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Solid waste management through vermicomposting and their influence on plant growth of Tomato (*Lycopersicon esculentum* Mill.)

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Abstract

Human activities are responsible for generation of a variety of solid waste including garbage from urban community as well as countless different materials such as food wastes, vegetable peels, paper cardboards and agricultural waste. These waste are disposed in open dumps creating considerable nuisance and environmental problems and thus are potential risks to health and breeding of disease vector primarily flies and rats. Apart from abatement of environmental pollution reuse of organic waste in agriculture helps in the improvement of physical, chemical and biological properties of the soil and thus helps in sustaining the soil quality. However due to some shortcomings of traditional composting system, the technology of recycling of organic wastes has not been widely accepted so far. Under this situation, vermicomposting has emerged as a simple but efficient method for recycling wide ranges of organic waste with the help of some specific group of earthworms.

The present study deals with ecoconservation and solid waste management of vegetable scalp, and agricultural waste with the help of earthworm forming vermicompost. The effect of different percentage of vermicompost (0%, 20%, 40%, 60%) amended with soil on growth and biomass of *Lycopersicon esculentum* Mill. plant under field condition was investigated. The result revealed that addition of vermicompost has statistically significant positive effect on growth and biomass of experimental plant.

Key words : vermicompost, biomass, organic waste, *Lycopersicon,* ecoconservation.

Solid Vermicomposts are products of a non thermophilic biodegradation and stabilization of organic materials by on intraction between earthworm & microorganism. They are finely divided, peat like materials with high porosity, aeration, drainage, water holding

capacity and microbial activity which make them excellent soil conditions[2]. It is well established that earthworms have beneficial physical, biological and chemical effect on soil and many researches have demonstrated that three effects can increase plant growth and crop yield is both material and managed ecosystem[1,3]. Waste management is an issue gaining global concern. Management of million tones of waste generated everyday is a great challenge. In today era heavy doses of chemical fertilizer and pesticides are being used by the farmers to get a better yield of various field crops. These chemical fertilizers and pesticides decrease soil fertility and cause health problem to the consumers. Due to advance effect of chemical fertilizers, interest has been stimulated for the use of organic manures[4].

Vermicomposting uses earthworm to turn organic waste into very high quality compost. This is probably the best way of composting hostel kitchen waste, adding small amount of wet kitchen scraps to a large compost pile in the garden day by day can disrupt the decomposition process so that the compost is never really done, but is work just fine with vermicomposting .Vermicompost consist mostly of worm casts (poop) plus some decayed organic matter, In deal conditions worms can eat at least their own weight of organic matter in a day. In fact it seems they don't actually eat it they consume it, sure enough, but what they drive their nourishment from is all the microorganism that are really eating it and yet their casts contain eight times as many microorganisms as their feed and these are the microorganism, that best favour healthy plant growth and the coasts don't contain any disease pathogen. Pathogenic bacteria are reliably killed in the worms gut. This is one of the great benefits of vermicomposting.

The vermicompost is a rich source of beneficial microorganisms and nutrients[9] and is used as a soil conditioner or fertilizer[6,11]. Increase in crop yield, soil nutrients status and nutrients uptake was reported due to application of vermicompost[10,12].

The technique of vermicomposting has emerged as solution for solid waste management. In recent years the applied use of earthworms in the breakdown of a wide range of organic residues, vegetables waste including roots ,stems, leaves, skin, peels, seed crops residues, eggshells, non greasy paper products (Cardboard, boxes, newspaper, envelope etc..) to produce vermicomposts has increased tremendously[1,5,7,8,14].

Disposal of hostel waste (solid) and other biodegradable waste is a major problem of our college hostel, catering about 450 students. Vermicompost is an ecofriendly solution for the decomposition of hostel waste. (vegetable scalpes,paper waste etc.)

Thus, the present study has been undertaken to manage the hostel vegetables waste and other biodegradable waste with the help of earthworm by vermicomposting and to analyze the effect of the different ratio of vermicompost blended with soil on the growth yield and quality of tomato plant under field conditions.

The study was divided into two phases-

-1. *Vermicompost preparation:*

2. *Effect of vermicompost:* blended with soil on growth parameters of *Lycopersicon esculentum* Mill. Hybrid US404 (Bhavani).

Preparation of vermibed : The waste material used were (Disposed food items, vegetable wastes, fruit peels, paper and rice husketc.) mix with cow dung and allowed to decompose for 15 days.After 15 days preparation of vermibed was started, It includes – A layer of broken bricks,coarse sand, a layer of coconut husk,cardboard, rotten disposed food items mixed with worms, then thin layer of rice husk and maintain 75-90% moisture, 20-25°C Temp. of the pits. Vermicompost were blended with soil at a concentration of 0%, 20%,40%,60%.and designate as control (soil), VC20,VC40,VC60 respectively. Seeds were sown in pots containing different concentration of vermicompost and different parameters of growth were recorded and analysed.

Statistical analysis: data was subjected to one way ANNOVA and significant difference between means were compared at 5% level with DMRT using SPSS 16.0.

The effect of different concentration of vermicomposting on seed germination, growth and biomass of *Lycopersicon esculentum* were studied. It was observed that germination percentage in terms of normal seedlings was maximum (83.3%) in treatment of VC60 (soil +60% VC). There was a gradual decrease in germination percentage in treatment VC 20 (soil +20% VC) and VC40 (soil+40% VC). VC 20 and VC40 treatment had germination percentage of 80 and 67 respectively. Least percentage germination of 60% was recorded in control (soil). Fig4a,4b

Growth and Dry weight parameters:

- Maximum mean plant shoot length (cm) in treatment of VC40 were found to be 3.02 ± 0.21 after 20 days, 12.43 ± 0.80 after 30 days and 16.19 ± 0.31 after 40 days from seeds sowing. (fig. 1, Table-2).
- Similarly, maximum mean number of leaves was found in treatment of VC40 with 2.90 ± 0.77 after 20 days. But after 30 days maximum mean number of leaves was found in treatment of VC 60 (4.91 ± 0.21). Again after 40 days, number of leaves was highest in VC 40 with an average value of 6.43 ± 0.25. (Fig. 1, Table 2,3,4).

There were no significant difference is shoot length and leaf number of experimental plant treated with control (soil), VC 20 and VC 60. The results showed that the soil amended with VC 40 had significantly greater positive effect on growth parameters of *Lycopersicon esculentum* as compared to control, VC 20, VC 60. Plant dry weight in control was obtained to be 9.62 gm while significantly higher values were found with 27.71 gm, 22.23 gm and 20 gm in VC 20, VC 40 and VC 60 respectively. (Fig. 2, Table-1).

The interaction between earthworms and microorganisms can produce significant quantities of plant growth hormone and humic acid which act as plant growth regulator. From the study it is clear that vermicompost can effectively enhance germination, growth and biomass by improving physical, chemical and biological properties of the soil.

Thus, in the present study the hostel vegetables waste and other biodegradable

Table-1. Percentage germination of *Lycopersicon esculentum (Hybrid Tomato US-404 Bhavani)* seeds in different concentrations of vermicompost

S .No.	% VC	% Germination
1	0	66.66
2	20	80.00
3	40	66.66
4	60	83.33

Table-2. Effect of different concentrations of vermicomposting on growth parameters of *Lycopersicon esculentum (Hybrid Tomato US-404 Bhavani)* after 20 days of sowing seeds

S.No.	% VC	Length of shoots Mean ± SE	No. of leaves mean ± SE
1	0	2.52 ± 0.23^{ab}	2.00 ± 0.00^{b}
2	20	2.24 ± 0.15^{d}	1.04 ± 0.37^{c}
3	40	3.02 ± 0.21^{a}	2.90 ± 0.77^{a}
4	60	2.40 ± 0.14^{b}	2.74 ± 0.69^{a}

Significance of difference is analyzed by ANNOVA. Values followed by the same letters within the column are not significantly different at 5% level (DMRT with SPSS 60.0)

Table-3. Effect of different concentrations of vermicomposting on growth parameters of *Lycopersicon esculentum (Hybrid Tomato US-404 Bhavani)* after 30 days of sowing seeds

S.No.	% VC	Length of shoots Mean ± SE	No. of leaves mean ± SE
1	0	5.42 ± 0.48^{b}	3.53 ± 0.21^{c}
2	20	12.32 ± 0.47^{a}	4.14 ± 0.18^{b}
3	40	12.43 ± 0.80^{a}	2.96 ± 0.18^{a}
4	60	12.68 ± 0.70^{a}	4.91 ± 0.21^{a}

Significance of difference is analyzed by ANNOVA. Values followed by the same letters within the column are not significantly different at 5% level (DMRT with SPSS 60.0)

Table-4. Effect of different concentrations of vermicomposting on growth parameters of *Lycopersicon esculentum* after 40 days of sowing seeds

S.No.	% VC	Length of shoots Mean ± SE	No. of leaves mean ± SE
1	0	7.05±0.41[c]	4.0±0.15[c]
2	20	14.21±0.48[b]	5.56±.20[b]
3	40	16.19±0.31[a]	6.43±.25[a]
4	60	14.18±0.63[b]	6.40±.26[a]

Significance of difference is analyzed by ANNOVA. Values followed by the same letters within the column are not significantly different at 5% level (DMRT with SPSS 60.0)

waste has been successfully managed with the help of earthworm by vermicomposting and a positive effect of vermicompost blended with soil was found on the growth yield and quality of tomato plant under field conditions.

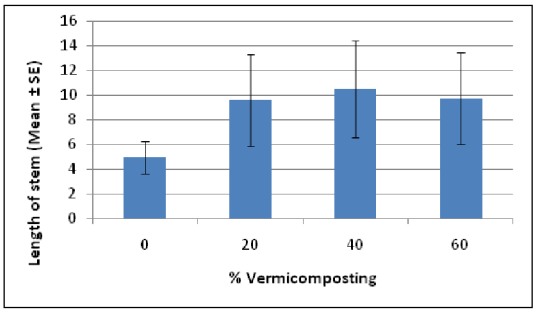

Fig. 1. Overall effect of different concentration of vermicomposting on growth parameters of *Lycopersicon esculentum. (Hybrid Tomato US-404 Bhavani)*

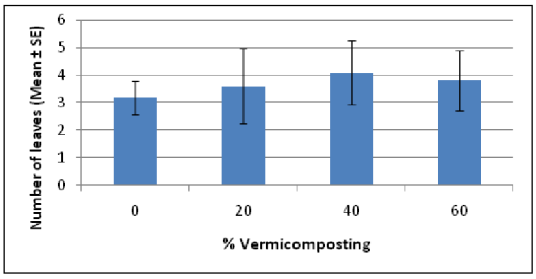

Fig. 2. Dry weight of *Lycopersicon esculentum(Hybrid Tomato US-404 Bhavani)*

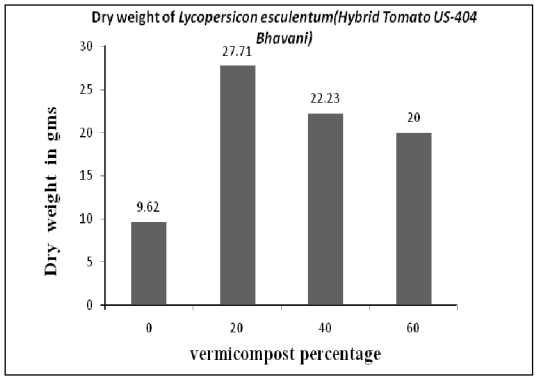

Fig. 3. Vermicopost pits at Govt. D.B. Girls P.G. College, Raipur (C.G.)

Fig. 4a. Germinating seeds on different concentrations of vermicomposting on *Lycopersicon esculentum (Hybrid Tomato US-404 Bhavani)* after 20 days of sowing seeds

Fig 4b -Effect of different concentrations of vermicomposting on growth parameters of *Lycopersicon esculentum (Hybrid Tomato US-404 Bhavani)* after 40 days after sowing seeds

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References :

1. Edwards, C.A. (Ed) (1998). Earthworm Ecology. CRC Press Boca Raton. 389 pp.
2. Edwards, C. A. and I. Burrows, (1988). The potential of earthworm composts as plant growth media. In Earthworms in Environmental and Waste Management Ed. C. A., Neuhauser, SPB Academic Publ. b.v. The Netherlands. 211-220.
3. Edwards, C. A. and P. J. Bohlen, (1996) Biology and ecology of earthworms (3rd edition) Chapman and Hall . London, New York, 426.
4. Follet, R. Q. Donhare and L. Murphy (1981). Soil and Soil Amendment, Prentice Hall; Inc. New Jersey.
5. Haimi, J., (1990). *Eisenia andrei and E. fetida. Revue d'Ecologie et de Biologie du Sol 27:* 415–421.
6. Hattenschwile Sand P. Gaser (2005). *PNAS. 102:* 1519-1524.
7. Kale, R.D. (1998). Earthworms:nature's gift for utilization of organic wastes. In: C.A. Edwards, (Ed.), Earthworm Ecology. CRC Press, Boca Raton, FL, pp. 355–377.
8. Mitchell MT, SB Horner,and B.I. Ibrasm (1980). *J. Environ. Qual. 9:* 373-378.
9. Paul, F. H. (2000). Earthworms. p. C77-C85. In Malolme Sumner (ed.) Hand book of Soil science. CRC Press.
10. Roberts P, G.E. Jones and D.L. Jones (2007) *Compost Sci. Util. 15:* 6-15.
11. Rock G.E., Martens J. (1995). Composting with red wiggler worms. In city farmer. Canada. 1-6. Available at http://www.prehall.com.
12. Singh A., Sharma S. (2003). Effect of microbial inocula on mixed solid waste composting, vermicomposting and plant response. Compost Sci. Util. *11:* 190-199.
13. Sinha, R. K., E. M. Heart, and D. Valani, (2010) *International journal of Global Environmental Issues 10* : 265-292.
14. Van Gestel, C.A.M., ven-van E.M. Breemen, and R., Baerselman, (1992). *Pedobiologia 36*:109–120.