Original Research Article

Studies on the effect of different levels of organic compost on growth, yield, betalain content and quality of beetroot (*Beta vulgaris*) Under Prayagraj Agro-Climatic Condition

Abstract

The present investigation entitled "Studies on the effect of different levels of organic compost on growth, yield and betalain content of beetroot (*Beta vulgaris*) under Prayagraj agro-climatic condition" was carried out during rabi season 2022 at Departmental Field of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj Uttar Pradesh. The experiment was laid out in Randomized Block Resign (RBD) with three replication and 10 treatments. The minimum days taken to germination 7.87, highest plant height 47.03 centimetre, maximum number of leaves 13.53 and highest leaf area 108.99 cm^2 was recorded from T_4: 50% vermicompost+50% poultry manure. The yield parameters i.e. diameter 6.0 centimetre ,polar length of beetroot 6.8 centimetre, weight of beetroot 126.92 gram and yield 21.93q/hac. was recorded highest among all treatments from T_4 followed by T_0. The quality parameters i.e. T.S.S 10.91^0 Brix, chlorophyll content (SPAD value) 68.61 and betalain content 58.46% was recorded highest from T_4 among all treatments. The benefit cost ratio among all treatments was highest recorded in T_4 2.53 respectively.

Introduction

Beetroot is one of the most widely farmed root vegetables in the world, and it is mostly used as a salad vegetable, however the leaves can also be eaten as spinach. The genus Beta L. belongs to the Betaoidide subfamily of the goosefoot family (Amaranthaceae). Beetroot is a vegetable that is widely consumed due to its high quantity of physiologically active substances, such as minerals and vitamins found in the tuberous root.

The taproot (bulb) section of the beetroot plant (*Beta vulgaris* L.) is an alkaline food with a pH range of 7.5 to 8.0. Haryana, Uttar Pradesh, Himachal Pradesh, West Bengal, and Maharashtra are the primary beetroot root crop growing states in India. Nationally, beetroot is produced on 0.079 lakh hectares with an annual output of 1.51 lakh million tonnes, with UP accounting for 0.08 lakh hectares and an annual production of 0.15 lakh million tonnes (HAPIS portal database 2019-2020). It is planted in temperate climates and is known as the bienniel plant. Beetroot and its juice are often consumed due to their delicious taste. Nutritional value as well as taste content. It is high in vitamins A, B, and C. It also contains calcium, magnesium, copper, phosphorus, sodium, and iron. Its powder is used as a natural red

culinary colourant in dry mixes (soup, Indian curry mixes), candies, jams, and jelly, among other things. Beetroot gets its brilliant red colour from red pigments known as betalains.

In India major beetroot growing states are Haryana, Uttar Pradesh, Himachal Pradesh, West Bengal and Maharashtra. Nationally beetroot is grown in an area of 0.079 lakh hectares with annual production of 1.51 lakh million tonnes and share of Telangana is 425 hectares with an annual production of 11,132 million tonnes (HAPIS portal database, 2017-2018).

The availability of large quantity of FYM being rich in organic matter needs for supplementing the nutrient. The organic manure (FYM) not only provides nutrient to the plant but also improves the soil texture by binding effect to soil aggregates. Organic manure increases cation exchange capacity (CEC), water holding capacity and phosphate availability of the soil besides improving the fertilizer use efficiency and microbial population of soil it reduces nitrogen loss due to slow release of nutrients. So recycling of different organic wastes in the form of compost would be a good source of organic manures, besides ensuring hygienic disposal of the organic wastes. FYM is extensively used organic manure in vegetable cultivation. It improves soil physical properties like structure, texture and water holding capacity etc. Application of FYM in soil increase buffering capacity of soil **(Sharma *et al*., 2003).**

Poultry manure is another amendment that has received much attention for its potential to improve similar soil quality characteristics. Poultry manure is a key resource in increasing and maintaining soil fertility, by providing nutrients, increasing soil organic matter, cation exchange capacity (CEC) and pH (acid soils), improving soil physical properties like water-holding capacity (WHC) and reducing soil erosion (**Adeleye *et al*., 2010).** Poultry manure is well known for its soil quality benefits including decreasing soil bulk density and increasing water holding capacity, nutrient input and retention, and biodiversity, which is mostly in response to increased soil organic matter **(Adekiya *et al*., 2020).** Organic amendments, particularly poultry manure, can thus replace or supplement mineral fertilizers and lime in reversing soil degradation.

Materials and Methods

This experiment was carried out during 2022 at Crop Research Farm, Department of Horticulture, SHUATS, Prayagraj, U.P. A detailed note on the materials used and the methodology adopted for the present study is detailed Geographically, the experiment site which is located at 25.28^{o}N latitude, 81.54^{o}E longitude and 98 m altitude above the mean sea level. This area situated on the right side of the river Yamuna by the side of Prayagraj Rewa Road about 5 km away from Prayagraj, city. The climate of this region is typically sub-tropical and semi-arid with monsoon commencing by the third week of June and

with drawing by end of September. The temperature reached up to 48^{o}C and in winter it goes down to as low as 2-3^{o}C. During the summer hot scorching winds known as *"Loo"* and frost during winter months are common features. Experimental mechanical analysis of the soil was sand 59.50 (%), silt 24.10 (%), clay 16.40 (%) and textural class silt loam, while chemical analysis of soil wasavailable nitrogen (242 kg/ ha), available phosphorus(24.50 kg/ ha), available potassium(95.00 kg/ ha), organic carbon(0.40 %), pH(7.50) and EC(0.19 dS/ m). The material for the study was comprised of 17 cowpea genotypes. The genotypes were raised in field experiment in randomized block design with three replications. Growth, yield and yield attributing parameters were studied and data were collected from the five randomly selected plants from each plot. The data collected on different parameters was subjected to statistical analysis as per method of analysis prescribed by Panse and Sukhatme (1995).

Objective

This study aimed to To find out the effect of different levels of organic compost on growth, yield and betalain content of beetroot (*Beta vulgaris*).To work out the economics of different treatments.

Results and Discussion

Pre Harvest Observations

The analysis of variance for all vegetative and yield parameters in beetroot have been tabulated, statistically computed and the same are presented here under the appropriate headings.

It is evident from the table 1 that the height of plant was significantly influenced by the different treatments. Data analysis showed that the Days taken to germination of beetroot were significantly influenced by different levels of organic compost used in present study. The treatment T4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (7.87), followed by T5 (75% Vermicompost and 25% Poultry Manure) and minimum (9.17) was in T0 -Control (RDF 100% NPK). The longest height was recorded with the Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (47.03), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (37.90) was in T_0 -Control (RDF 100% NPK). This could have led to its high vegetative growth. The results are in support with findings of Tiamiyu *et al*., 2012 in okra. Similarly, the Number of leaves per plant at harvest of beetroot was significantly influenced by different levels of organic compost used in present study. Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was

(13.40), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (10.90) was in T_0 - Control (RDF 100% NPK). However, Treatment T_5, and T_6 was found at par with T_4. Application of organic manures to the soil, physical condition of the soil will be improved by the better aggregation of soil particles (Sahabifar J. 2019). However the Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (108.99), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (57.73) was in T_0 -Control (RDF 100% NPK). However, Treatment T_5 was found at par with T_4. Leaf area is the best measure of the capacity of a crop for producing dry matter, which is called as its productive capital. In this experiment, availability of adequate nutrients by application of poultry manure (50%) might have resulted better growth of the plants as observed with good plant height which ultimately found to be beneficial for high leaf area throughout all growth stages. The results are similar to the findings of Bharad *et al*., 2013 in spinach by using Vermicompost 50%.

Table 1. Performance of growth parameters influenced by different level of organic compost

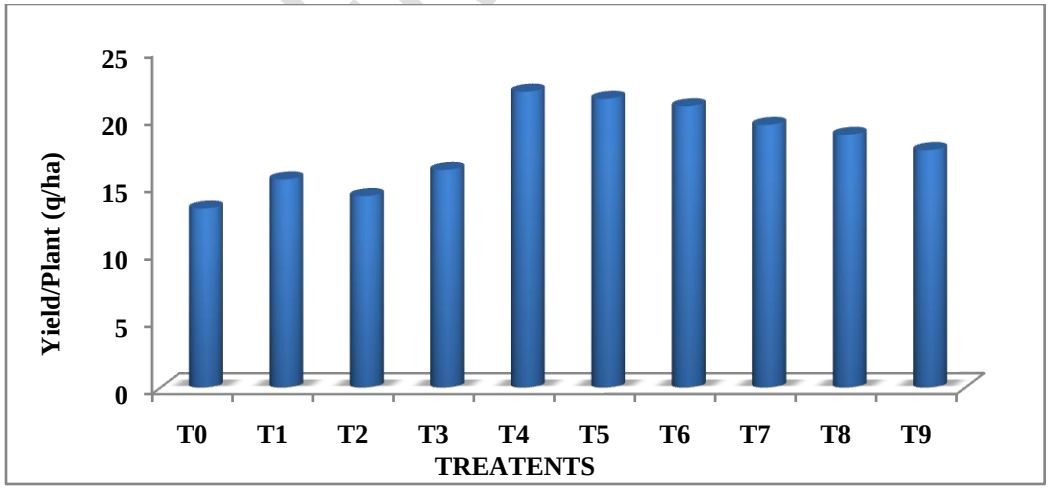
Treatments	Days taken to germination [DAS]	Plant Height (cm)	Number of leaves per plant	Leaf area (cm^2)
T_0-Control (RDF 100% NPK)	9.17	37.90	10.90	57.73
T_1-50% FYM and 50% Vermicompost	8.47	38.00	11.40	77.56
T_2-75% FYM and 25% Vermicompost	8.10	40.33	10.60	68.24
T_3-100% FYM	8.13	35.03	11.06	84.86
T_4-50% Vermicompost and 50% Poultry Manure	7.87	47.03	13.40	108.99
T_5-75% Vermicompost and 25% Poultry Manure	7.93	42.87	13.53	96.65
T_6-100% Vermicompost	9.03	38.30	10.63	76.38
T_7-50% Poultry Manure and 50% FYM	8.53	38.93	11.70	67.83
T_8-75% Poultry Manure and 25% FYM	8.17	40.90	11.53	79.77
T_9-100% Poultry Manure	8.87	42.67	10.60	77.23
F- test	NS	S	S	S
SE(m)	0.584	0.703	0.88	6.608
C. D. (P = 0.05)	1.205	1.451	1.816	13.638
CV	10.11	12.1736	15.2364	57.158

Yield Parameter

The mean data on the Diameter (cm), Beetroot Length (cm), Beetroot Weight (g) and Yield/Plant (q/ha) as influenced by different treatments were recorded during the experimentation and are presented in table 2. The Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (6.00), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (4.80) was in T_0 -Control (RDF 100% NPK). This may be due to the higher content of phosphorus in poultry manure. The higher root diameter recorded may be attributed to enhanced cell division and quick cell multiplication. Okokoh and Bisong (2011) reported poultry manure application had significant influence on stem diameter and the result showed that the application of 10, 15 and 20 t/ha of poultry manure resulted in sufficiently larger stem diameter than other treatments. Data analysis showed that the Beetroot Length (cm) of beetroot was significantly the Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (6.80), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (3.84) was in T_0 -Control (RDF 100% NPK). This may be due to the higher content of phosphorus (1.70%) in poultry manure. Phosphorus stimulates root growth, greater absorption and translocation of nutrients. Phosphorus also brings about improvement in the physicchemical characteristics of the soil (Horvad T Petek M 2015). Similar results of Beetroot Weight (g) the Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (126.92), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (55.3) was in T_0 -Control (RDF 100% NPK). However, the Treatment T_4 (50% Vermicompost and 50% Poultry Manure), recorded significantly maximum as compared to other organic compost combinations was (21.93), followed by T_5 (75% Vermicompost and 25% Poultry Manure) and minimum (13.27) was in T_0 -Control (RDF 100% NPK). Increased yield due to better availability of nutrients and the balanced C/N ratio might have increased the synthesis of carbohydrates which ultimately promoted greater yield (Dongawar *et al*.,2007.). It can also be attributed to better carbon assimilation and better accumulation of carbohydrates in the plants. Similar findings with the application of organics were observed by Chitti jagadish, Madhavi M. 2014 in the tuber yields of potato. The translocation of photo-synthates from source (leaves) to sink (root) might have contributed to increased root length and diameter resulting in root yield.

Table 2. Performance of yield parameters influenced by different level of organic compost

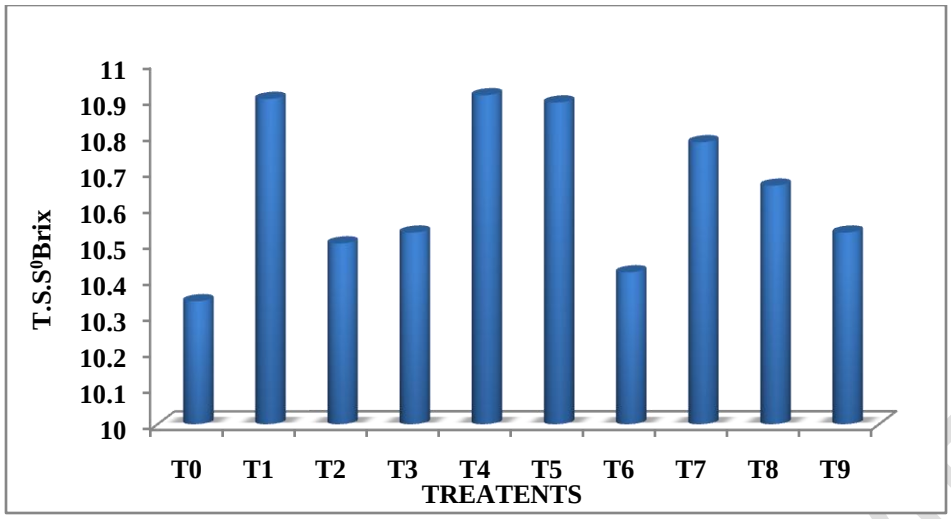
Treatments	Diameter (cm)	Beetroot Length (cm)	Beetroot Weight (g)	Yield/Plant (q/ha)
T_0-Control (RDF 100% NPK)	4.80	3.84	55.30	13.27
T_1-50% FYM and 50% Vermicompost	5.20	4.08	92.06	15.42
T_2-75% FYM and 25% Vermicompost	5.00	4.40	86.80	14.19
T_3-100% FYM	4.90	5.28	90.60	16.13
T_4-50% Vermicompost and 50% Poultry Manure	6.00	6.80	126.92	21.93
T_5-75% Vermicompost and 25% Poultry Manure	5.90	6.34	119.52	21.40
T_6-100% Vermicompost	5.50	4.42	71.70	20.85
T_7-50% Poultry Manure and 50% FYM	5.70	5.86	89.60	19.47
T_8-75% Poultry Manure and 25% FYM	5.10	5.10	101.20	18.73
T_9-100% Poultry Manure	5.40	5.14	97.20	17.60
F- test	S	S	S	S
SE(m)	0.221	0.019	1.036	0.193
C. D. (P = 0.05)	0.456	0.04	2.139	0.399
CV	3.824	3.143	0.314	16.364



Graph 1 Effect of different levels of organic compost on Yield/Plant (q/ha) of beetroot.

Table 3. Performance of yield parameters influenced by different level of organic compost

Treatment No.	Treatments	T.S.S 0 Brix	Chlorophyll content (SPAD Value)	Betalain content (%)
T_0	Control (RDF 100% NPK)	10.34	48.46	30.98
T_1	50% FYM and 50% Vermicompost	10.8	59.47	34.61
T_2	75% FYM and 25% Vermicompost	10.5	61.24	36.83
T_3	100% FYM	10.53	63.64	39.21
T_4	50% Vermicompost and 50% poultry manure	10.91	68.67	58.46
T_5	75% Vermicompost and 25% Poultry Manure	10.89	67.7	52.86
T_6	100% Vermicompost	10.42	52.93	38.91
T_7	50% Poultry Manure and 50% FYM	10.78	54.54	43.01
T_8	75% Poultry Manure and 25% FYM	10.66	61.15	46.37
T_9	100% Poultry Manure	10.53	63.25	37.96
F- test		S	S	S
SE(m)		0.838	7.078	3.238
C.D. (P = 0.05)		1.729	14.61	6.683
CV		2.236	58.036	18.458



Graph 2.Effect of different levels of organic compost on T.S.S^0 Brix of beetroot

Figure 1 Beetroot influenced by different level of organic compost

Figure2 Recording chlorophyll content from healthy plant

Conclusion

The findings of the current experiment showed that the minimum days taken to germination, growth, yield and quality such as T.S.S and betalain content were significantly affected by different levels of organic fertilizer in Treatments. Among all the treatment T_4 sowing effective in germination, growth as well as yield and quality attributes of beetroot.The highest profit and maximum benefit cost ratio was observed in the Treatment T_4 respectively. From the above findings it is concluded that 50% vermicompost and 50 % poultry manure are effectively for getting highest quality wise production.

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