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Research Paper **Poster Presentation**

Production and Evaluation of Leaf litter Compost using Carrier based Starter cultures of Cellulolytic inoculums

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ABSTRACT: Millions of farmers in developing countries need adequate resources for augmenting the crop productivity. Proper soil management ensuring continued maintenance and building up soil fertility is indispensable for productivity from agricultural land. There is no need to emphasize that organic manures influence favorably plant growth and yield directly as well as indirectly. Fungi are important in the composting process. Fungi live on leaves and wood in the compost pile. Many fungi can break down (degrade) the cellulose in leaves. They can also degrade wood, which is made of large, complex molecules called lignins. Wood also contains the long molecules hemicellulose and cellulose, the stuff that paper is made of. Fungi are the most efficient organisms at breaking down wood. This fungus is growing on a rotting wood stump. The present investigation was carried out with the objective of utilizing these plentiful and nutrient rich resources to a useful product, i.e. organic manure with the help of powerful cellulolytic fungal inoculum.

KEY WORDS : Composting, Leaf litter.

INTRODUCTION:

The soil is not enough to provide all the nutrients for growth and vigour of crop plants, so the external input of nutrients is necessary. The importance of organic manures as a source of humus and plant nutrients to increase the soil fertility has been well recognized (Banger & Patil, 1981).

Past few years have seen rise in the popularity of sustainable organic agriculture all over the world. In fact, organic farming is the old age system which is eco friendly as it takes care of the crops as well the soil. It helps it helps to maintain environmental balance. The organic manures have several beneficial effects on soil as improvement in structure, buffering capacity, water holding capacity, availability of micro and micro nutrients (Hue, 1995).This will lead to at least, partial replacement of chemical fertilizers by organic manures. For replacing chemical fertilizers, which supply plant nutrients by organic manures, the basic requirement is the availability of raw material i.e. the organic matter or biomass that can be decomposed to organic manure.

In the present investigation compost was prepared using leaf litter and screened for its potential use.

MATERIALS AND METHODS:

A mixed inoculum of efficient, cellulolytic fungal organisms (isolates of *Chaetomium*) was used in the present

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investigation. These organisms were isolated from various cellulosic substrates. Following five superior isolates of *Chaetomium* were selected for composting on the basis of their cellulolytic activities.

1. *Chaetomium globosum*
2. *Chaetomium mollicellum*
3. *Chaetomium subspirale*
4. *Chaetomium cochliodes*
5. *Chaetomium brasiliense*

The compost pit of 6 x 3 x 2 feet was dug in the ground of K.V.Pendharkar College campus, Dombivli (E). The leaf litter was collected from college campus and nearby areas. The collected material was sorted out and undegradable materials were removed and discarded. The leaf litter, inoculum and other organic inputs were added into the pit in the following manner.

Raw material + Mixed inoculum (0.1, W/W) + Urea @1% and Bone meal @ 2% of the weight of the raw material.

The observations were recorded periodically. The compost were recovered from the composter after 35 days of first inoculation, then after pounding & sieving it was stored in air tight bags. The leaf litter was analyzed for nutrient contents before putting it into composting.

OBSERVATIONS AND RESULTS:

Process Of Composting Leaf litter - Location: K.V.Pendharkar College, Dombivli (E).

Parameters	Values
Size of the pit	6 x 3 x 2 feet
Raw material	Leaf litter
Weight of raw material	100 Kg.
Size	Entire leaf litter in available form without shredding
Minimum moisture content	60 % during the process
Turning	Every 7 days
Temperature	Recorded daily at 3.30 pm

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Aeration	Natural
Activators	Use of carrier based mixed inoculum of 5 efficient cellulolytic fungi inform of starter culture
Duration	35 days
Particle size after recovery (After pounding & sieving)	< 2 mm
Recovery	21.5 Kg.

The raw materials viz. leaf litter was analyzed for nutrient contents at the beginning of the experiment.
The changes in temperature during composting were recorded at fixed time. The compost samples were weighed at the end of the composting process i.e. compost from leaf litter = 35 days and percentage recovery of compost was determined.
At the end of the experiment, the chemical analysis of compost was carried out. It was also analyzed for its microbial flora.
From the data it can be observed there was a rise in temperature after initiation of the experiment. The first week exhibited a rapid rise in temperature. The experiments recorded maximum of 50– 52°C temperature around 9th-12th days, there after subsequent decrease in temperature was recorded. There was a considerable reduction in the weight of compost at the end of experiment observed.
For leaf litter, initial weight of raw material was 100 kg and final weight of compost was 21.5 kg after 35 days i.e. around 78.5% reduction in weight was observed.
During degradation of waste, the raw material showed fading and discolouration at the end of first week. The fungal mycelium of inoculant organism was found covering the raw materials. During the second week of composting process raw material turned black in colour and found covered with mass of fungal perithecia. Towards the end of process degrading masses appeared like brownish – black humus due to complete degradation of material but it was still moist. The final weight and analysis of compost were taken in next week.
The analysis of final compost samples is presented in table no. 1. The table value depicts the changes of various nutrients during composting. Determination of C: N ratio revealed that the original C: N ratio i.e. 22.03:1(leaf litter) was reduced to 12.08:1.
The decrease in % organic matter and % organic carbon was also recorded. % Nitrogen, % Phosphorus and % Potassium was slightly increased after the completion of composting.

DISCUSSION: Composting can be defined as a process of bioconversion of complex organic substances by the activities of a mixed microbial population into similar, readily available nutrient substances under optimum

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conditions of moisture and aeration. Composting is a microbiological, non polluting and safe method for disposal and recycling of organic wastes by bioconversion to manures Bioconversion of organic material is carried by different groups of heterotrophic microorganisms such as bacteria, fungi, actinomycetes and protozoa (Bagyaraj & Radhakrishnan, 2000). The role of cellulolytic and lignolytic microorganisms in decomposition of crop wastes and residues is of prime importance (Guar *et al.*, 1995 and Bagyaraj *et al.*, 2006). Fungi are more efficient than bacteria and actinomycetes in waste degradation (Hawksworth, 1991 and Wahal, 1998).

The present investigation was carried out with the objective of utilizing these plentiful and nutrient rich resources to a useful product, i.e. organic manure with the help of powerful cellulolytic fungal inoculum and nutrient amendments such as urea and bonemeal for hastening the process of composting and enriching the product.

Use of cellulose degrading microorganisms in production of rapid compost is also reported by several workers (Hajra & Kole, 1998; Kolet, 2003). This process also occurs naturally with the help of native cellulolytic microorganisms in soil and compost pits, but takes a long time. The addition of effective cellulolytic microorganisms grown in the laboratory can enhance the rate of microbiological processes in composting of organic waste and final product is well decomposed compost which contains readily available plant nutrients. The fungi are not merely restricted to the role of decomposer organisms but also participate in recycling of minerals in soils.

Chemical analysis of compost:

1. C: N Ratio- The C: N ratio of raw material is the most important aspect of composting (Subba Rao, 1997 and Talashilkar, 1998) The C: N ratio of raw materials used in experimentations was recorded 22.03 : 1. This average C: N ratio was then reduced to average of 12.08: 1 at the end of composting.

2. Moisture content: Moisture content is an important factor for aerobic composting since excessive moisture brings about anaerobic conditions and delays the process of composting (Gowda, 1997). The moisture content of raw material used in present experimentations was 56.5 %. The finished compost recorded average 37.3% moisture content.

3.Aeration: Composting is an aerobic process and maintenance of aerobic conditions are necessary for faster decomposition (Guar, 1992 and Cuevas, 1997). The waste material decomposing inside the pit was turned over at 7 days interval as suggested for composting in pits or in heaps (Guar, 1996; Talashilkar *et al.*, 1998 and Sharath & Jagadeesh, 2004).

4. Temperature: In the present investigation, temperatures were recorded at fixed time on daily basis. The highest average temperature was recorded up to 50-52°C around 9^{th} – 12^{th} day of process indicating intense microbial activity (Gowda, 1996 and Sharath & Jagadeesh, 2004) which was then stabilized to 33 – 35°C progressively.

5. Reduction in volume: The reduction in volume supports efficient microbial activity in decomposition of waste and evolution of CO_2 (Martin, 1987; Guar *et al.*, 1995 and Rasal *et al.*, 2002).

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6. **Reduction in weight:** Great reduction in weight of composted material indicates faster composting process (Yadav & Subba Rao, 1980 and Bagyaraj *et al.*, 2006). There was a sizable reduction in the weight of compost at the end of experiment i.e. 78.5% reduction and average percent recovery of about 21.5%.

7. Nutrient availability: Along with carbon and nitrogen, compost also provides other nutrients like phosphorus and potassium in small amounts (Bagyaraj *et al.*, 2006). All these nutrients decide quality of the compost. The chemical analysis of final compost showed considerable increase in the % organic nitrogen, % organic phosphorus and % organic potassium.

The quality of compost obtained and nutrient contents can be comparable with the range suggested by various workers (Adiku, 2002; Swarup, 1997; Kadam & Hande, 2001).

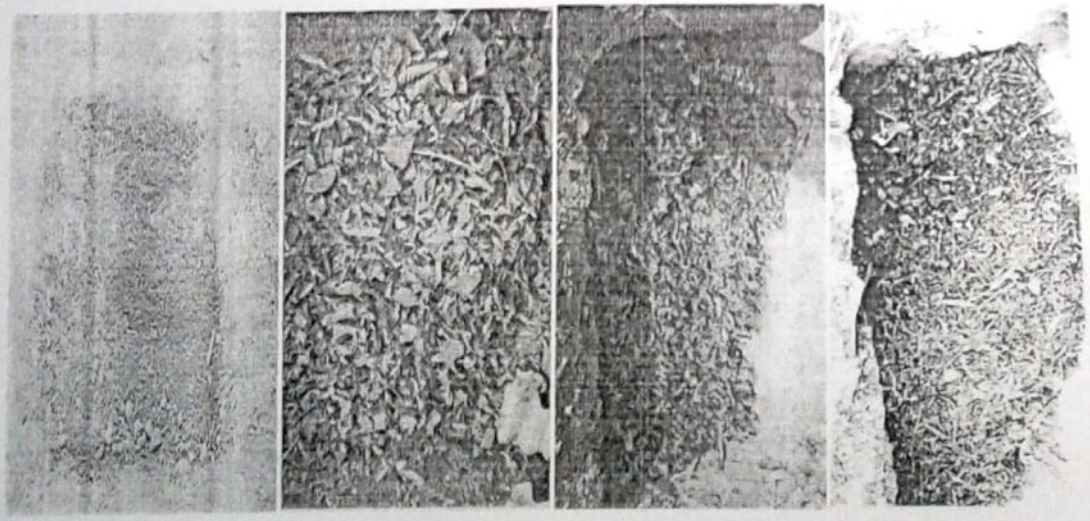
Table no. 1 : Chemical analysis of raw materials used in composting and final compost

Material	% Moisture	% Organic Matter	% Organic Carbon	% Organic nitrogen	C:N ratio	% Organic phosphorus	% Organic Potassium
Raw material	56.5%	79.1%	52.0%	2.36%	22.03: 1	0.19%	1.2%
Final compost	37.3%	71.26%	32.5%	2.69%	12.08: 1	0.23%	1.8%

Plate no. I

(A) Experimental pit

Empty Pit (0 day) | Pit filled with waste (0 day) | Stages in composting (14 days) | (35 days)



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(B) Growth of test organism on raw material

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