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EFFECT OF VERMICOMPOST TREATMENT ON USAR SOIL FOR GROWTH AND PRODUCTIVITY OF *LYCOPERSICUM SCULENTUM*

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Abstract

In the present experiment, usar soil is the main problem of limited crop production of Uttar Pradesh. In this experiment the Vermicompost treatment was given to usar soil, for advancements of fertility of usar soil. The vermincompost from 40% to 80% was added in usar soil during winter season in various samples. Seeds of *Lycopersicum esculentum* were sowed in different samples and 100% usar soil sample. The Data of growth of plants and it's parts were recorded by Arc Auxanometer and simple scale, after 25 days of sowing. Present data of growth of shoot, root, leaflets and productivity of tomato show that 75% dose level of vermicompost improved the soil fertility. Average length of branches was maximum (19.73cm) in amended soil. Weight of fruits (43g) was more in vermicompost enriched soil. In the present study recorded data show that the addition of vermicompost in usar soil, increase the fertility of usar soil. Therefore, this method of advancements in fertility and productivity is very useful to requirement of chemical fertilizer. It can be used as parafertilizer for improving the soil fertility and productivity of crop.

***Key words*:** Vermicompost, leaflet growth, soil fertility, *Lycopersicum esculentum*, para fertilizer.

Introduction

It has been realized that organic manure (Compost, Vermicompost) gives a favorable action. Since it brings all the nutritive substances are indispensable for the biological cycles. It also maintains a favorable action on the structure of soil besides stimulating the growth of the population of saprophytic eco-friendly microbes with antagonistic properties. Thus soil becomes productive on one hand and soil borne pathogens suppressive on the other hand (Hu *et al.*, 2003), beside managing deficiency level. Vermicompost is a natural product with the potential of revolutionizing Indian agriculture (Gupta, 1993). The natural process and other biodegradation activities of organic wastes are aimed at increasing food supply for man's need. Vermicomposting is the process of preparing the compost from organic wastes with the help of earthworms which generally live in soil, eat biomass excrete it in digested form. Vermicompost consists of mostly worm cast (poop) plus some decayed organic matter. In ideal condition 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 micro organism they are really eating it and yet mystery; their casts contains eight times as many micro organism as their feed, and these are the micro organism that best favour healthy plant growth. The costs don't contain any disease pathogens, pathogenic bacteria are reliably killed in the worms gut. This is one of the great benefits of vermicomposting. This method is an alternate to fulfill the requirement of fertilizer (Singh and Singh, 2004).

Worm casts also contain five times more nitrogen, seven times more phosphorus, and 11 times more potassium than ordinary soil, the main minerals needed for plant growth, but the large numbers of beneficial soil micro organisms in worm casts have at least as much to do with it. The casts are also rich in humic acids, which condition the soil, have a perfect pH balance, and contain plant growth factors similar to those found in seaweed. Vermicomposting is an important component of organic farming without much financial involvement which can convert rural and urban biowastes into nutrient rich organic manures (Sajnanath and Sushama, 2004).

Vermiculture technology easily converts the organic wastes into a good quality of vermicompost within 60-90 days. Continued price think of fertilizers coupled with low purchasing capacity of farmers and persistent depletion from soil have revived the interest of recycling along with chemical fertilizers, so as to sustain optimum yield and improve soil physical, chemical and biological properties (Siag and Yadav, 2004).

Materials and Methods

In the present investigation usar soil was surveyed in Hawai Patti, Farrukhabad District of Uttar Pradesh for collection of soil (Normal). Analysis of various physicochemical properties of normal soil and vermicompost was done by Kalra and Maynard (1991) Methods. Vermicompost have been taken from Braj Gausala trust Brindawan, Mathura (U.P.) Usar soil collected from Hawai Patti, Mohammdabad, District-Farrukhabad (U.P.) and normal soil from field of tomato. Vermicompost contain 9.15 to 17.98% organic carbon, 1.75 to 2.5% nitrogen, 1.55-2.25% available phosphorus, 1.25-2.0% potassium, calcium, magnesium sulphate, 3-5 times better than farm yard manure. Normal soil have pH-7.2, Ec-0.6, organic matter 0.22, phosphate 8%, potash 80%. The usar soil have pH-9.5, Ec-2.3., Vermicompost treatment (Usar soil 60% + Vermicompost 40% Usar soil 50% + Vermicompost 50% Usar soil 40% + Vermicompost 60%, Usar soil 30% + Vermicompost 70%, Usar soil 20% + Vermicompost 80%) was given to usar soil (Yoram, 1994) and observed the growth and development parameters of tomato. Experiment was sat in treatment combinations and normal usar soil pots. Seeds of *L. esculentum* were sown in winter season in normal soil pot

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and vermicompost mixed usar soil pots. Irrigation was done as required by plants throughout the growing season till the maturation stage as ripening of fruits. Data from germination to flowering of the plant and The growth of shoot, root and leaf were observed by Arc auxanometer (Srivastava,1996).

Statistical analysis of observed data was conducted by M S-Excel software package. The significance level was presented as P (probability values at either 0.05 or 0.01 levels). LSD05-least significance difference was done for comparative assessment of difference among various treatments. Significant differences were observed at>0.05. Correlations between difference parameters were done by using MS- Excel analysis

Results and Discussion

In present investigation usar soil samples were collected from chosen sites of Hawai Patti region Mammdabad in Farrukhabad district of Uttar Pradesh for amendments to assess the role of vermicompost additive in the improvement of soil fertility. Effect of varying doses of vermicompost in improving soil properties was investigated. Studes were carried out separately for treated and unamended samples of usar soil (control). The organic enricher vermicompost was employed in 25%, 50% and 75% doses. The chosen soil type was found to be barren on account of poor fertility status. Amended soil was compared with reference (fertile) soil for noting the suitable organic amendments on the basis of their relative value in improvement of soil fertility, along with their reclamation potentiality.

A total 13 parameter of different physico chemical attributes were studied to assess the physical and chemical characteristics. Data Presented in Table 1 exhibited better improvement in gain percent for soil porosity, bulk density, water holding capacital for plant growth. Vermicompost acquired high gains (82.12).

Goel and Behl (2002) studying impact of different enrichers in saline-sodic soils of Lucknow noted that 4.68 to 65.5% acquired gains in vermicompost amended soil and noted efficiency of vermicompost in reclamation of soil. Similar observation was made by the Dubey (2009) and Chaudhary *et al*. (2013) stated that the various organic amendments in problem soil the reclamation process through improving soil structure, supplying required plant nutrients and enhancing microbial activity. The effects of Vermicompost treatment on the usar soil was apparent from observations of growth of shoot, root, leaves and productivity of *L. esculentum.* Observations of experiment are given in table 2, 3, 4. The improvement in plant growth characteristics by mixing of vermicompost in usar soil was recorded and given in table 2. It is evident from the results that organic enricher vermicompost favours the length of root and shoot and due to scarcity of nutrients control soil could not support better growth. Growth of plant is more prominent in 50% and 75% dose level of vermicompost as compared 25% dose level. The growth of root observed in higher side (6-20cm) in 50% dose plots while shoot growth was recorded higher (5.1-70.5cm) in75% dose level sample.

Atiyeh *et al*. (2002) reported greatest vegetative growth (Root and Shoot length) of French marigold in 30% and 40% vermicompost amendment. In the present investigation the plant showed higher the doses of vermicompost provide better results. The vermicompost enrichment favour the maximum growth of root and shoot. Edwards and Lofty (1978) demonstrated greatly increased growth of root and shoots of barley in soil sterilized and then inoculated with earth worms these beneficial results have been mainly related to an improvement in physical and chemical properties of soil. Improved growth of root has also been related to a greater availability of nutrients in earthworm castes, which contain more available mineral nutrients than tha soil in which the earthworm live (Bouche, 1975; Anderson *et al*., 1983) Rao and Sitarammay (2000) suggested an improvement in physical properties of soil and plant growth in rice after various amendments due to sustained availability of Sufficient amount of plant nutrients for growing plants.

Impact of organic enricher was clearly seen in number, length and width of leaves of tomato plant raised after amending different doses in chosen usar soil. Data observed in experiment at different time intervals were given in table 3,4,5. Number of leaves in unamended was maximum (8) in 130th day of study, after which leaves started drying and thus number reduced at 160th day almost complete foliage dried. The vermicompost enrichment favours the Foliage cover most (75). Higher the dose of vermicompost better the result was seen by progressive increase in the number of leaves was noted with the time intervals in vermicompost.

Table 4 showed similar increasing trend in size of leaves were noted in vermicompost amended soil pots and with the advancements of doses as well as time intervals the increasing trend was observed. However, maxmimum (19.0) smooth length was achieved on 100th days of study. Data on pooled mean taken at 100th days indicates that average length was maximum (14.4cm) in vermicompost. The effects of vermicompost on the growth of variety of crops including cereals, legumes, vegetables, flowering plants have been assessed in green house lesser digree in field crops (Edwards and burrows, 1988; Wilson and Carlile, 1989; Mba, 1996).

An observation of leaf width was given in Table 5 which shows considerable advancements in amended soil over the control soil. The maximum width was recorded (4.62) in the 100th day of experiment conducted in control soil while the range of width of leaves of tomato was observed in bet been 2.0 to 13.41cm in different doses of vermicompost in the various time intervals.

Reproductive characteristics were given in Table 6 and 7. The flowering in the plants was started at the 100th day in 25% treated vermicompost amended pot and it was seen at 85th day in 50% and 75% doses of vermicompost treated soil. Data of flowers character are shown in Table 6 reveals that maximum (34 flowers) found in 75% vermicompost dose at 130th days of experiment. The flowering in the control soil was recorded very poor at 140th day (1) and 160th day (2).

In control soil plants could not reached to the maturity of floral stage and they died before maturity and exhibited 1.5 number of flower (average). Average number was more in vermicompust (19.7) amended soil. Fruiting could not seen in control soil. The productivity of *Lycopersicum esculentum* was given in table 7. Recorded data show that maximum (43) gms in 75% dose level pot of vermicompost.

Fruiting was not observed in 25% dose of vermicompost level and control soil due to the lack of nutrients in the soil. The higher availability of nutrients at higher doses of application of vermicompost may state favorable conditions leading to increase flower number and their duration as observied by Anserwadekar and Patil, 1986; Roychaudhary *et al*., 1995. Moraditochael *et al.* (2011) made analysis on egg plant and showed the significant impact of vermicompost on fruit yield, length, number of fruits per plant. Tomato is one of the most popular vegetable crop growth lobately and almost thought out the year all over India. Fruits of crop are eaten as raw in salad & cooks in various recipes, In several districts of the state farmed are facing difficulty in getting desired productivity of the produce of their field. Moreover to bring

out more and more area under cultivation organic amendment practices have gained the momentum (Goel and Behl, 2002).

The addition of vermicompost treatment will improve the growth of shoot, root, leaf and productivity of Tomato. Thus it is concluded from present experiment that the fertility of usar soil was improved by Treatment of Vermicompost by farmers of India. The application of vermicompost increases the growth of root, shoot, leaf number, length width and whole the plant without any kind of disease in plant. Therefore, the treatment of usar soil by farmers of areas of wasteland can be increase the productivity of *L. esculentum* fruits and fulfill the requirements of vegetable for population of our country. Thus economical status of poor farmers was improved by vermicompost technology principles.

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Table 1: Physico-chemical characteristics of usar soil and amended soil by vermicompost

Characteristics	Usar soil (control)	Vermicompost	
		Mean	%gain
1. Soil Porosity (%)	38.1	46.03	55.06
2. Soil moisture (%)	4.43	4.73	16.48
3. Bulk density(g/cm3)	1.59	1.43	84.21
4. Water holding capacity (%)	36.0	42.56	164.0
5. Soil pH	9.23	8.09	79.72
6. Electrical conductivity dsm -3	0.678	0.783	181.03
7. Organic carbon (%)	0.751	2.14	55.60
8. Organic matter (%)	1.29	3.70	55.91
9. Total nitrogen (%)	0.066	0.247	41.86
10. Phosporus (mg/kg)	5.18	8.23	80.90
11. Ex Na (mg/100gm)	8.9	7.73	38.36
12. K (meg/100gm)	0.353	0.511	123.07
13. Ca (meg/100gm)	3.6	4.88	91.42
Total Gains	-	-	1067.62
Avg acquired gains%	-	-	82.12
Avs required gain %	-	-	17.88

Table 2: Root and Shoot length (cm) of tomato plants in amended and control soil

Days	%Doses Vermicompost				Control
		25%	50%	75%	
25th days	Root	4.5	6.0	5.1	2.1
	Shoot	6.7	7.4	7.7	2.3
	R.S	0.67	0.81	0.66	0.91
40th days	Root	6.13	6.56	7.22	5.6
	Shoot	16.50	19.86	23.26	11.2
	R.S	0.38	0.33	0.31	0.50
55th days	Root	8.9	14.5	16.2	9.8
	Shoot	38.2	48.2	52.2	14.7
	R.S	0.23	0.30	0.30	0.66
160th days	Root	14.3	20.0	17.5	12.1
	Shoot	62.4	73.7	70.5	36.80
	R.S	0.22	0.27	0.24	0.32
Mean	Root	8.45	11.76	11.50	7.4
	Shoot	30.95	37.29	38.49	16.25
	R.S	0.27	0.31	0.29	0.45

Table 3: Number of leaves in tomato (*Lycopersicum esculentum*) plants in vermicompost amended soil at different time interval

No of days	25th day	40th day	55th day	70th day	85th day	100th day	115th day	130th day	145th day	160th day	mean	
Vermicompost												
25%dose	2.0	7.0	8.0	13.0	18.0	22.0	28.0	31.0	23.0	24.0	17.60	
50%dose	3.0	8.0	10.0	14.0	21.0	25.0	29.0	26.0	25.0	23.0	18.4	
75%dose	4.0	10.0	14.0	29.0	43.0	57.0	66.0	78.0	69.0	75.0	44.5	
Pooled mean	**3.0**	**8.3**	**10.6**	**18.6**	**27.3**	**34.6**	**41.0**	**45.0**	**39.0**	**40.66**	**5.3**	
Control	2.0	4.0	5.0	7.0	7.0	8.0	8.0	8.0	4.0			

Table 4: Length of leaves in tomato plants in vermicompost amended soil

No of days	25th day	40th day	55th day	70th day	85th day	100th day	mean
Vermicompost							
25%dose	2.7	6.3	10.3	10.6	10.9	10.9	8.6
50%dose	3.3	6.8	11.7	12.6	13.4	13.5	10.2
75%dose	3.4	8.7	15.1	18.3	18.9	19.0	13.9
Pooled mean	3.1	7.2	12.3	13.8	14.4	14.4	
Control	1.4	2.9	4.3	4.9	5.3	5.9	4.1

Table 5: Width of leaves (cm) of tomato plants at different time interval in vermicompost treated soil

No of days	25th day	40th day	55th day	70th day	85th day	100th day	mean
Vermicompost							
25%dose	2.0	4.72	6.48	7.22	7.24	7.25	5.81
50%dose	2.11	5.43	7.13	9.14	9.18	9.20	7.33
75%dose	2.35	6.83	11.66	13.25	13.38	13.41	10.14
Control	1.33	3.44	3.89	4.17	4.43	4.62	3.64

Table 6: Number of Flowers in *Lycopersicum esculentum* plants in vermicompost amended soil

Day after sowing / Doses Vermicompost	85th day	100th day	115th day	130th day	145th day	160th day	Mean
25%	-	-	6	8	13	8	8.75
50%	-	9	19	28	23	18	23.2
75%	-	14	26	38	27	31	27.2
Control	-	-	-	-	1	2	1.5

Table 7: Productivity of *Lycopersicum esculentum* with different doses of Vermicompost

Vermicompost	Fruit No	75% dose		50% dose		25% dose		Control 100%	
		Weight (gram)	Seed count	Weight (grams)	Seedcount	Weight (grams)	Seed count	Weight (grams)	Seed count
	1	46	74	33	87	-	-	-	-
	2	31	142	36	108	-	-	-	-
	3	42	257	31	78	-	-	-	-
	4	38	155	37	138	-	-	-	-
	5	41	167	32	114	-	-	-	-
	6	43	186	31	119	-	-	-	-
	7	-	-	28	97	-	-	-	-