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Effect of vermicompost on growth of brinjal plant (*Solanum melongena*) under field conditions

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ABSTRACT

The study was aimed at understanding the effect of vermicompost on the growth and productivity of brinjal plant. The vermicompost of cow dung, garden waste and kitchen waste in combination were used with brinjal plants under field conditions. The different treatments affected the seed germination of the test crop significantly. Plant height, number of leaves and fruit weight ware higher in the vermicompost treated field as compared to control and no disease incidence was observed in the fruits of vermicompost treated plot. The study revealed that vermicompost amendments affected brinjal crop differently and we recommend that while raising brinjal crop farmers should use vermicompost instead of synthetic fertilizers.

Key Words: Vermicompost, brinjal, fruit growth, disease free, ecofriendly

INTRODUCTION

The use of synthetic fertilizers causes a great impact on the environment and the cost of these fertilizers is increasing over the years. The farmers need to raise the crops by organic farming that will reduce the costs and will decrease the impact on the environment. In addition, organic farming will reduce the additional burden of environmental pollution that is caused while manufacturing these synthetic fertilizers at the source (Rathier and Frink, 1989). Now it is a well established fact that organic fertilizers provide enough requirements for proper growth of the crop plant and may enhance the uptake of nutrients, increase the assimilation capacity and will stimulate the hormonal activity as well (Tomati *et al*., 1990; Grapelli *et al*., 1985). Vermicompost is also useful as it increases soil porosity, aeration and water holding capacity.

Vermicompost increases the surface area, provides strong absorbability and retention of nutrients as well and retain more nutrients for a longer period of time.

It has been found that soil amended with vermicompost had significantly greater soil bulk density and the soil does not become compacted (Lunt and Jacobson, 1994; Martin, 1976). Humic acids isolated from vermicompost enhanced root elongation and formation of lateral roots in maize vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs (Pramanik *et al*., 2007). The suppressing, repelling or by inducing biological resistance in plants to fight them or by killing them through pesticide action of Vermicompost aids in protecting crop plants against pests and diseases (Al-Dahmani *et al.*, 2003).

The use of vermicompost appears to affect plant growth in ways that cannot be directly linked to physical or chemical properties (Dash and Petra, 1979). However, the improvements in physical and chemical structure of the growth media are attributed to the increase in plant growth. It is argued that growth promotion may be due to micro flora associated with vermicomposting that induce hormone-like activity on the production of metabolites (Parle, 1963; Tomati *et al*., 1987; Atiyeh *et al*., 2002).

We conducted field experiments that included the effects of vermicompost in the growth, production of leaves and fruiting of brinjal plants. A consistent trend in all these growth trials has been observed in the brinjal plants that were inoculated with vermicompost as compared to the plants that was not inoculated with vermicompost. The objective of this work was to evaluate the impact of vermicompost on brinjal plant height, number of leaves and weight of fruits.

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MATERIALS AND METHODS

We conducted two separate field studies to compare how vermicompost affect plant growth when added to the soil. The vermicompost was produced at IGAEERE, Jiwaji University Gwalior, however, the field trials were conducted in private vegetable gardens. In these experiments, we compared the height, number of leaves and weight of brinjal substituted with three types of vermicomposts (garden waste, cow manure and kitchen waste) in combination.

We germinated and grew brinjal (*Solanum Melongena*) in private garden with one field inoculated with vermicompost and the other without vermicompost. The seedlings were bought from the same nursery and were planted at the same time in both fields. The soil that was used in both the fields was also bought from the same agricultural land. At regular intervals the fields were watered depending upon the requirements. A random sampling technique was used to select the plants for evaluation of height, number of leaves and weight of fruit.

The soil samples were taken from two points from each field (Site I and Site II). The pH of the soil samples was determined by using digital pH meter MKVI- 8611 (Systronics) and the moisture content and humus of the soil was determined following the standards of Thorex *et al.*, 2008. Phosphate, nitrogen, potassium and organic carbon in the soil samples were analyzed by using a soil testing kit (Jyoti Scientific, India).

RESULTS AND DISCUSSION

The pH of the field without vermicompost was 6.2 and 6.1 at site I and site II and the pH of the field amended with vermicompost shows a pH of 7.9 and 8.2 at site I and site II respectively (Table. 1).

The moisture content of the soil sample was 10.3% and 12.1% at site I and site II respectively and the moisture content of the soil sample amended with vermicompost was 56.87% and 52.34% at site I and site II respectively. The humus content of the soil sample was 14.03% and 12.6% at site I and site II respectively and the humus content of the soil sample amended with vermicompost was 47.23% and 46.06% at site I and site II respectively. The Phosphate content of the soil sample was 20-50Lbs (medium) at both the sites and the soil sample amended with vermicompost was having high phosphate content above 45Lbs on both the sites. The nitrogen (nitrate) content of the soil sample was 18Lbs (medium) and 9Lbs (low) at the site I and site II respectively and the soil sample amended with vermicompost was having high nitrate content of 45Lbs on both the sites. The ammonical nitrogen content of the soil sample at both the sites was 13Lbs which is very low and the soil sample amended with vermicompost was having high ammonical nitrogen content above 180Lbs on both the sites. The potassium content of the soil sample was low, below 100Lbs at both the sites and the soil sample amended with vermicompost was having high potassium content of 250-350 Lbs at both the sites. The Organic carbon content of the soil sample was 0.5-0.75% (medium) and below 0.5% (low) at the site I and site II respectively, and organic carbon content of the soil amended with vermicompost was above 0.75% (high) at both the sites (Table 1).

Organic amendment to soil affects the plant growth and soil fertility positively which varied quantitatively depending on the quality of organic residues added to the soil.

Mulching had different effects on the seed germination of different plant species. Vermicompost has considerable potential for improving plant growth significantly, when used as a component of horticultural soil or container media (Edwards & Burrows 1988). Nevertheless, there appear to be major differences between the effects of the vermicompost that were used in our study, in terms of their influence on brinjal plant growth, production of leaves and weight of fruits as compared to the brinjal that were raised without vermicompost. These differences in growth responses could be due to fundamental differences between the vermicomposting and without vermicomposting processes.

Vermicompost has been reported to have 40–60% higher levels of humic compounds than conventional composts (Dominguez *et al*., 1997). It has been observed that growth of tomato and cucumber was enhanced when treated with up to 500 mg/kg humic acids derived from vermicompost (Atiyeh *et al.,* 2002). David *et al*., 1994 found that humic acid in conditions of limited nutrient availability increase nutrient accumulation.

The higher degree of decomposition and mineralization in Vermicompost may partially account for the higher N-content (Syres and Springett, 1984; Bano *et al*., 1987; Shuxin *et al.,* 1991). The increased N-content in vermicompost (62% higher than that of conventional compost) may also be due to the release of nitrogenous products of earthworm metabolism through the cast (excreta), urine as well as mucoproteins.

Table 1. Macronutrient content in field samples without vermicompost and in vermicompost amended field

Parameters	Without vermicompost		With vermicompost	
	Site I	Site II	Site I	Site II
pH	6.2	6.1	7.9	8.2
Moisture content	12.12%	10.3%	56.87%	52.34%
Humus	14.03%	12.6%	47.23%	46.06
Phosphate	Medium (20-50 Lbs)	Medium (20-50 Lbs)	High (above 65Lbs)	High (above 65Lbs)
Nitrogen (nitrate)	Medium (18Lbs)	Low (9 Lbs)	High (above 45 Lbs)	High (above 45)
Nitrogen (ammonical)	Low (13)	Low (13)	High (above 180)	High (above 180)
Potassium	Low (Below 100Lbs)	low (Below 100Lbs)	High (250-350 Lbs)	High (250-350 Lbs)
Organic carbon	Medium (0.5-0.75%)	Low (below 0.5%)	High (above 0.75%)	High (above 0.75%)

Figure 1 a. Brinjal from field amended with vermicompost; b. brinjal from field without vermicompost c. A diseased brinjal from the field without vermicompost

Table 2. Plant and fruit characteristics of field samples without vermicompost and in vermicompost amended field

Plant characteristics	Without vermicompost	With vermicompost
Height of plant	1-1.5 ft	2-2.8 ft
No. of leaves	22-29	37-42
Length/width of the leaves	6-7.2cm/2.5-3.2 cm	13-15cm/5-7.6 cm
No. of fruits to each plant	2 to 3	6-12
Weight of brinjal	19.1-27.1 gms	296.1-343.7 gms

The contents of Phosphorus (P) and Potassium (K) were substantially higher in the vermicompost soil sample than the normal soil sample. The P content of soil sample ranged between low to medium (20-50 Lbs) and of soil sample containing vermicompost is high (65 Lbs). The K content of the soil sample is low (100 Lbs) and higher in the vermicompost soil sample (250-350 Lbs). Greater mineralization is a result of phosphate activity and physical breakdown of minerals. The biological grinding of matter together with the enzymatic influence after passing through the gut of earthworms is responsible for increasing the different forms of potassium (Sharpley and Syres, 1977; Mathur *et al.,* 1980; Rao *et al.,* 1996).

In our field experiments the plant height, number of leaves and fruit weight was significantly higher in the brinjal plants that were amended with vermicompost as compared to control (fig.1 a and b). This may be due to the increase in soil fertility level in the amended soil as vermicompost is rich in nitrogen. However, we also observed that brinjals that were taken from the field with vermicompost did not show any signs of disease as it was observed in the control field (fig.1c).

This may be attributed to the pesticide action of vermicompost that aids in protecting crop plants against pests and diseases by suppressing, repelling or by inducing biological resistance in plants to fight them or by killing them (Al-Dahmani *et al*, 2003 Atiyeh *et al,* (2000). It was also observed that vermicompost have the potential for improving plant growth when added to the greenhouse container or soil and in some cases it is superior to compost.

From the findings, it can be concluded that the organic amendments of soil increase the height of brinjal plants (*Solanum melongena)*, number of leaves and fruit weight and also decreased the disease incidence of brinjal plants. Different forms of organic amendment to soil could be useful for different crops; however, use of vermicompost could be a better option in general. This practice will give boost to the brinjal production in the Northern Province of Madhya Pradesh and thus we recommend that farmers should be educated about the importance of vermicomposting. This will also reduce the additional burden of synthetic fertilizers in our vegetable gardens that in turn will decrease the pollution load on our environment.

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REFERENCES

Al-Dahmani JH, Abbasi PA, Miller SA, Hoitink HAJ. 2003. Suppression of bacterial spot of tomato with foliar sprays of compost extracts under greenhouse and field conditions. Pl Dis, 87: 913-919.

Atiyeh RM, Lee S, Edwards CA, Arancon NQ, Metzger JD. 2002. The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Biores Tech 84: 7–14.

Bano K. Kale RD, Ganjan GN. 1987. Culturing of earthworm *Eudrillus eugineae* for cast production and assessment of worm cast as biofertilizer. J Soil Bio Eco 7 (2): 98–104.

Canellas LP, Olivares FL, Okorokova AL, Facanha RA. 2000. Humic Acids Isolated from Earthworm Compost Enhance Root Elongation, Lateral Root Emergence and Plasma Membrane H+-ATPase Activity in Maize Roots. Int J Pl Physio130: 1951-1957.

Dash MC, Petra UC. 1979. Wormcast production and nitrogen contribution to soil by tropical earthworm population from a grass land site in Orissa, India, Rev Eco Biol Sol 16: 79-83.

David PP, Nelson PV, Sanders DC.1994. A humic acid improves growth of tomato seedling in solution culture. J Pl Nutrit 17(1):173–184.

Dominguez J, Edwards CA, Subler S.1997. A comparison of vermicomposting and composting. Bio Cycle 38 (4): 57–59.

Edwards CA, Burrows I.1988. The potential of earthworm composts as plant growth media. In: Edwards, C.A., Neuhauser, E. (Eds.), Earthworms in Waste and Environmental Management. SPB Academic Press, The Hague, The Netherlands, pp. 21–32.

Grapelli A, Tomati U, Galli E, Vergari B. 1985. Earthworm casting in plant propagation. Hort Sc.20: 874 876.

Lunt H A and Jacobson HG. 1994. The chemical composition of earthworm casts. Soil Sc 58: 367-75.

Martin JP. 1976. Darwin on Earthworms: The Formation of Vegetable Moulds; Bookworm Publishing, ISBN 0-916302-06-7.

Mathur BS, Sarkar AK, Mishra B. 1980. Release of N and P from compost charged with rock phosphate. J Ind Soil Sc Soc. 28: 206–207.

Pramanik P, Ghosh GK, Ghosal PK, Banik P. 2007. Changes in organic-C, N, P and K and enzyme activities in vermicompost of biodegradable organic wastes under liming and microbial inoculants. J Biores Tech 98: 2485-2494.

Rao S, Subba Rao A, Takkar PN. 1996. Changes in different forms of K under earthworm activity. National Seminar on Organic Farming and Sustainable Agriculture, India, October pp 9–11.

Rathier TM, Frink CR. 1989. Nitrate in runoff water from container grown juniper and alberta spruce under different irrigation and N fertilization regimes. J Environ Horticul 7 (1): 32–35.

Sharpley AN, Syres JK. 1977. Seasonal variations in casting activity and in the amounts and release to solution of phosphorous forms in earthworm casts. Soil Bio Biochem 9: 227–231.

Shuxin L, Xiong D, Debing W. 1991. Studies on the effect of earthworms on the fertility of red arid soil. In: Advances in management and conservation of soil fauna, pp. 543–545.

Syres JK, Springett JA. 1984. Earthworms and soil fertility. Plant Soil 76: 93–104.

Tomati U, Galli E, Grappelli A, DiLena G.1990. Effect of earthworm casts on protein synthesis in radish (*Raphanus sativum*) and lettuce (*Lactuca sativa*) seedlings. Bio Fert Soils, 9: 288–289.