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Efficacy of Organic Manures and Micronutrients on Growth and Economics of Brinjal (*Solanum melongena* L.) var. Pusa Uttam

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ABSTRACT: A field experiment was conducted at Horticultural Farm of S.K.N. Agriculture University, Jobner, Jaipur during *kharif* season 2018 to evaluate the effect of organic manures and micronutrients on growth and economics of brinjal *(Solanum melongena* L.) var. Pusa Uttam. The treatments involved organic manures [control, vermicompost (6.6 t/ha) and poultry manure (6.6 t/ha)] and micronutrients [control, Zn (0.5%), Fe (0.5%) and B (0.3%)]. The maximum plant height (22.84, 52.97, 67.26 and 79.33 cm at 30, 60, 90 and 120 DAT, respectively), plant spread (E-W) [28.05, 57.97 and 81.56 cm at 30, 60, 90 and 120 DAT, respectively], plant spread (N-S) [26.05, 55.89 and 79.56 cm at 30, 60 and 90 DAT, respectively], leaf area (553.84, 3652.07 and 13986.03 cm^2 at 30, 60 and 90 DAT, respectively), net returns (226690.63 Rs/ha) were recorded under vermicompost @ 6.6 t/ha than control. While the maximum B:C ratio (4.07) was found under poultry manure @ 6.6 t/ha than control. In micronutrient, the maximum plant height (23.64, 53.78, 68.21 and 80.42 cm at 30, 60, 90 and 120 DAT, respectively), plant spread (E-W) [28.45, 58.78 and 82.46 cm at 30, 60 and 90 DAT, respectively], plant spread (N-S) [26.45, 56.70 and 80.46 cm at 30, 60 and 90 DAT, respectively], leaf area (557.69, 3677.58 and 14059.17cm^2 at 30, 60 and 90 DAT, respectively), net returns (244900.07 Rs/ha) and B:C ratio (4.18) were recorded with Zn @ 0.5%.

Keywords: Brinjal, Vermicompost, Poultry manure, net returns, B:C ratio.

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is also known as poor man's vegetable. It occupied a prominence place in daily diet in India and became more popular not only because of several luscious and beautiful dishes prepared from its fruits but also due to its easy availability. It is popular and most common vegetable in India (NHB, 2020). Organic manures increased productivity of crops with long term maintenance of soil fertility and soil health (Anonymous, 2021). FYM not only supplies a lot of macro and micro nutrients to the soil, but also improve the soil physical, chemical and biological properties. Conventional FYM contains about 0.73 per cent N, 0.18 per cent P and 0.71 per cent K (Tolessa and Friesen 2001). 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 increase in nitrogen as found in poultry manure has its profound effect on the vegetative development of plants and ensures healthy and vigorous growth (Aliyu, 2000).

Zinc is an essential component of a number of enzymes *i.e*., dehydrogenase, aldolase, isomerases, proteinase, peptidase and phosphohydrolase (Mousavi, 2011). It is directly involved in the synthesis of indol acetic acid (IAA) and proteins. Boron helps in the absorption of water and carbohydrate metabolism (Haque *et al*., 2011) translocation of carbohydrates in plants, DNA synthesis in meristems, cell division and elongation, active salt absorption, fertilization, water relation and photosynthesis and involves indirectly in metabolism of nitrogen, phosphorous, fat and hormones. Iron is indispensable for chlorophyll synthesis. It acts as an oxygen carrier and is a constituent of certain enzymes and proteins.

MATERIALS AND METHODS

An experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner Jaipur, Rajasthan during *kharif* season, 2018. The experiment was laid out in randomized block design with 8 treatments and each replicated thrice. The plot size was 2.25 m × 2.40 m and spacing followed was 60 cm × 45 cm. The treatments involved were organic manures [control, FYM (40 t/ha), vermicompost (6.6 t/ha), poultry manure (6.6 t/ha)] and micronutrients [control, Zn (0.5%), Fe (0.5%) and B (0.3%) foliar spray]. Four weeks old healthy seedlings were transplanted on 21 July, 2018. Light irrigation was given after transplanting. All cultural practices were followed regularly during crop growth and observation were

recorded on plant height, plant spread (E-W), plant spread (N-S), leaf area, net returns and B:C ratio. The data on the growth and yield were statistically analysed according to the method suggested by Fisher (1959).

RESULT AND DISCUSSION

The maximum plant height (22.84, 52.97, 67.26 and 79.33 cm at 30, 60, 90 and 120 DAT, respectively) and plant spread (E-W) [28.05, 57.97 and 81.56 cm at 30, 60, 90 and 120 DAT, respectively] were recorded under vermicompost @ 6.6 t /ha (M_2), which was statistically at par with poultry manure @ 6.6 t /ha (M_3). Whereas, the minimum plant height (18.07, 46.07, 59.07 and 71.41 cm, respectively) and plant spread (E-W) (21.96, 50.92 and 73.55 cm, respectively) at 30, 60, 90 and 120 days were recorded under control (M_0). The magnitude in plant height 26.40, 14.98, 13.86 and 11.09 percent, respectively and plant spread 27.73, 13.84 and 10.89 percent, respectively at 30, 60, 90 and 120 DAT more over control. This perceptible increase in height is due to organic source of manure having the rich source of humus, N- fixation by the microbes, regulation of nitrogen supply to the plant and production of plant growth promoters (Rao and Ravi Sankar 2001). The vermicompost applied in soil enhances the organic carbon of soil by increasing microbial activity and microbial biomass, which are key components in nutrient recycling and increasing the indigenous plant growth regulators result in increase in plant height and plant spread. Finding confirmed with the results obtained by Ullah *et al*. (2008); Kashyap *et al*. (2014); Samadhiya *et al*. (2015).

The perusal of data further revealed that the plant height at 30, 60, 90 and 120 days was also significantly affected by micronutrients. The maximum plant height (23.64, 53.78, 68.21 and 80.42 cm at 30, 60, 90 and 120 DAT, respectively) and plant spread (E-W) [28.45, 58.78 and 82.46 cm at 30, 60 and 90 DAT, respectively] were observed under the treatment Zn @ 0.5 per cent spray (N_1) which was significantly higher over control.

Table 1: Effect of organic manures and micronutrients on growth parameters of brinjal at various stages of crop.

Treatments	Plant height (cm)				Plant spread (E-W) (sq. cm)		
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT
Organic Manures							
M_0 _Control	18.07	46.07	59.07	71.41	21.96	50.92	73.55
M_1- FYM (40 t /ha)	20.71	48.99	62.90	74.29	24.90	53.99	76.01
M_2-Vermicompost @ 6.6 t /ha	22.84	52.97	67.26	79.33	28.05	57.97	81.56
M_3- Poultry Manure @ 6.6 t /ha	22.09	51.01	65.24	77.10	27.03	56.02	79.10
SEm±	0.69	1.12	1.31	1.56	0.67	1.11	1.61
CD (P= 0.05)	1.99	3.23	3.79	4.51	1.93	3.20	4.64
Micronutrients							
N_0 _ Control	18.12	46.56	60.18	72.32	22.71	51.59	74.50
N_1- Zn (0.5%) foliar spray	23.64	53.78	68.21	80.42	28.45	58.78	82.46
N_2- Fe (0.5%) foliar spray	21.46	50.25	63.54	75.49	25.83	55.25	77.48
N_3- B (0.3%) foliar spray	20.50	48.46	62.53	73.90	24.94	53.31	75.79
SEm±	0.69	1.12	1.31	1.56	0.67	1.11	1.61
CD (P= 0.05)	1.99	3.23	3.79	4.51	1.93	3.20	4.64

The mean increase in plant height (30.46, 15.50, 13.34 and 6.81 per cent at 30, 60, 90 and 120 DAT, respectively) and plant spread (25.27, 13.93 and 10.68 per cent at 30, 60 and 90 DAT, respectively) were found to be higher than control. This perceptible increase in height is due to active synthesis of tryptophan, in the presence of Zn which acts as precursor of IAA, which stimulates the growth of plant tissues. There is an enhancement in cell multiplication and cell elongation resulting in more plant growth (Raj *et al.*, 2001). Similar results were obtained by Solanki *et al*. (2017) ; Uikey *et al*. (2018).

The data presented in Table 4.2 that significantly affected plant spread (N-S) by different organic manures and micronutrients. The maximum plant spread (N-S) [26.05, 55.89 and 79.56 cm at 30, 60 and 90 DAT, respectively] and leaf area (553.84, 3652.07 and 13986.03 cm^2 at 30, 60 and 90 DAT, respectively) were observed under vermicompost @ 6.6 t /ha (M_2) which was statistically at par with poultry manure @ 6.6 t /ha (M_3). While, the minimum plant spread (N-S) [20.10, 48.92 and 71.55 cm at 30, 60 and 90 DAT, respectively] and leaf area (463.37, 3303.95 and 12475.90 cm^2 at 30, 60 and 90 DAT, respectively) were observed under control. The plant spread at 30, 60 and 90 DAT was found to be 29.60, 14.24 and 11.19 per cent, respectively under the treatment M_2 and leaf area at 30, 60 and 90 DAT was found to be 19.52, 10.54 and 12.10 per cent, respectively under the treatment vermicompost @ 6.6 t /ha (M_2) more over control. The positive influence of organic manures could be because of increase in shoot length and plant vigour, application of organic manures which have helped in the plant metabolic activity through the supply of important micronutrients in the early growth phase, which in turn encouraged early vigorous growth (Anburani and Manivannan (2002).

Application of micronutrient significantly influenced the plant spread (N-S) and leaf area. The maximum plant spread (26.45, 56.70 and 80.46 cm at 30, 60 and 90 DAT, respectively) and leaf area (557.69, 3677.58 and 14059.17cm^2 at 30, 60 and 90 DAT, respectively)

were observed under Zn @ 0.5 per cent (N_1), While the minimum plant spread (N-S) [20.85, 49.56 and 72.50 cm at 30, 60 and 90 DAT, respectively] and leaf area (468.41, 3310.07 and 12535.07 cm^2 at 30, 60 and 90 DAT, respectively) were observed under control. Plant growth parameters increased may be due to promotive effects of macro and micronutrients on vegetative growth which ultimately lead to more photosynthetic activities. Similar results have been reported by Ali *et al.* (2013); Singh *et al.* (2014); Tawab *et al.* (2015) ; Uikey *et al.* (2018).

The data revealed that the maximum net returns (226690.63 Rs/ha) was found with vermicompost @ 6.6 t /ha (M_2) which was statistically at par with poultry manure @ 6.6 t /ha (M_3) whereas the minimum net returns (149294.44 Rs /ha) was found with control. Net returns under the treatment vermicompost @ 6.6 t /ha (M_2), was found to be 51.84 per cent higher as compared to control. The application of organic manures significantly increased the B:C ratio. The maximum B:C ratio (4.07) was recorded under poultry manure @ 6.6 t /ha (M_3) and the minimum B:C ratio (3.32) was recorded under control. The plants received all the required nutrients, which resulted into better growth, development and ultimately higher yield. Similar findings are reported by Selvi and Thiageshwari (2002).

Table 2: Effect of organic manures and micronutrients on growth parameters and economics of brinjal.

Treatments	Plant spread (N-S)			Leaf area (cm^2)			Net returns (Rs/ha)	B:C ratio
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT		
Organic Manures								
M_0 -Control	20.10	48.92	71.55	463.37	3303.95	12475.90	149294.44	3.32
M_1- FYM (40 t /ha)	22.90	51.98	74.01	492.03	3399.97	13131.63	189758.59	3.49
M_2-Vermicompost @ 6.6 t /ha	26.05	55.89	79.56	553.84	3652.07	13986.03	226690.63	3.50
M_3-PoultryManure @ 6.6 t /ha	25.03	54.01	77.09	548.93	3505.52	13347.18	224196.18	4.07
SEm±	0.68	1.13	1.61	15.69	70.26	277.74	7087.92	0.09
CD (P= 0.05)	1.96	3.26	4.64	45.31	202.92	802.17	20471.39	0.27
Micronutrients								
N_0 - Control	20.85	49.56	72.50	468.41	3310.07	12535.07	147752.12	2.98
N_1- Zn (0.5%) foliar spray	26.45	56.70	80.46	557.69	3677.58	14059.18	244900.07	4.18
N_2- Fe (0.5%) foliar spray	23.83	53.24	75.48	522.82	3446.08	13189.70	201246.41	3.63
N_3- B (0.3%) foliar spray	22.94	51.31	73.79	509.25	3427.77	13156.80	196041.24	3.60
SEm±	0.68	1.13	1.61	15.69	70.26	277.74	7087.92	0.09
CD (P= 0.05)	1.96	3.26	4.64	45.31	202.92	802.17	20471.39	0.27

Application of micronutrients significantly increased the net returns and B:C ratio. The maximum net returns (244900.07 Rs/ha) was recorded under Zn @ 0.5 per cent (N_1), while the minimum net returns (147752.12 Rs /ha) was recorded under control. Net returns under the treatment Zn @ 0.5 per cent (N_1) was found to be 65.75 per cent more than control. The maximum B:C ratio (4.18) was recorded under Zn @ 0.5 per cent (N_1) and the minimum B:C ratio (2.98) was recorded under control. Similar results have been reported by Singh *et al.* (2014a).

CONCLUSIONS

From the above findings it is concluded that the use of vermicompost @ 6.6 t/ha and micronutrient Zn @ 0.5 % resulted in the maximum plant height, plant spread (E-W), plant spread (N-S), leaf area and net returns as compared to the control in brinjal. The treatment vermicompost @ 6.6 t/ha was statistically at par with poultry manure (6.6 t/ha) but the maximum B:C ratio was recorded under poultry manure (6.6 t/ha) and Zn @ 0.5 % as compared to control.

FUTURE SCOPE

The study on "Efficacy of organic manures and micronutrients on growth and economics of brinjal (*Solanum melongena* L.) var. Pusa Uttam" will help another interested researcher and farmer who work on brinjal and other vegetable crops. Through this research, I investigated the role of organic manures and micronutrients in increased the productivity of vegetable crops and maintain soil fertility and soil health.

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