

Original Research Article

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Response of Organic Manures and Micronutrients on Growth, Yield and Quality Attributes of Carrot (*Daucus carota* L.) cv. Pusa Rudhira

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ABSTRACT

Field experiment was conducted to observe the response of organic manures and micronutrients on vegetative growth, yield and quality attributes of carrot. The experiment was arranged in a Randomized Block Design (RBD) with 10 treatments (T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉ and T₁₀) of three replicates each. Data on plant height, number of leaves, length of leaves, fresh weight of leaves, dry weight of leaves, fresh weight of plant, dry weight of plant, length of root, diameter of root, girth of root, fresh weight of root, dry weight of root, yield of root, T.S.S. content and ascorbic acid were taken and analyzed with Analysis of Variance (ANOVA). The results revealed that all growth character, yield parameters and quality attributes were significantly improved by organic manures and micronutrients. The highest values for plant height (96.82 cm), number of leaves (16.78), length of leaves (67.57 cm), fresh weight of leaves (127.78 g), dry weight of leaves (17.03 g), fresh weight of plant (270.57 g), dry weight of plant (37.48 g), length of root (29.25 cm), diameter of root (5.10 cm), girth of root (13.58 cm), fresh weight of root (142.79 g), dry weight of root (20.45 g), yield of root/plot (3.42 kg), yield of root/ha (342 q), T.S.S. content (9.27 °Brix) and ascorbic acid (5.76 mg/100 g) were recorded with treatment (FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron). The values of these parameters were recorded minimum under control *i.e.* treatments T₁.

Keywords

Organic manures,
Micronutrients,
Analysis of
variance,
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Poultry manures
etc.

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Introduction

Carrot is an important vegetable crop of both tropical and temperate countries. It is a cool season crop. Roots are rich in carotene, iron, thiamine, riboflavin, ascorbic acid, niacin and sugar content. Carrot roots are used as vegetables, salad, soup, stews, and curries. A special type of beverage known as 'kanji' is

prepared from black carrot and used as appetizer (Fageria *et al.*, 2018). Nutrient composition of carrot are - Moisture 86 g, Fat 0.2 g, Protein 0.9 g, Fibre 1.2 g, Carbohydrates 10.6 g, Calories 57 Kcal, Calcium 80 mg, Magnesium 14 mg, Oxalic acid 55 mg, Phosphorus 30 mg, Iron 2.2 mg, Potassium 108 mg, Sodium 35.6 mg, Copper 0.13 mg, Sulphur 27 mg, Vitamin A 3150 IU,

Thiamine 0.04 mg, Riboflavin 0.02 mg, Nicotinic acid 0.6 mg, Vitamin C 3 mg (Bose *et al.*, 2000).

The nutrients supply including the use of organic manures with micronutrients like Zinc and Boron not only helps in bridging the existing wide gap between the nutrients removal and supply but also ensures balance nutrients proportion by enhancing nutrients response efficiency and maximizing crop productivity of desired quality. Nutritional imbalance in the soil causes instability in productivity and hidden hunger of nutrients besides resulting in poor nutritional quality of produce. The maintenance of sustainability in production through manures use of difference sources may also help to maintain the fertility of soil and plant nutrients besides suppression of the some insect pest and diseases.

Manures supply the required nutrients, improve soil structure, increase microbial population and at the same time maintain the quality of crop produce (Wong *et al.*, 1999; Suresh *et al.*, 2004; Dauda *et al.*, 2008).

Farmyard manure being a bulky organic material releases the soil compaction and improves the aeration in addition to the supply of essential plant nutrients and organic matter, thereby increasing the soil microbial establishment along with accumulation of excess humus content. Vermicompost is a potential source of readily available nutrients, growth enhancing substances and a number of beneficial microorganisms like N-fixing, P-solubilizing and cellulose decomposing organisms. It has been studied that the vermicompost effects on the plant growth, yield and quality of crops considerably. Micronutrients also play vital roles in the growth and development of plants, due to their stimulatory and catalytic effects on metabolic processes and ultimately on flower yield and quality.

Thus, in this experiment an attempt has been made to assess the response of organic manures and micronutrients on growth, yield and quality attributes of carrot (*Daucus carota* L.) cv. Pusa Rudhira.

Materials and Methods

Field experiment were conducted to observe the response of organic manures and micronutrients on vegetative growth, yield and quality attributes of carrot at Experimental Unit, Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur. Jaunpur is situated in eastern part of Uttar Pradesh which lies between 25°00' North latitude and 82°41'00" East longitudes at an elevation of 83.230 meter above mean sea level. The topography of the experimental field was plain with good irrigation facilities.

The present investigation was carried out during year 2018-19. Carrot seed cv. Pusa Rudhira was procured from Indian Agricultural Research Institute (IARI), New Delhi. The climatic condition of Jaunpur is subtropical with three distinct seasons i.e., winter, summer and rainy. During the winter season (December-January) temperature fall, 5°C or even low, while in summer season (May-June) it reaches as high as 45°C. Occasional spell of frost and precipitation may occur during winter. Most of the rainfall is received in the middle of July to end of September after which the intensity of rainfall decreases. The mean annual rainfall is about 850-1100 mm. The minimum mean temperature is 15-20°C and maximum 18-32°C, maximum relative humidity 95% and minimum 55%. The experiment was laid out in a Randomized Block Design (RBD) with ten treatments, each replicated three times and each plot size of 1 m² conducted during the winter (Rabi) season of 2018-19. The treatments viz., T₁ (Control), T₂ (FYM + Zinc), T₃ (Vermicompost + Zinc), T₄ (Neem

cake + Zinc), T₅ (Poultry manure + Zinc), T₆ (FYM + Boron), T₇ (Vermicompost + Boron), T₈ (Neem cake + Boron), T₉ (Poultry manure + Boron) and T₁₀ (FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron). The seed of carrot sowing on the ridges were done at a spacing of 30×10 cm in first week of November. Farm yard manure, vermicompost, neem cake, poultry manure, zinc and boron were applied in the concerned plots as per the treatment. The required quantity of organic manures and micronutrients as per treatments was applied at the time of field preparation. Other cultural practices like weeding, hoeing, irrigation, insect pest and disease management were done as and when required. The observations were recorded from each treatment to assess the response of organic manures and micronutrients on growth, yield and quality attributes of carrot. The data recorded during the course of investigation were analyzed by analysis of variance (ANOVA) using the statistical program and the significance differences between the mean were tested against the critical difference at 5% probability level.

Results and Discussion

The data (Table 1) showed that maximum height of the plant (96.82 cm) was recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron and the minimum height of plant (75.36 cm) was recorded with Control. The increase in height of plant by the use of vermicompost and FYM may be due to beneficial influence of nitrification inhibition properties of vermicompost and FYM in the soil. Besides, it may also be due to rapid elongation and multiplication of cell in the presence of adequate quantity of nitrogen. (Barman *et al.*, 2014), similar results were reported by Bhattarai and Maharjan (2013) in carrot.

Highest number of leaves/plant (6.67, 8.70, 13.56 and 16.78) were observed with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron while the lowest number of leaves/plant (3.50, 5.25, 7.42 and 8.54) was observed with control at all the stages of crop growth.

The maximum length of leaves (7.76, 15.88, 28.92 and 67.57 cm) was recorded with the nutrient level FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum length of leaves (3.49, 10.33, 19.83 and 54.74 cm) was observed under Control.

The maximum fresh weight of leaves (127.78 g) was recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron while, the minimum fresh weight of leaves (98.21 g) was observed with Control. The maximum dry weight of leaves (17.03 g) was noted with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum dry weight of leaves (13.72 g) was observed with Control.

These results are due to slow release of nutrients through vermicompost thus enriching available nutrient pool of the soil that resulting in more number of leaves/plant (Bhattarai and Maharjan, 2013).

The data (Table 2) showed that maximum fresh weight of plant (270.57 g) was observed with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum fresh weight of plant (199.43 g) was observed with Control.

Maximum dry weight of plant (37.48 g) was recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. Minimum dry weight of plant (28.52 g) was recorded with Control.

Table.1 Response of organic manures and micronutrients on growth characters in carrot cv. Pusa Rudhira.

Treatments	Plant height (cm)	Number of leaves/ plant				Length of leaves (cm)				Fresh weight of leaves (g)	Dry weight of leaves (g)
		30 DAS	45 DAS	60 DAS	At harvesting	30 DAS	45 DAS	60 DAS	At harvesting		
T ₁	75.36	3.50	5.25	7.42	8.54	3.49	10.33	19.83	54.74	98.21	13.72
T ₂	81.50	4.01	5.91	9.28	10.65	4.21	11.62	22.16	57.89	107.73	14.68
T ₃	90.61	5.56	7.38	11.72	14.54	5.84	13.75	25.77	62.76	122.49	15.92
T ₄	85.78	4.54	6.88	10.94	13.32	5.12	12.68	24.21	59.64	115.68	15.75
T ₅	79.27	3.76	5.69	8.39	9.26	3.79	11.11	20.82	56.52	103.35	14.36
T ₆	80.33	3.89	5.78	8.82	9.97	3.92	11.34	21.56	57.32	105.37	14.51
T ₇	83.62	4.32	6.37	10.32	12.23	4.85	12.27	23.51	58.95	111.49	14.79
T ₈	82.55	4.16	6.01	9.71	11.40	4.49	11.92	22.81	58.37	109.38	14.69
T ₉	77.41	3.65	5.50	7.97	8.95	3.67	10.87	20.45	55.73	101.29	13.97
T ₁₀	96.82	6.67	8.70	13.56	16.78	7.76	15.88	28.92	67.57	127.78	17.03

Table.2 Response of organic manures and micronutrients on yield and quality attributes in carrot cv. Pusa Rudhira.

Treatments	Fresh weight of plant (g)	Dry weight of plant (g)	Length of root (cm)	Diameter of root (cm)	Girth of root (cm)	Fresh weight of root (g)	Dry weight of root (g)	Yield of root (kg/plot)	Yield of root (q/ha)	T.S.S. (⁰ Brix)	Ascorbic acid (mg/100 g)
T ₁	199.43	28.52	20.62	3.34	9.74	101.22	14.80	2.42	242.33	7.25	5.76
T ₂	217.54	30.60	23.61	3.80	11.18	109.81	15.92	2.63	263.00	7.74	5.20
T ₃	247.71	33.72	27.85	4.67	12.34	125.22	17.80	3.00	300.33	8.95	4.89
T ₄	233.57	32.67	25.80	4.40	12.08	117.89	16.92	2.82	282.33	8.24	4.98
T ₅	209.56	29.54	22.75	3.58	10.67	106.21	15.18	2.54	254.33	7.46	5.48
T ₆	213.74	30.14	23.01	3.69	10.93	108.37	15.63	2.59	259.66	7.59	5.32
T ₇	224.50	31.54	24.95	4.24	11.84	113.01	16.75	2.70	270.00	8.15	5.07
T ₈	220.46	30.90	24.18	4.13	11.59	111.08	16.21	2.65	265.66	7.95	5.17
T ₉	205.65	28.91	21.68	3.47	10.47	104.36	14.94	2.49	249.66	7.39	5.58
T ₁₀	270.57	37.48	29.25	5.10	13.58	142.79	20.45	3.42	342.00	9.27	4.48

Maximum length of root (29.25 cm) recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum length of root (20.62 cm) recorded in Control.

Maximum diameter of root (5.10 cm) and girth of root (13.58 cm) in carrot was found FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum diameter of root (3.34 cm) and girth of root (9.74 cm) in carrot was observed with Control.

Maximum fresh weight of root (142.79 g) and maximum dry weight of root (20.45 g) was observed with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron. The minimum fresh weight of root (101.22 g) and minimum dry weight of root (14.80 g) was observed with Control.

The maximum yield of root kg/plot (3.42 kg) and maximum yield of root q/ha (342 q) recorded under the FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron,

while minimum yield of root kg/plot (2.42 kg) and minimum yield of root q/ha (242.33 q) was observed with Control.

The maximum T.S.S. content (9.27 °Brix) recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron, while the minimum T.S.S. content (7.25 °Brix) was determine in case of Control.

The minimum ascorbic acid (4.48 mg/100g) recorded with FYM + Vermicompost + Neem cake + Poultry manure + Zinc + Boron, while the maximum ascorbic acid (5.76 mg/100g) recorded in Control.

These results due to the beneficial effect application of organic manure (vermicompost) might be attributed to the increased efficacy of micronutrients and supply of all the essential nutrients in a balanced amount owing to their control release coinciding with the stage of root growth (Kumar *et al.*, 2014). Similar findings have been reported by Sunandarani and Malareddy (2007).

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