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Comparative Study of Normal Soil and Vermicompost

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Abstract: **In India chemical degradation of land is very fast causing pollution and decreasing agricultural production. Increasing use of chemical fertilizers is a major threat to environment. Soil needs some natural alternative having rich microbial activity. Vermicomposting is the best alternative .in this research soil with vermicompost is compared with soil from chemical fertilizers based farms. It is found that, vermicompost soil has more diverse bacterial and fungal species which can degrade vast variety of organic waste into simpler soil nutrients. Vermicompost soil is finely divided, peat like soil with high porosity, aeration and water holding capacity. It can improve soil texture, fertility and microbial activity. It can be the best ecofriendly alternative of chemical fertilizers.**

Keywords: **Complex organic matter, biodegradation, fertilizer, micronutrient. macronutrient.**

I. INTRODUCTION

Environmental degradation is a major threat comforting the world and the rampant use of chemical fertilizers contribute largely to the deterioration of the environment through depletion of soil, generation of co_2 and contamination of water resources. Fertilizers pesticides, herbicides, nematocides, and fungicides have been use to increase the crop yield but these all cause pollution and side effect on human and animal health and make soil sick. Vermicompost appears to be the most promising alternate. It is good source of different macro and micro nutrients particularly NPKS. Now there is a growing realization that the adoption of ecological and sustainable farming practices can only reverse the dealing trend in global productivity. On one hand, there is a large number of produced due to human activities which are rich in macro and micro nutrients while tropical soil is deficient in all necessary plant nutrients and on other hand, large amount of such nutrient are getting deplete in the form of domestic waste and agricultural by product . It is estimated that in India nearly 700 million tone organic wastes is produced annually which is burned or land filled (Bhiday 1994). In nature's laboratory there is alarge number of organisms (macro and micro) that can convert organic waste into valuable resources containing plant nutrient and organic matter which can maintain soil productivity. The earthworm population is about 8-10 times higher in uncultivated area. Which indicates that earthworm population decrease with soil degradation and can be used as a sensitive indicator of soil degradation. The environmentally acceptable vermicompost in technology using earth worm can very well be adopted for converting waste into wealth. Vermicomposting is a simple biotechnological process of composting. In which earthworm casts are the final product. It is an aerobic, bioxidation and stabilization non-thermophilic process of organic waste decomposition. Vermicompost contain vast variety of bacteria, fungi, actinomycetes, protozoa, insect, etc. Voracious feeders feed on organic waste and secrete organic by product which after combining with soil work as organic fertilizer. Vermicompost fertilizer are reported already in use for commercial operation in Japan , Canada and USA and practiced in Asia. The Vermicomposting through different earthworm species has been studied In the process of Vermicomposting

1. Microbes form a part of food for earthworm.
2. Microbes are proliferated in the gut of earthworm.
3. Earthworms help in distribution of microbes.
4. Together with earthworm the microbes mineralize organic matter and facilities chelating of some metal ions.

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II. MATERIALS AND METHODS

Vermicompost was produced in strict protocol with the help of Earthworm in laboratory using house hold waste collected from some house.

Soil sampling – soil sample were collected by sterile method from field applied with vermicompost and the agricultural field applied with chemical fertilizer and stored in air tight poly bags at 4 ^{0}C. Samples were taken 10-15 cm depth. Chemical reagent used were of standard label purchased from Himidia, Ranbaxy.

Isolation of micro organism- sample were processed using soil dilution plates method. 1 gm soil sample was serially diluted with distilled water up to 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} and 0. 1 ml.Each dilution was added to 20 ml nutrient gar media and allowed to incubate for 48 hr at 37^{0}C .

Separate colonies were sub cultured on agar plates according to standard medium (nutrient agar medium, starch agar medium , simmon's citrate agar medium , potato dextrose agar medium and nutrient broth)

Isolation of bacteria - Using serial dilution method, isolated bacterial colonies were streaked on agar plates.

Physical test- Gram staining was done for differentiate between Gram positive and Gram negative bacterial species.

Biochemical test:- To determine the ability of isolated bacterial strain to degrade amino acid, indole production test was done by using amino acid tryptophan in tryptone broth, to determine sugar oxidative property and production of acid as end product , methyl red test was done using MR-VP broth. To determine production of non- methyl carbinol from organic acid by glucose metabolism vogus proskaver test was done using MR-VP broth, to differentiate among isolated bacterial species on the basis of their ability to form citrate as a role of carbon source citrate utilization test was done using Simmon's citrate agar medium. To determine the fermentation ability of microorganism by producing acid and gas, carbohydrate fermentation test was done using broth with glucose ,sucrose and fructose. To determine starch degrading capacity (production of amylase) of bacterial strain ,starch hydrolase was checked using starch agar medium and iodine .

Isolation of fungi:- A large number of different groups of microorganism were isolated, in which fungi constitute a major place . Soil sample of vermicompost and agricultural fields were dissolve in 10 ml distilled water and diluted in10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} and. 1 m , concentration then spread on potato dextrose agar medium and incubated at 25^{0}C for 5 days . After proper growth, fungal mycelium from each fungus colony was transferred on fresh PDA plate and cultured for 5 days.

Identification:-Mycelium of each fungus was mounted on slide and observed under microscope and morphology was noticed then identified by using micro logical literature.

Table.1 Shows that vermicompost isolate have more rod shaped bacterial species as compared to coccid shaped. The bacterial species in vermicompost prefer in chain pattern while in normal soil it is in bunches. Most bacterial species are gram positive in vermicompost and fast growing compare to normal soil also more different color and pattern of colonies shows the more species of bacteria and present in vermicompost as compare to normal soil.

Table.2 Tells that bacterial species found in vermicompost degrade more bio waste as compared to normal soil.

Table.3 Shows the total of 65 different bacterial isolate were obtain from 1 gm sample of vermicompost soil by making serial dilution respectively and a total of 09 different isolate were obtain from 1 gm normal soil using same dilution. There is an incredible higher account of microbial mass in vermicompost soil as compared the normal soil.

Table.4 Shows that more diverse fungal colonies having different color and pattern are found in vermicompost soil as compare to normal soil. A total of 19,7,7,10,10 and 12 different colonies were obtain after analyses of 1 gm of vermicompost by making serial dilution respectively while a total of 3,1,4 and 2 different fungal colonies were isolated from 1 gm normal soil. Aspergillum species, trichoderma species, cladosporium and penicilium species are identified in vermicompost soil. On the basis of following result it is cleared that higher account occur in vermicompost soil signifying that vermicompost has high nutritional value. More number of fungus and diversified from indicate vermicompost has more favorable habitat for their growth. Considerable growth of actinomycetes also occurred in vermicompost but their identification and characterization was not done as present focus was more on microbial, bacterial and fungal count and their diversity. From the obtain data it was concluded that vermicompost soil is highly rich and denser in microbial count in comparison of normal soil.

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III. CONCLUSION

The vermicompost appears to be the good source of different micronutrient. It is environmentally acceptable and can be used to convert organic waste into wealth. It is an ecobiotechnological process that transform energy rich and complex organic substance into simpler one. Vermicompost is finely divided, peat-like material with high space porosity, aeration, drainage, good water holding capacity and microbial activities, which make it excellent as a soil conditioner.

IV. SUMMARY

Vermicomposting is the transforming of organic waste constituent into more useful form with the help of aerobic and non aerobic flora. These microorganism helps in conversion of complex organic matter into simpler usable from which readily available to plant utilize for their metabolic activities. The interaction between earthworm and microbes help in mineralization of organic matter and chelation of metal ions. Large number of microorganisms are isolated from Vermicompost soil in comparison to normal agriculture soil (as per result obtained). It provide protection against harmful microbes and act as pesticides and provides a clean pollution free. vermicompost is a low cost technology process which provides a good fertilizer at an affordable price compare to chemical fertilizer which are not only costly but also harmful. Thus using vermicompost is a sustainable, ecofriendly approach.*Singhal.bharat@rediffmail.com, Ex. Lecturer Uttaranchal college of science and technology, Dehradun.

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APPENDIX - A

Table.1 Characterization of unknown bacterial colonies isolated from Vermicompost & Agricultural soil

Sample	Dilution	Dilution Factor	Shape & Arrangement	Colony Character	Growth	Gram staining	Named
Vermicompost isolates	10^{-1}	10^{1}	Rods in chains	Whitish clump	V.fast	-	V1
	10^{-2}	10^{2}	Rods in chains	Yellow clump	V.fast	+	V2
	10^{-3}	10^{3}	Rods in bunches, chains	Whitish spread	V.fast	+	V3
	10^{-4}	10^{4}	Curved rods	Whitish , clumped spread	V.fast	+	V4
	10^{-5}	10^{5}	Rods in bunches, chains	Whitish, clumped spread	Fast	-	V5
	10^{-6}	10^{6}	Cocci in cluster & chains	Single golden	Fast	-	V6
Agricultural soil isolates	10^{-1}	10^{1}	Rods in chains	Whitish, abundant	Fast	+	A1
	10^{-2}	10^{2}	Cocci in chains	Slimy white	V.fast	-	A2
	10^{-3}	10^{3}	Cocci cluster	Whitish spread	V.fast	-	A3
	10^{-4}	10^{4}	Cocci in cluster	Thick , white, discrete	V.fast	+	A4
	10^{-5}	10^{5}	Cocci in chains	White, thick	V.fast	-	A5
	10^{-6}	10^{6}	Cocci in chains	White, thick	Low	-	A6

V: very fast, + : Gram positive , - : Gram negative

Table: 2 Different biochemical tests for characterization of isolated bacterial colonies:

Organism	Carbohydrate fermentation			Starch hydrolysis	Indole production	M.R. test	V.P.test	Citrate utilization	Catalase test	Oxidase test	Gelatin liquefaction
	Glucose	Sucrose	Lactose								
V1	+	+	+	-	-	+	+	-	+	-	+
V2	+	+	+	+	-	+	+	-	-	-	-
V3	+	-	+	+	+	+	-	-	+	+	+
V4	+	+	+	+	+	+	-	+	+	+	+
V5	+	+	+	-	+	-	+	-	-	+	+
V6	+	+	+	-	+	+	+	-	+	+	-
A1	+	+	+	-	-	-	+	-	-	-	-
A2	+	+	+	-	-	+	-	-	-	-	+
A3	-	-	-	+	+	-	-	+	+	+	+
A4	+	+	+	-	+	-	-	-	+	+	-
A5	+	-	+	-	-	-	-	-	-	-	-
A6	+	+	-	-	-	-	-	-	-	-	-

*-ve shows absence , +ve shows presence

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Table: 3 showing the no. of fungal and bacterial colonies per gram of sample

Sample	Dilution	Dilution factor	Average no. of fungal colonies	Org./gm of soil=no. of colonies *dilution factor/dry.wt. of soil	Average no. of bacterial colonies	Org./gm of soil=no. of colonies *dilution factor/dry.wt. of soil
Vermicompost isolates	10^{-1}	10^{1}	19	$19*10^{1}$	Confluent growth	-
	10^{-2}	10^{2}	12	$12*10^{2}$	Confluent growth	-
	10^{-3}	10^{3}	10	$10*10^{3}$	45	$45*10^{3}$
	10^{-4}	10^{4}	10	$10*10^{4}$	33	$33*10^{4}$
	10^{-5}	10^{5}	7	$7*10^{5}$	4	$4*10^{5}$
	10^{-6}	10^{6}	7	$7*10^{6}$	1	$1*10^{6}$
Agricultural soil isolates	10^{-1}	10^{1}	No growth	0	Confluent growth	-
	10^{-2}	10^{2}	No growth	0	Uncountable growth	-
	10^{-3}	10^{3}	4	$4*10^{3}$	250 CFU	$25*10^{4}$
	10^{-4}	10^{4}	3	$3*10^{4}$	100 CFU	$1*10^{6}$
	10^{-5}	10^{5}	2	$2*10^{5}$	4 CFU	$4*10^{5}$
	10^{-6}	10^{6}	1	$1*10^{6}$	3 CFU	$3*10^{6}$

Table: 4 Characterization of unknown fungal colonies isolated from vermicompost

S.N.	Morphology of colony	Mycelium	Color	Species
01	Round	Thick wall branched	Greenish	Aspergillus
02	Round	Thin to thick wall, branched, septate	Grayish	Unknown
03	Elliptical	Thick wall hypae	Pinkish	Tricoderma
04	Oval	Thick wall, branched	Brownish, baby pink	Unknown
05	Kidney shape	Thin to thick wall, unbranched	Blackish	Unknown
06	Invert oval	Thin wall, branched, septate	Reddish at bottom off rounded	Unknown
07	Slightly round	Highly branched	Green centered grayish, round, white	Tricoderma
08	Oval	Branched	Green	Cladosporium
09	Oval	Branched compactly, round circle	Yellow	Penicillium