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Effect of Earthworm Vermicompost and Coelomic Fluid Treating on Unfertile Soil.

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ABSTRACT

Agricultural field is a largely depending upon nutrients such as fertilizers for the better support of growth of plants. Vermicomposting using earthworms is a safer and more economical and ecofriendly process. In the present study the unfertile soil samples were collected from agriculture land in Jayankondam, Ariyalur district. To analyze the microbial count, micro and macro nutrients level. The vermicompost were prepared using the agricultural wastes and the coelomic fluid was collected from earthworm (*Eudrilus eugeniae*) by heat shock treatment. The good quality of *Vigna mungo* seeds were collected and inoculated in the different test samples. The soil sample I was unfertile soil, soil sample II was mixed with vermicompost, soil sample III was mixed with coelomic fluid and soil sample IV was vermicompost with coelomic fluid. The present study to analyze the microbial count, nutrient level, water holding capacity, growth and yield. The results were observed in the 30^{th} and 60^{th} days. The overall results conclude that the vermicompost with coelomic fluid treating soil gave the good growth and good yield because the vermicompost increasing microbial count and nutrient level, the coelomic fluid have the immune mechanism to inhibit the soil pathogens.

Key words: Vermicompost, coelomic fluid, *Vigna mungo,* water holding capacity.

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INTRODUCTION

Agricultural sector plays an important role in the sphere of providing large scale employment to the people. It is the backbone of our economic system. Agriculture not only provides food and raw material but also employment opportunities to a very large proportion of population. Earthworms are able to protect themselves against invading microorganisms through their immune system. Although there are many studies about defense systems of *Pendrobaena veneta*, this is the first report focusing on the immune properties of earthworms belonging to same species, which live in different localities. Worm fertilizer supports the establishment of beneficial microbes which help in nutrient mobilization. Worm fertilizer can be used as manure for crops, vegetables, flowers, gardens, etc. worm fertilizer enhances the soil fertility through microbial activity. Nutrients in worm fertilizer are in readily available form, which is rapidly mineralized and taken up by plants during period of high nutrient demand. Vermicompost is purely a biologically processed by the interactions between microbes and earthworms on organic materials. Microbes in the digestive system of earthworms are responsible for transforming some organic material like protein, nucleic acids, fats and carbohydrates into more stable products [1-3].

Earthworm is specialized to live in decaying organic wastes and can degrade into fine particulate materials, which are rich in available nutrients to revive productivity and fertility of soil. Organic amendments like vermicompost promote humification increased microbial activity and enzyme production. Soil pathogens activity decreased by coelomic fluid and earthworm compost bears its natural characteristics of black color without any odor. Organic earthworm cast increases the soil nutrition and microbial population that directly promotes the plant growth and increase the yield.

Coelomic fluid in an earthworm is the fluid within the coelom which serves as a circulatory medium, and locomotion. This fluid also serves as a site for temporary food storage, excretion of nitrogen containing wastes, and for maturation of gametes. Coelom is a fluid filled cavity within the mesoderm it can be seen as the digestive track of an earthworm. Earthworms are formers friend, they dig up and mix the soil, eat up decayed plants and convert them to fertilizer thus enriching the soil in recent years.

Coelomic fluid contain different enzymes including proteases, amylases and phosphateases and some of hormones like oxyn and cytokinins and essential nutrients like K, Ca, Mg, Cl, Cu, P and Na for plant growth and increases disease resistance. There the present study investigation is under taken with “Effect of earthworm vermicompost and coelomic fluid treating on unfertile soil”.

MATERIALS AND METHODS

Collection of soil and substrates

Soil samples were collected from agricultural land in Jayankondam, Ariyalur (district). Cow dung, coir waste was collected from cow shelters.

Vermicompost preparation

Layer (15-20 cms) of organic waste (coir waste, paddy husk,) spreaded in the cement tank. Non-decomposable material separated first and then the waste is spread on the ground to expose into sunlight for two days. This will help to reduce insect population. Cow dung was collected and then added as a layer on top of the mixture. Soil filled on the cement tank. The organic waste mixed with cow dung in equal quantity and appropriate quantity of water poured over it so as to make a homogenous mixture. Earthworms inoculated on the cement tank and covered with sack cloths to prevent birds from eating the worms.

Maintenance of moisture

The earthworms require adequate moisture for growth and survival. Water sprinkled over the whole mixture at 3-day intervals for 2 months, to maintain adequate moisture and body temperature of the worms. Beds should be crumbly moist, not soggy wet. They should not exposed directly to hot sunshine, because this may cause drying and heating which will adversely affect the worms and not be sprinkled for several days (or) until the top 1or 2 inches are barely moist. They should then be sprinkled sufficiently to restore them to their normal moisture content.

Yield of compost

The sacks removed after 2 months the compost ready, it is black, quite light weight and has a pleasant, earthy smell. Excreta of the worms are scooped up manually from the surface of the bed after 60 days from the date of commencement of the experiment.

Collection of coelomic fluid

Mature earthworms were collected from the vermicompost.The mature earthworm was immersed in clean, cool water for few hours to eliminate gastro intestinal metabolites and contaminants. They are rapidly dry on a paper and are subsequently excited with heat shock for few seconds, after the heat shock treatment the coelomic fluid release through their epidermal dorsal pores. The coelomic fluid was collected from earthworm.

SAMPLE-I (Unfertile soil)
SAMPLE-II (Soil+Vermicompost)
SAMPLE-III (Soil+Coelomic fluid)
SAMPLE-IV (Soil+Vermicomost+Coelomicfluid)

Seed inoculation

Vigna mungo seeds were inoculated in the four soil samples.

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Analysis of physicochemical parameters of soil sample before and after the addition of coelomic fluid and vermicompost

Soil samples were collected from the field. Micro and macro nutrients of the soil were analyzed from the Soil fertility Research Institute, Thiruchirappalli.

Isolation and enumeration of microorganisms from soil by serial dilution agar plating method

Preparation of media

Media is defined as the substrate in which microorganisms could grow and multiply. For the present study the selective media for bacteria, fungi, Actinomycetes, Azotobacter, phosphate solubilizing bacteria plates were prepared. Each soil samples were serially diluted up to 10^{-7} dilution. 0.1 ml of each dilution spreaded into respected plates. The plates were incubated, after the incubation period, colonies was counted by using colony counter.

S.No	Microorganisms	Selective media	Incubation period
1	Bacteria	Nutrient agar	37°c 24 hours
2	Fungi	Potato dextrose agar	25°c 3-5 days
3	Actinomycetes	Starch casein agar	25°c 4-5 days
4	Azotobacter	Jensen's medium	37°c 3-5 days
5	Phosphate solubilizing microbes	Pikovskaya's medium	37°c 14 days

RESULT AND DISCUSSION

The unfertile soil samples were collected from agriculture land. To analyze the microbial count, micro and macro nutrients level. The vermicompost were prepared using the agricultural wastes and the coelomic fluid was collected by heat shock treatment. The good quality of *Vigna mungo* seed were collected and inoculated in the different test samples. The present study to analyze the microbial count, nutrient level, water holding capacity, plant growth and yield. The result was observed from the soil sample I, II, III and IV. In this study two analyses were observed 30^{th} and 60^{th} days. The 30^{th} day the microbial count of Bacteria, Fungi, Phosphate solubilizing fungi, Actinomycetes, and Azotobacter were analyzed the present results conclude that compared with soil sample I, the sample II microbial count increased. Compared with soil sample II the soil sample III increased and compared with III the sample IV microbial count increase. The overall results conclude that the microbial count level increased in the sample IV.

The 60^{th} day results were observed and compared with 30^{th} days, the table 1 showed that the microbial count level increased in the sample II, III, and IV. The nutrients level also increased in the soil sample II, III, and IV compared with soil sample-I.

Earlier report concluded that the vermicomposting is used to describe the bioconversion of organic waste material through earthworm consumption.

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The earlier workers vermicompost increases the growth, yield, productivity and taste of the product. It also improves the soil fertility by providing an amicable soil environment which promotes beneficial soil organisms

Table 1: Enumeration of microbes from sample I (unfertile soil), II(soil with vermicompost), III(soil with coelomic fluid), and IV(soil with vermicompost and coelomic fluid).

S.No	Microbes	At 30 days				At 60 days			
		Sample-I	Sample-II	Sample-III	Sample-IV	Sample-I	Sample-II	Sample-III	Sample-IV
1	Bacteria	195	236	298	380	195	306	388	491
2	Fungi	4	7	10	16	4	8	15	22
3	Phosphate solubilizing fungi	3	5	10	15	3	6	17	26
4	Actinomycetes	69	98	133	229	69	196	289	348
5	Azotobacter	2	3	6	8	2	5	8	13

Table 2: *Vigna mungo* growth changes in sample I, II, III and IV.

S.No	Plant growth	Unfertile soil	Soil with vermicompost	Soil with coelomic fluid	Soil with vermicompost And coelomic fluid
1	Height	19.2 cm	22.8 cm	26 cm	28.7 cm
2	Leaves	7	11	16	21
3	Flowers	5	10	16	21
4	Yield of the seed	3	8	14	18

Table 3: Soil nutrient analysis from sample I, II, III and IV

S.No	Nutrients	Unfertile soil	Soil with vermicompost	Soil with coelomic fluid	Soil with vermicompost and coelomic fluid
I	p^H	6.3	7.4	7.8	8.0
II	MACRO NUTRIENTS	0.48	0.85	1.85	2.53
	i)Nitrogen	0.35	0.65	1.32	1.96
	ii)Phosphorous	0.50	0.52	1.65	2.11
	iii)Potassium				
III	MICRO NUTRIENTS				
	i) Zinc sulphate	0.00	0.30	0.95	1.56
	ii)Copper	0.09	0.55	0.86	1.42
	iii)Iron	0.14	0.32	5.02	7.4
	iv)Boron	0.00	0.00	3.45	5.6
	v)Molybdenum	0.06	0.37	0.71	1.02
	vi)Manganese	0.04	0.42	0.65	0.98

such as symbiotic fungi and bacteria. The present results are conclude that bacteria, fungi, Actinomycetes and Azotobacter level also increased.

The table 3 showed that the micro and macro nutrients level were analyzed in the soil samples. The nutrients level compared with unfertile soil, the soil sample II, III, and IV the nutrient level increased in 30th days. These results compared with 60th day the nutrients level increased. The present results conclude that increasing number microbial count should have increased the nutrient level. The earlier workers reported that a healthy soil must also contain ready supply of the various nutrients needed by plants such as nitrogen, phosphorous, potassium etc. which must be converted to forms that plants can assimilate. This is done by various bacteria like nitrogen fixers, phosphorous, solubilisers, vitamin, antibiotic and hormone procedures etc. The soil fixes atmospheric nitrogen as per the crop's requirements and no excess nitrogen is fixed. Earthworms ensures proper utilization of bio-carbon to produce balanced nutrition for the plants.

The water holding capacity increased in the sample II, III, and IV. The soil sample IV the water holding capacity increased compared with sample II, III. The earlier worker reported that the earthworms improve the aeration of soil by their burrowing activity. They also influence the porosity of soil. Earthworm activity increased the porosity of soil from 27.5% to 31.6% and 58.8% to 61.8%, four to ten times faster than the soil without earthworms. After 24 hours of free drainage, there was little difference in moisture content, but soil without worms was water-logged, whereas soil with worms was well aerated, with water held as capillary water within larger aggregates. Thus, it is clear that earthworms influence the drainage of water from soil and the moisture holding capacity of soil, which is an important factor for growing crops [3-5].

Figure.1 Plant Growth in Soil Samples I, II, III, and IV

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FIGURE .2 PLANT GROWTH YIELD IN SOIL SAMPLES I, II, III, AND IV

The figure1, figure2 and table 2 showed that the sample IV (vermicompost and coelomic fluid) have showed the yield in quality, germination and flowering are also found to be much faster compared with other two samples. The results concluded this increase may be attributed to the hormonal effect due to the microbial action in the vermicompost.

The previous study reported that the antimicrobial activity of coelomic fluid associated with lysozyme like substances and humoral molecules support haemocytic reactions in the annelied defence system [2]. In the earlier report the earthworm exhibit different immune mechanisms against environmental pathogens [1].

CONCLUSION

The results conclude that the vermicompost with coelomic fluid treating soil gave the good growth and good yield because the vermicompost increasing microbial count and nutrient level, the coelomic fluid have the immune mechanism to inhibit the soil pathogens.

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REFERENCES

[1] Cooper EL, Cossarizza A, Kauschke E and Frances. 1999. Microsc Res Tech 1999;44:237-253.
[2] Jarosz J. and Glinski Z. Folia Biol 1997;45:1-9.
[3] Kamemoto FI, Alice E, Spadling and Sharon M. 1949. Ionic balance in blood and coelomic fluid of Earthworms. University of Missouri, 228-231.
[4] Kuppuraj Rajasekar, Thilagavathy Daniel and Natchimuthu Karmegam. 2012. Microbial Enrichment of Vermicompost. ISRN Soil Science , 13.
[5] Shobha SV and Radha D Kale. 2008. Invitro Studies on Control of Soil-Borne Plant Pathogens by Earthworm Eudrilus Eugeniae Exudates.