.

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