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Effect of organic fertilizers and chemical fertilizers on soil attributes and other aspects of eggplant (*SolanumMelongena L.*) in Jaipur

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Abstract: Human-made inputs were used in farming to meet the demands of an expanding population. The ecosystem's links— soil, plants, and animals—have all suffered as a result of the inputs' overuse. Because of this disruption, a lot of unhealthy food has become widespread. Produce grown with inorganic inputs, like fertilizer, pesticides, and insecticides, poses health risks to consumers due to the presence of toxic chemicals. Fertilizer is applied to soil in order to replenish nutrients depleted during prior plant growth, with the ultimate purpose of improving production and economic benefit. Modern society places a premium on understanding how increased chemical fertilizer use will affect the soil ecosystem. The usage of chemical fertilizer has been shown to affect not just soil quality but also the survival of soil organisms. Eelworms are an essential component of the soil fauna, since they aid in biodegradation and stabilization in a wide variety of soil settings either directly through their feeding habits or indirectly through the creation of humus and other soil processes. In addition to improving plant health, growth, soil fertility, plant production, and human health, organic fertilizer also makes food more secure and nutritious. There were 25 different containers used to cultivate eggplant (SolanumMelongena L.). In this study, we used five different treatments: vermicompost, vermiwash, vermitea, chemical fertilizer, and a control. They used 5 pots each treatment. The researches have made their own vermiwash and vermitea, and have also used commercially available vermicompost and chemical fertiliser. In addition, the findings support the idea that vermiwash, vermitea, and vermicompost have a beneficial effect on crop development, yield, and soil quality. Fruit from plants treated with vermin technology had dramatically increased germination, fruit diameter, and protein content. pH, organic carbon, accessible phosphorus and potassium were all improved in soil that had been treated with vermiwash, vermitea, and vermicompost.
Keywords: Vermitechnology, Vermiwash, Vermitea, vermicompost

INTRODUCTION

Mineral nutrients are taken up by plant roots from the soil. These nutrients come from a variety of places, including fertiliser, manures, composts, and other organic amendments; the decomposition of plant residues; air deposition; etc. Growing plants relies heavily on the organic matter in the soil. It adds to the nutrition of crops and the richness of the soil. Bacteria, Actinomycetes fungi, nematodes, earthworms, mites, and insects are all examples of living soil creatures. They function as part of the soil's food web to cycle nutrients through the ecosystem biologically.

Soil biodiversity has been negatively impacted by the over use of various agrochemicals in the horticulture eco-system, which has tipped the delicate balance of soil flora and fauna. As a result of this harmful change, soil disease has spread without the natural suppression of harmful and beneficial organisms known as bio-control agents. Many nematode, fungal, and bacterial disease complexes have emerged as a result of the current situation.

Earthworms are an essential waste nutrient that plays a crucial role in organic matter and soil metabolism's decomposition process. They are known as soil health indicators. The complex process of partial organic matter decomposition and mixing with mucus and intestines enhances the fertility of the soil. The soil is affected by forming the atmosphere which contributes to the porosity of the soil. For plant growth and productivity, the positive role of earthworms is very important. Includes a worm technology that has been developed because of the importance of the earthworm.Use of surface and earthworms in soil management and fertilization. The production ofvermicompost, which have proven to be an essential ingredient for plant growth and productivity, can therefore optimally recover bio waste through the processing of cyclone composts. The present study is an effort to introduce a clear picture of the existing situation about use of vermin-technology in the production of organic vegetable. The regular use of chemical fertilizers leads to risks of certain diseases, and the biggest problem facing the use of chemical fertilizers is cancer, goiter, birth defects, high blood pressure, testicular cancer and abdominal cancer.

Impact on soil

For maximum return, one of the most valuable commodities must be kept in pristine condition, and that means soil. Both fertility and organic matter levels have been declining due to excessive mineral fertilisation and illogical cultural practises. Earthworms and soil microorganisms work together to create vermin-compost, a "organic fertiliser" that includes highly mature material with advantageous properties such high porosity, aeration, drainage, water storage capacity, and microbial activity. A number of research show that organic fertilisers applied regularly improve soil structure.

Ansari and Sukhraj (2010) Authors tested the effects of vermin-compost and vermin-wash obtained using vermin-technology on soil okra quality, with a focus on recycling organic waste (Abelmoschusesculentus). Soil samples taken from the experimental pots revealed the following beginning conditions: a pH of 7.97, 1 percent organic carbon, 0.1 percent accessible nitrogen, 5 parts per million magnesium, 11 parts per million calcium, and 10.44 parts per million zinc. Vermiwash and vermicompost showed the greatest increase in organic carbon percentage, followed by vermicompost and cattle dung. It has been determined that the lack of organic carbon in the chemical fertilisers is responsible for the lack of growth in organic carbon levels in both the control and chemical fertiliser groups. It was discovered that the soil's trace element content was enhanced by using vermiwash and vermicompost.

Atiyeh et al. (2002) Plant growth regulators like indole acetic acid, gibberellins, and cytokinins extracted from vermicomposts in water were thought to have shown significant effects on plant growth. It's possible that such chemicals have a short lifetime in soils. Plant growth regulators that are only around for a short time may adsorb onto humates and work along with them to affect plant development. Crop yield potential, or fertility, is influenced by a wide range of soil characteristics, including its chemical composition, biological makeup, and physical structure. Indirectly and directly, earthworms and their vermin-compost can greatly improve soil quality and plant yields. Soil structure and tilth, as well as nutrient cycling and the activity of other beneficial soil organisms, can all benefit from earth worm activity. Vermi-composts have a number of growth-regulating components, including plant growth hormones and humic acids, which contribute to their beneficial effects on plants. Superior soil management and fertilisation practises are key to good quality crop and helps in creating better arrangement of nutrients.

Impact on nutrients in plant products

More polyunsaturated fatty acids were detected in organic animal products and plant goods, and there was more dry matter and minerals like Fe and Mg in organic plant products (Lairon, 2009). For three years, Lester (2007) grew entire grapefruits using both methods of cultivation. Conventional and organic whole fruits were compared for marketability (fruit weight, specific gravity, peel thickness, and peel colour), and juices were compared for marketability (specific gravity, percent juice, and colour), human health-bioactive compounds (minerals, ascorbic acid, lycopene, sugars, pectin, phenols, and nitrates), taste intensity, and consumer acceptance within each harvest season. The juice from organic fruit was found to have more ascorbic acid and sugars and less nitrate, making it more desirable for commercial use.

Worthington (2001) examined the literature on the subject of organic and conventional crop nutrition using statistical techniques to distinguish between significant differences and trends. A percentage disparity was determined between organic and conventional methods for each comparison. The study calculated mean percentage differences for each important nutrient for the most frequently studied vegetables. Based on these differences, it was determined that the nutrient content of organically grown vegetables was higher than that of conventionally grown vegetables for the five most studied vegetables. The nutrient content of the daily vegetable consumption was calculated for both an organic and conventional diet, and the results showed that the organic variety had higher concentrations of vitamin C, iron, magnesium, and phosphorus compared to the conventional variety. A 27 percent increase in vitamin C content, 21 percent increase in iron content, 29 percent increase in magnesium content, and 13 percent increase in phosphorus content were all reported for organic crops. Furthermore, there was a 15.1% reduction in nitrates in organic food compared to non-organic products.

Despite their lowly appearance, earthworms demonstrate intelligence in their behaviour. Producing a large harvest of nutritious vegetables and fruits without risk is possible using earth worm fertiliser. Even more so than conventional fertiliser, vermin-compost has a high nutrient density and strong growth-promoting properties. The nitrogen fixing bacteria and mycorrhizal fungi included in Vermicompost are excellent growth stimulants, and the compost has a healthy dose of potassium (1.85-2.25%) and phosphorus (1.55-2.25%) as well (Sinha et al. 2010).

3.0 EXPERIMENT ON Eggplant (*SolanumMelongena L.*)

The Eggplant (*SolanumMelongena L.*) “As a healthy vegetarian food has an important role in human food”. It is a cheap source of high quality protein in the diets of millions of people in developing countries, who cannot afford animal protein for balanced nutrition. “In addition to proteins, it is a good source of carbohydrates, minerals and trace elements”. The paper aims at analyzing various fertilizers related to the impact of chemical vs. organic fertilizers on Nutrient content, disease incidence and impact on soil of Eggplant(*SolanumMelongena L.*)

Methodology

The experiment was laid in Completely Randomized Design. Eggplant (*SolanumMelongena L.*) was cultivated in kitchen garden in Jaipur. The sandy loam soil was procured from a nursery. The soil was sieved to remove any stones and debris and then sun dried for 10 days. Conical earthen pots of 30.48 cm heights and 30.48 cm diameters were selected for vegetable cultivation. Each pot was filled with 10 kg after crocking, to avoid water and soil loss. Trichoderma was applied to the soil of nursery beds to protect plants from "damping' off" disease. Before launching the experiment, soil sample was collected from the pile of soil.

Experiment details 1.

Treatment Table

1. Treatment

The quantities of various fertilizer inputs

S.No. Treatment Quantity (on area weight basis)

1. (T1) Vermiwash 0.265 g

2. (T2) Vermitea 0.365g

3. (T3) Vermicompost 0.625g

4. (T4) Chemical Fertilizer Urea 1.916g
SSP 2.935g
MoP 0.375g

5. (T5) Control Nil (only water)

Experiment

Replication: 5

Number of plant per pot: 1

Number of experiment: 3

Seasons: Ist- Oct. 5th,2015, II nd- Jan.5th 2016, IIIrd-July 5th, 2017

Vermiwash, vermitea, vermicompost, chemical fertilizers and control versus inorganic fertilizer inputs on growth and yield of eggplant. For the experiment, *Eiseniafetida* was selected as earthworm and casting treatment. These are voracious cannibals. *Eiseniafetida* has a wide temperature tolerance. Produced with buckets, Vermiwash is a liquid fertilizer obtained from earthworms and used as a foliar spray. It contains plant growth hormones like auxins and cytokines apart from nitrogen, phosphorous, potash and other micronutrients. Falling water removes all secretions from the body of earthworms as well as other nutrients from decomposing matter. The pooled water contains many nutrients readily available to crop plants. Vermitea is produced when worm castings are mixed with water and molasses and fermented for 24 hours. Molasses was a food source for beneficial microorganisms that are part of the worms' castings. The fermentation process multiplies the beneficial microorganisms of the worm that quickly pours tea.

The chemical fertilizer urea, monophosphate (SSP) and potash murates (MoP), was weighted according to eggplant requirements. One superphosphate and potash murates were added to the soil at the initial level. Urea was added in three divided doses, the first dose was applied 15 days after sowing the seeds. Potted seeds of the *"Ritu Raj*" eggplant variety. 5 pots were prepared for each treatment separately. We planted five seeds 2.5 cm below the top layer of soil. Initially 4-5 seeds were planted in each pot. Only one plant was allowed to grow to maturity on all vegetables. Initially the soil was moistened with 2 liters of water. In the summer seasons 600 ml. Water was poured every day in the evening and during the winter the same amount of water was poured every alternate day. Pots containing earthworms were covered with a piece of burlap sacks at the height of the seasons (summer or winter).

All the utensils are arranged in such a way that they receive uniform sunlight. Representative samples of eggplant fruit were collected from each treatment for protein content. For the determination of protein content in eggplant fruits during ripening was representative samples of eggplant were collected from each treatment to analyse protein content. The edible portion of fruits were collected from each pot and dried in an electric oven at 60 O C. After drying the samples were ground in an electric grinder having stainless steel blades. These dried fruit samples were used for protein estimation through Microjheldahl process.

Soil sample was collected from each pot to evaluate the impact of various fertilizer inputs on soil. Then soil was sun dried for 15 days and reused for next experiment. In each pot, same treatment input in measured amount was added in next experiment.

The experiment data for growth, yield and quality parameters recorded were subjected to statistical analysis using analysis of variance technique. The critical differences for the treatment comparison were worked out at 5 percent level of significance.

RESULTS

Analysis of variance showed that various organic fertilizers have significantly better on germination, Fruit diameter, nutrient, soil and disease.

Table 1 Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on germination in eggplant.

Treatment	Experiment	Total number of seed germinated (in days)									Total	Germi-nation %	Mean	SD	SE
		Days wise													
		7	8	9	10	11	12	13	14	15					
T1 (Verm iwash)	1	7	17	24	18	22	8	3	0	0	99	79.2	105.00	5.57	3.21
	2	11	17	23	21	24	8	2	0	0	106	84.8			
	3	12	19	18	24	24	10	3	0	0	110	88			
T2 (Vermitea)	1	2	16	22	20	17	1	1	0	0	79	63.2	81.33	3.21	1.86
	2	4	18	19	18	17	3	1	0	0	80	64			
	3	4	18	18	18	20	6	1	0	0	85	68			
T3 (Vermi-compost)	1	4	18	22	21	20	5	3	0	0	93	74.4	94.67	1.53	0.88
	2	4	14	24	23	19	8	3	0	0	95	76			
	3	5	15	21	23	21	6	5	0	0	96	76.8			
T4 (Chemical fertilizer)	1	0	10	12	14	12	3	0	0	0	51	40.8	54.00	2.65	1.53
	2	0	9	12	13	15	6	1	0	0	56	44.8			
	3	0	11	13	12	12	5	2	0	0	55	44			
T5 (Control)	1	0	3	6	11	12	9	3	0	0	44	35.2	47.33	2.89	1.67
	2	0	4	11	12	11	10	1	0	0	49	39.2			
	3	0	5	12	12	10	10	0	0	0	49	39.2			
S Em±	1.418														
C.D. at 5%	4.04														

A. Germination

The results indicate that the total number of seedling germinated over the period of 10 days with these above mentioned five treatments, was maximum with vermiwash (105) followed by vermicompost (94.67). The minimum number of seed germinated in control (47.33) during all the three experiments. All the organic treatments (T1 105, T2 81.3, T3 94.67) were found significantly (CD 4.04) superior at 5% level, over control. Vermiwash 105 (T1) registered its significant superiority over chemical fertilizer 54.00 (Picture 1).

Table 2.Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on Average Fruit diameter and Maximum fruit diameter in eggplant.

Treatment	**Av. Fruit diameter (cm)**						**Max. Fruit diameter (cm)**					
	Expt I	**Expt II**	**Expt III**	Mean	SD	SE	**Expt I**	**Expt II**	**Expt III**	Mean	SD	SE
T1	**6.40**	**6.46**	**6.50**	6.45	0.05	0.03	**6.58**	**6.74**	**6.76**	6.69	0.10	0.06
T2	**5.24**	**5.48**	**5.60**	5.44	0.18	0.11	**5.42**	**5.78**	**5.78**	5.66	0.21	0.12
T3	**5.46**	**5.60**	**5.80**	5.62	0.17	0.10	**5.72**	**5.88**	**6.1**	5.90	0.19	0.11
T4	**4.16**	**4.38**	**4.46**	4.33	0.16	0.09	**4.36**	**4.6**	**4.64**	4.53	0.15	0.09
T5	**3.44**	**3.20**	**3.22**	3.29	0.13	0.08	**3.56**	**3.34**	**3.36**	3.42	0.12	0.07
S Em±	**0.52**	**0.56**	**0.58**	**0.55**			**0.53**	**0.59**	**0.60**	**0.57**		
C.D. at 5%	**0.15**	**0.18**	**0.16**	**0.11**			**0.14**	**0.15**	**0.16**	**0.09**		

B. Fruit diameter:

The results of maximum fruit diameter depicted in Table 2 shows that the treatment T1 (vermiwash) was found superior to T4 (chemical fertilizer) and T5 (control) treatments with 6.40, 6.46, and 6.50 cm maximum fruit diameter. The treatment T4 (chemical fertilizer) got the maximum fruit diameter i.e. 4.46 cm in the third experiment. Vermicompost was found to be at par with vermitea. Treatment T5 could not register significant superiority over any treatment in any experiment. Consistently superior performance of vermin-wash and vermin-compost could be due to growth promoting hormone "auxins', cytokinins' and flowering hormone gibberellins' secreted by earthworms. The presence of these hormones in vermin-wash and vermin-compost makes them better in comparison to chemical fertilizers.

Table 3.Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on nutrient content (protein) in Eggplant.

	Protein (in 100h og edible protein)					
Treatment	Expt I	Expt II	Expt III	Mean	SD	SE
T1	27.22	27.43	30.24	28.29	1.11	0.64
T2	26.06	25.34	27.33	26.24	0.51	0.30
T3	27.09	27.17	28.51	27.59	0.23	0.13
T4	24.17	23.34	23.77	23.76	0.42	0.24
T5	22.64	23.18	23.02	22.95	0.28	0.16
S Em±	**0.80**	**0.80**	**1.02**	**0.86**		
C.D. at 5%	**0.62**	**0.67**	**0.50**	**0.34**		

C. Nutrient content: Eggplant in vermiwash had the highest protein content 27.22, 27.43 and 30.24 g protein respectively in first, second and third experiments. The lowest protein content 22.64 g was determined in control group. There were significant differences at 5 percent level for protein between various fertilizer and control. Compared to control and chemical fertilizer, the protein content of vermiwash grown eggplant were significantly higher. Shankar and Sumathi (2008) also supported these findings. They reported that vermicompost application to tomato crop cultivated in kharif registered significantly higher lycopene content compared to other organically grown tomato.

Table 4. Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on soil pH and EC of Eggplant crop.

Treatment	pH						EC(dS/m)					
	Expt I	Expt II	Expt III	Mean	SD	SE	Expt I	Expt II	Expt III	Mean	SD	SE
Blank	8.4	8.4	8.4				1.45	1.45	1.45			
T1	7.56	7.64	7.58	7.59	0.04	0.02	0.828	0.794	0.796	0.81	0.02	0.01
T2	7.9	8.2	8.12	8.07	0.16	0.09	0.938	0.946	0.824	0.90	0.07	0.04
T3	7.76	7.82	7.8	7.79	0.03	0.02	0.858	0.858	0.852	0.86	0.00	0.00
T4	8.74	8.72	8.5	8.65	0.13	0.08	1.534	1.456	1.526	1.51	0.04	0.02
T5	8.8	8.82	8.62	8.75	0.11	0.06	1.62	1.648	1.678	1.65	0.03	0.02
S Em±	**0.26**	**0.24**	**0.20**	**0.23**			**0.17**	**0.17**	**0.19**	**0.18**		
C.D. at 5%	**0.09**	**0.12**	**0.14**	**0.07**			**0.04**	**0.04**	**0.04**	**0.00**		

D. Soil : The organic carbon increased in soil treated with vermiwash (28 percent), vermicompost (0.26 percent) followed by vermitea (0.25 percent). On the contrary this quality was observed to be decreased in soil treated only with chemical fertilizer and control in third consecutive experiment (Table 4). Earth worms play an

important role in the process of soil formation and soil aggregation, mainly through the production of casts. The application of chemical fertilizer was found to enhance slightly the pH. On the contrary, a slight decrease in pH was observed in soils treated with vermiwash.

Application of vermiwash revealed that EC had been reduced (0.79 ds per m). There was an increase in the available P and K in the pots treated with vermitea (P.O. 26.2kg per ha) and vermicompost (P2O5- 28.6 kg per ha) in the third consecutive experiment.

Table 5. Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on soil OC and P_2O_5 of Eggplant crop.

Treatment	OC (%)						P_2O_5(kg/ha)					
	Expt I	Expt II	Expt III	Mean	SD	SE	Expt I	Expt II	Expt III	Mean	SD	SE
Blank	0.12	0.12	0.12				14.98	14.98	14.98			
T1	0.278	0.276	0.286	0.28	0.01	0.00	30.4	30.4	32.2	31.00	1.04	0.60
T2	0.248	0.252	0.252	0.25	0.00	0.00	26.6	25.8	26.6	26.33	0.46	0.27
T3	0.272	0.256	0.262	0.26	0.01	0.00	26.6	28.8	28.2	27.87	1.14	0.66
T4	0.12	0.144	0.108	0.12	0.02	0.01	18.2	18	17.2	17.80	0.53	0.31
T5	0.084	0.078	0.1	0.09	0.01	0.01	12.8	14	13.6	13.47	0.61	0.35
S Em±	**0.04**	**0.04**	**0.04**	**0.04**			**3.22**	**3.17**	**3.50**	**3.29**		
C.D. at 5%	**0.00**	**0.00**	**0.00**	**0.00**			**1.15**	**1.20**	**1.41**	**0.75**		

Similarly in the present study due to application of vermicompost to a very slight decrease in pH from 8.4 to 7.49 was observed. Manivannan et al. (2009) reported that vermincompost alone or in combination with chemical fertilizers is recommended for improving the long-term soil fertility and crop productivity. The pH was observed in 7.56 invermiwash during second experiment which was the minimum among all. In control OC (0.9 precent), EC (1.65 ds per m) and pH (8.75) was recorded.

Table 6. Impact of vermiwash, vermitea, vermicompost, chemical fertilizer and control group on Disease Incidence in eggplant.

Treatment	Expt	Incidence of disease (in days)	Number of treatment required	Time taken for eradication
T1	**1**	**52**	**1**	**12**
	2	**0**	**0**	**0**
	3	**0**	**0**	**0**
T2	**1**	**51**	**1**	**17**
	2	**48**	**1**	**16**
	3	**50**	**1**	**15**
T3	**1**	**50**	**2**	**14**
	2	**0**	**0**	**0**
	3	**49**	**1**	**15**
T4	**1**	**41**	**3**	**27**
	2	**39**	**3**	**24**
	3	**43**	**2**	**26**
T5	**1**	**34**	**3**	**30**
	2	**38**	**3**	**26**
	3	**40**	**3**	**27**

E. Incidence of diseases on plants: Eggplant was attacked by 'Blossom-end rot' and 'Fungal' in all experiments. In each treatment different intensity of disease was observed. In the pots treated with vermiwash, the disease occurred with low intensity. When it was treated with 'Neemgold', it took 9 days time to eradicate in only one application. Whereas in plants grown with chemical fertilizer, two applications of 'Malathion' were required to eradicate disease in 17 days time. Surprisingly, the plants treated with vermiwash not infested with 'Fungal' or any other disease pest during second and third experiment. Arancon et al. (2002) also reported that populations of plant-parasitic nematodes were depressed significantly by the three vermicomposts in all four field experiments compared with those in plots treated with inorganic fertilizer.

CONCLUSION

It can be concluded with the experiment and extensive review that application of vermiwash, vermitea and vermicompost enhanced growth, yield and quality as compared to control and chemical fertilizer. Earthworms and their casts contain high concentration of nutrients but releases gradually according to plant requirement. Therefore the nutrients are absorbed by the plant and do not settle in the ground by leaching. Vermiwash has proved to be powerful growth promoter as well as growth protector. Hence it can be concluded that horticulture with vermiwash ,vermitea and vermicompostcan be beneficial for plant growth, product quality, human health and soil too.

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