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Effect of Organic Manures and Biofertilizer on Growth, Yield and quality of Beetroot (*Beta vulgaris* L.) cv. Red express

Manjesh Kumar[1*], I.N. Shukla[2], Braj Kishor[3], Nirankar[3], Ravi Pratap[4] and Subham Singh[1]
[1]M.Sc. Scholar, Department of Vegetable Science,
CSA University of Agriculture and Technology, Kanpur (Uttar Pradesh), India.
[2]Assistant Professor, Department of Vegetable Science,
CSA University of Agriculture and Technology, Kanpur (Uttar Pradesh), India.
[3]Ph.D. Scholar, Department of Vegetable Science,
CSA University of Agriculture and Technology, Kanpur (Uttar Pradesh), India.
[4]Ph.D. Scholar, Department of Fruit Science,
CSA University of Agriculture and Technology, Kanpur (Uttar Pradesh), India.

(Corresponding author: Manjesh Kumar)*
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ABSTRACT: The current study, "Effect of organic manures and biofertilizer on growth, yield, and quality of beetroot (*Beta vulgaris* L.)," was carried out at the vegetable research farm of the department of vegetable science at Chandra Shekhar Azad University of Agriculture and Technology Kalyanpur, Kanpur, during the Rabi season of 2021–2022. With eight treatment combinations and three replications, the experiment was carried out using a randomised block design. The treatment comprises of PSB (5 kg/ha), FYM (20 t/ha), VC (5 t/ha), PSB (2.5 kg/ha) + FYM (10 t/ha), PSB (2.5 kg/ha) + VC (2.5 t/ha), FYM (10 t/ha) + VC (2.5 t/ha), FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha). The result of the present investigation revealed the following traits viz. Early germination 8.0 (DAS), the highest Plant height 34.01 (cm), maximum number of leaves per plant 18.58, maximum leaf area per plant 1266.16 (cm2), maximum root length 11.84 (cm), maximum diameter per root 6.17 (cm), maximum root weight per root 118.33 (g), maximum root yield per plot 5.68 (kg), maximum root yield per hectare 142.0 (quintal), maximum harvest index 0.69, maximum Total Soluble Solids (T.S.S.) 19.36 (Brix°), and benefit cost ratio 2.97.
In the following experiment the highest yield obtain was in the treatment that was with FYM 10 ton/ha) + VC 2.5 ton/ha) + PSB 2.5 kg/ha). The operations were done as per requirement and time thus produced high yield. All the treatments found superior over control (T_1) on the basis of growth, yield, quality, and economics.

Keyword: FYM, Vermicompost and PSB.

INTRODUCTION

Beetroot (*Beta vulgaris* L.), also called as garden beet or table beet, is one of the major root vegetable belongs to the family Chenopodiaceae along with spinach, palak, swiss chard, parsley, celery and it has chromosome number of 2n=18. The beet root was first cultivated for human and animal consumption in Western Europe and North Africa. As a cool season annual, this crop is a biennial. India's northern and southern regions both grow it. It is grown, albeit on a modest scale, in practically all of India's states. It produces green tips and a swelling root that can be used in salads and as vegetables. It produces a lot and is typically free of pests and illnesses (Ado, 1999). It is an excellent vegetable for people who are concerned about their health because it is a great source of protein, carbohydrates, calcium, phosphorus, and vitamin C (Deuter and Grundy 2004). Because betanine pigment is present, roots are red. It provides a number of therapeutic benefits and lowers the risk of peripheral and cardiovascular disorders. Beet root helps to lower blood pressure, prevent plaque buildup and lower bad cholesterol, manage diabetes, treat anaemia, relieve fatigue, boost sexual health and stamina, and protect against cancer, among other things.

The amount that sugar beet farmers get paid depends on how much recoverable sucrose is taken out of their crop. Therefore, to maximise sugar beet profitability, a crop with a high sucrose content must be produced in large quantities. The management of nutrients is a crucial element in achieving this objective. Three essential elements—beet yield, sucrose content, and sucrose recovery efficiency—are the foundation of sugar beet earnings. Yield optimization for sugar beets can be difficult. All three aspects can be impacted by nutrients, especially nitrogen (N). In addition to increasing nitrate impurities, which lower sucrose

recovery, excess nitrogen can also diminish the sucrose concentration. While maintaining N levels is simple, micronutrients are also essential for getting the best sugar yields. Conversely, N deficiencies can lower the root and sugar output.

Both Maharashtran farmers and sugar mills have little interest in growing sugar beet. The lack of scientific and technological knowledge about sugar beet agriculture in these areas is mostly to blame for the low productivity and low sugar recovery of the plant. Genetic progress and rigorous cultural traditions can increase production and sugar content.

MATERIAL AND METHODS

At the Vegetable Research Farm, Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (208002), a field experiment titled "Effect of organic manures and bio-fertilizer on growth, yield, and quality of beetroot (*Beta vulgaris* L.) cv. Red express" was done during the rabi season of 2021–2022. (U.P.). Eight treatment combinations were used in the trial, which used a Randomised Block Design with three replications. All the different combination of organic manures and biofertilizer treatments *viz.*, T_1: Control, T_2: PSB (5 kg/ha), T_3: FYM (20 t/ha), T_4: VC (5 t/ha), T_5: PSB (2.5 kg/ha) + FYM (10 t/ha), T_6: PSB (2.5 kg/ha) + VC (2.5 t/ha), T_7: FYM (10 t/ha) + VC (2.5 t/ha) and T_8: FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha). The seed of Red express were sown in plot size of 2m × 2m, spaced with 45 × 15 cm. To cultivate a good crop, all other recommended cultural practices were followed. The observation were recorded in randomly taken four plant per plot and tagged plants from each replication on morphological traits *viz.*, number of days taken for germination of seed, plant height (cm), number of leaves per plant, leaf area (cm^2), root length (cm), root diameter (cm), harvest index, root yield (kg/plot), root yield (quintal/ha), root weight (g/plant) and total soluble Solids (Brix°). The data based on individual plants selected for observation were statistically analysed as described by Sukhtme (1985).

RESULTS AND DISCUSSION

Plant height. Plant height is one of the important growth contributing characters for sugar beet plant. Plant height of sugar beet was measured at 25, 50 days and harvest after sowing. It was significantly influenced by different organic manure and biofertilizers (Table 1). During the growth period, plant height increased gradually and reached to peak at around 90 days after sowing. Plant height varies from (11.92, 18.99 and 24.17 cm) in T_1 (control) to (17.74, 28.10, 34.01 cm) in T_8 (FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha)) at 25, 50, days and harvest respectively. The combination of organic manures and biofertilizers may have provided plant nutrients for proper growth of plants by improving the physical chemical properties, drainage, porosity, and aeration of soil, as evidenced by the highest plant height found in treatment T_8 and lowest plant height observed in treatment T_1. The outcome showed that better plant height of beet roots was seen with the combined application of FYM, Vermicompost, and PSB. The results were accorded with Gyewali *et al.* (2020).

Table 1.

Treatment	Plant height (cm) at the 25 DAS	Plant height (cm) at the 50 DAS	Plant height (cm) at harvest
T_1	11.92	18.99	24.17
T_2	13.87	23.71	28.56
T_3	14.46	24.08	28.98
T_4	15.43	25.82	29.93
T_5	15.57	25.93	31.75
T_6	16.33	27.06	31.84
T_7	16.33	26.73	31.83
T_8	17.74	28.10	34.01
SE(m)±	**0.297**	**0.180**	**0.510**
C.D at 5%	**0.910**	**0.55**	**1.563**

Number of Leaves. The number of leaves per plant was greatly affected by organic manure and biofertilizer. With respect to time, the number of leaves gradually grew. At 25, 50 DAS, and harvest stage after planting, the number of leaves per plant varied significantly (Table 2), respectively. The treatment T8 (FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) produced the most leaves per plant (8.75, 15.41, 18.58), followed by treatments T_7 (FYM (10 t/ha) + VC (2.5 t/ha) (7.66, 13.75, 16.66), and T_5 PSB (2.5 kg/ha) + VC (2.5 t/ha) (7.75, 14.00, 16.33). It may be attributable to the synergistic effects of organic manures and biofertilizer, which finally resulted in better growing conditions with the provision of sufficient plant nutrients.

The minimum number of leaves were found in the treatment control T_1 (6.33, 11.91, 14.25) at 25, 50 and harvest stage respectively.

Root Attributes

Root length (cm). According to the findings in Table 3, beetroot root length was greatly increased by applying organic manure and biofertilizer treatments. Application of biofertilizer and organic manures combined Compared to other treatments, (T_8) FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) produced significantly longer roots (11.84 cm).

Table 2.

Treatments	Number of leaves at 25 DAS	Number of leaves at 25 DAS	Number of leaves at 25 DAS
T_1	6.33	11.91	14.25
T_2	7.33	13.75	16.08
T_3	7.41	13.08	15.66
T_4	7.58	13.50	16.00
T_5	7.75	14.00	16.33
T_6	7.66	13.50	16.50
T_7	7.66	13.75	16.66
T_8	8.75	15.41	18.58
SE(m)±	**0.132**	**0.404**	**0.361**
C.D at 5%	**0.405**	**1.237**	**1.107**

The minimum root length found with control T_1 (8.60 cm). Such effect of bio fertilizer along with organic manure application on root size may be attributed active role of bacteria which released from bio fertilizer in producing certain growth regulators and stimulation compounds such as GA3 and IAA which play an important role in formation a large and active root system and also due to availability of sufficient amount of nitrogen, phosphorus by organic manures of natural status of nutrient present in soil and therefore increasing nutrient uptake. Similar results were suggested by Jabeen *et al.* (2018).

Root Diameter (cm). Application of organic manures combined with biofertilizer had a substantial impact on root diameter in this study, according to data collected and analyzed in Table 3. Roots in the treatment of combined organic manure and Phosphorus solubilizing bacteria (PSB) as biofertilizer with FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) in T8 (6.17cm) were significantly thicker than all other treatments whereas treatments T_4 (5.44 cm), T_3 (5.24 cm), T_7 (5.19 cm) and T_2 (5.18 cm) at par each other. The minimum root diameter (4.21 cm) under control. The results are accorded with Devi *et al.* (2016).

Table 3.

Treatments	Root length (cm) per root	Root diameter (cm) per root
T_1	8.60	4.21
T_2	9.48	5.18
T_3	9.91	5.24
T_4	9.64	5.44
T_5	9.93	5.06
T_6	9.18	5.13
T_7	9.81	5.19
T_8	11.84	6.17
SE(m)±	**0.298**	**0.161**
C.D at 5%	**0.914**	**0.494**

Root Yield

Root yield in gram per plant. At various phases of plant development, the application of PSB, FYM, and vermicompost had a substantial impact on the root production (g/plant). Table 4 data analysis and presentation. The application of FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) in T_8 resulted in the highest beet root yield (118.33g), followed by FYM (10 t/ha) + VC (2.5 t/ha) in T_7 (104.16g), which is considerably better than control, and the lowest was reported in control T_1 (76.04g). According to Thanunathan *et al.* (1997) similar findings were reported

Root yield in kg per plot. At various phases of plant growth, the application of PSB, FYM, and vermicompost had a substantial impact on the root yield (kg/plot). Table 4 data analysis and presentation. The application of FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) in T_8 resulted in the highest beet root yield (5.68 kg), followed by FYM (10 t/ha) + VC (2.5 t/ha) in T_7 (5.0 kg), which is considerably higher than control, while the lowest yield was reported in control T_1 (3.65kg). Similar results were suggested by Ijoyah *et al.* (2008).

Root yield in quintal per hectare. The use of organic manures and biofertilizer in combination had a significant impact on the root yield. The findings are shown in Table 4. The application of FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) T_8 (142.0 q/ha) produced the maximum root yield, followed by FYM (10 t/ha) + VC (2.5 t/ha) T_7 (125.0 q/ha). Control T_1 produced the lowest yield (91.25 q/ha). Similar results were suggested by Anna and Maria (2013).

Total soluble solids (°Brix). The application of organic manures and biofertilizer, as well as their combinations, had a substantial impact on the TSS of roots. The data that were analysed were shown in Table 5. The application of FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) T_8 (19.36) produced the highest TSS, which was followed by FYM (10 t/ha) + VC (2.5 t/ha) T_7 (18.20). The Control T_1 had the lowest TSS (13.20). Similar result were reported by Mog (2015).

Table 4.

Treatments	Root yield in gram per plant	Root yield in kg per plot	Root yield in quintal per hectare
T_1	76.04	3.65	91.25
T_2	96.66	4.64	116.0
T_3	97.08	4.66	116.5
T_4	97.50	4.68	117.0
T_5	100.83	4.84	121.0
T_6	97.50	4.68	117.0
T_7	104.16	5.00	125.0
T_8	118.33	5.68	142.0
SE(m)±	**6.488**	**0.110**	**4.510**
C.D at 5%	**8.066**	**0.358**	**12.84**

Harvest Index. The calculations and results for the harvest index are shown in Table 5. The application of FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) had a considerable impact on the harvest index as well. FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) T_8 (0.69) and FYM (10 t/ha) + VC (2.5 t/ha) T_7 (0.67) had the highest harvest indices, whereas control T_1 had the lowest (0.60). Similar result were reported by Carter *et al.* (1985).

Table 5.

Treatments	Total Soluble Solids (T.S.S.)	Harvest Index
T_1	13.20	0.60
T_2	15.70	0.66
T_3	16.53	0.66
T_4	16.63	0.66
T_5	18.10	0.66
T_6	15.96	0.65
T_7	18.20	0.67
T_8	19.36	0.69
SE(m)±	**0.922**	**0.07**
C.D at 5%	**2.824**	**0.14**

CONCLUSION

The experiment's findings showed that the application of organic manures FYM and Vermicompost in combination with biofertilizers PSB with treatment (T_8) FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) produced the highest levels of growth, yield, and quality characteristics, including plant height, number of leaves per plant, leaf area per plant, root length per plant, root diameter per plant, harvest index, root yield kg under the regional climatic conditions of Central Uttar Pradesh, the treatment (T_8) FYM (10 t/ha) + VC (2.5 t/ha) + PSB (2.5 kg/ha) was shown to be excellent and superior.

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Conflict of Interest. None.

REFERENCES

Ado, P. O. (1999). Beetroot cultivation. *Beetroot and Eggplant Newsletter*, *18*: 21-24.

Anna, A. S. and Maria, G. (2013). Comparison of yield and quality of red beetroots cultivated using conventional, integrated and organic method. *Journal of Horticultural Research*, *21*(1): 107-104.

Carter, J. N., Kemper, W. D. and Traveller, D. J. (1985). Yield and quality as affected by early and late fall and spring Harvest of sugar beets. *Journal of the American Society of Sugar Beet Technologists*, *23*(1): 8-27.

Deuter, P. and Grundy, T. (2004). Beetroot Commercial Production and Processing. Agency for Food and Fibre Sciences. *Holland Horticultural Limited Partnership*, 1-4.

Devi, T. I., Haripriya, K., and Rajeswari, R. (2016). Effect of organic nutrients and biostimulants on yield characters of beetroot (*Beta vulgaris* L.). *Plant Archives*, *16*(1): 399-402.

Gyewali, B., Maharjan, B., Rana, G., Pandey, R., Pathak, R., and Poudel, P. R. (2020). Effect of different organic manures on growth, yield, and quality of radish (*Raphanus sativus*). *SAARC Journal of Agriculture*, *18*(2): 101-114.

Ijoyah, M. O., Sophie, V. L. and Rakotomavo, H. (2008). Yield performance of four beetroot (*Beta vulgaris* L.) varieties compared with the local variety under open field conditions in Seychelles. *Agro-Science*, *7*(2): 139-142.

Jabeen, A., Narayan, S., Hussain, K., Ahmed Mir, S., and Khan, F. A. (2018). Effect of organic manures and biofertilizers on quality of spinach beet (*Beta vulgaris* var. *bengalensis*). *Int. J. Curr. Microbiol. Appl. Sci.*, *7*: 1312-1317.

Mog, B. S. (2015). Assessing the impact of organics and bio fertilizers on biochemical parameters and yield components in carrot.

Thanunathan, K., Natarajan, S., Senthilkumar, R. and Arulmurugan, K. (1997). Effect of different sources of organic amendments on growth and yield of onion in mine spoil. *Madras Agric. J.*, *84*(7): 382-384.

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