



E-ISSN: 2663-1067
P-ISSN: 2663-1075
NAAS Rating (2026): 4.74
www.hortijournal.com
IJHFS 2026; 8(9): 01.08
Received: 02-07-2026
Accepted: 04-08-2026

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Effect of different organic nutrient sources (FYM, Vermicompost, poultry manure, neem cake) on growth, yield, and quality of beetroot (*Beta vulgaris* L.)

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DOI: <https://www.doi.org/10.33545/26631067.2026.v8.i9a.845>

Abstract

The experiment was conducted in the Karguaji Organic Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, to study the effect of different organic sources (FYM, vermicompost, poultry manure, and neem cake) on growth, yield, yield-attributing traits, and overall performance of beetroot. The study included nine treatments, viz., T₁ : Control (No external organic input- baseline), T₂ : Farmyard manure (FYM) @ 20t/ha (100% recommended dose), T₃ : Vermicompost @ 5 t/ha (100% recommended dose), T₄ : Poultry manure @ 8 t/ha (100% recommended dose), T₅ : Neem cake @ 2 t/ha (100% recommended dose), T₆ : FYM @ 10 t/ha Vermicompost @ 2.5 t/ha (50%+50%), T₇ : Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha (50%+50%), T₈ : FYM @ 10 t/ha + Neem cake @ 1 t/ha (50%+50%), T₉ : FYM @ 6.67 t/ha + vermicompost @ 1.67 t/ha + poultry manure @ 2.67 t/ha (33% each) arranged in a Randomized Block Design with three replications.

Results indicated that growth, yield, yield-attributing parameters. Among all treatments, Poultry Manure and FYM + Neem cake was found most effective in enhancing plant height, number of leaves per plant, leaf length, leaf width, root length, root diameter (cm), root weight (g) and harvest index.

Keywords: Beetroot, *Beta vulgaris* L., organic nutrient sources, farmyard manure, vermicompost, poultry manure, neem cake, growth, yield, quality

Introduction

Beetroot (*Beta vulgaris* L.) belongs to the family *Chenopodiaceae* (*Amaranthaceae*) and is an important root vegetable crop cultivated throughout the world. Its edible swollen roots are rich in vitamins, minerals, carbohydrates, and natural pigments like betalains. Beetroot is widely used in salads, juices, pickles, and processed food products due to its high nutritional and medicinal value. The crop is known for its antioxidant properties and health benefits, including improvement of blood circulation and reduction of blood pressure. Proper nutrient management and suitable agronomic practices are essential for obtaining higher yield and better quality roots.

Beetroot is an important root vegetable crop cultivated widely across the world for its nutritional and medicinal value. Countries such as Russia, the United States, France, Germany, Turkey, and Poland are among the major producers of beetroot. In India, beetroot is mainly cultivated in Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, West Bengal, and Punjab. According to the First Advance Estimates of 2025-26, India's total horticultural production is estimated at about 370.85 million tonnes, showing continuous growth in vegetable cultivation and production (Ministry of Agriculture & Farmers Welfare, Government of India).

This crop exhibits rapid growth, high productivity, and generally remains unscathed by pests and diseases. Although it is traditionally considered a cool-season crop, beetroot thrives in warmer climates, allowing for winter cultivation in the plains of Nepal. Nevertheless, the growth, development, and yield of beetroot are heavily influenced by soil conditions (Sapkota *et al.*, 2021)^[5].

Material and Methods

The present investigation was conducted during *rabi* season 2025-26 at the Organic Research Farm, Karguaji, Department of horticulture, Institute of Agricultural Sciences,

Bundelkhand University, Jhansi, Uttar Pradesh (26°44' N latitude, 79°25' E longitude; 284 m above mean sea level), situated under Agro-climatic Zone VIII (Central Plateau and Hill Region).

The treatments used under different organic nutrient management practices were, T₁: Control (No external organic input - baseline), T₂: Farmyard manure (FYM) @ 20 t/ha (100% recommended dose), T₃: Vermicompost @ 5 t/ha (100% recommended dose), T₄: Poultry manure @ 8 t/ha (100% recommended dose), T₅: Neem cake @ 2 t/ha (100% recommended dose), T₆: FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha (50% + 50%), T₇: Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha (50% + 50%), T₈: FYM @ 10 t/ha + Neem cake @ 1 t/ha (50% + 50%), and T₉: FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each). The organic manures were applied as per the treatment combinations before sowing and thoroughly mixed into the soil to ensure proper nutrient availability for the beetroot crop.

Field observations were recorded on plant height (cm), number of leaves per plant, leaf length (cm), leaf width (cm), root length (cm), root diameter (cm), root weight (g), and harvest index (%). Observations were taken at appropriate growth stages and at harvest to evaluate the effect of different organic nutrient management treatments on growth and yield parameters of beetroot. The experimental data obtained from various observations were subjected to statistical analysis using analysis of variance (ANOVA) following the procedure suggested by Cochran and Cox (1950). The significance of treatment differences was tested by using Critical Difference (CD) at 5% level of significance.

Results and Discussion

Organic nutrient management treatments significantly influenced the growth and yield parameters of beetroot variety "Rosy Red-555" under Jhansi conditions. Analysis of variance revealed significant differences among the treatments for all the characters studied. Among the nine treatments, T₄: Poultry manure @ 8 t/ha recorded the highest performance for most of the growth and yield parameters, followed by T₈: FYM @ 10 t/ha + Neem cake @ 1 t/ha, whereas the treatment T₉ showed the lowest values for most of the observations recorded.

Growth Parameters

Plant height was significantly affected by different organic nutrient management treatments in beetroot variety "Rosy Red-555". The maximum plant height was recorded At 25 DAS, 50 DAS and Harvest under T₄: Poultry manure (18.57, 33.36, 34.82), followed by T₈: FYM + Neem cake (17.83, 30.53, 33.72), whereas the minimum plant height was observed in the treatment T₉. The increased plant height under poultry manure application may be attributed to the continuous supply of essential nutrients, improved soil physical properties, and enhanced microbial activity, which promoted better vegetative growth and plant development. Similar results were also reported by (Okokoh and Bisong 2011)^[3], (Katel *et al.* 2021)^[1].

The maximum number of leaf per plant was recorded At 25 DAS, 50 DAS and Harvest under T₄: Poultry manure (12.74, 16.80, 20.75), followed by T₈: FYM + Neem cake (12.15,

16.28, 19.76), whereas the minimum number of leaves per plant was observed in the treatment T₉. The results were in conformity with findings of Tiarniyu *et al.*, 2012^[6] in okra. Okokoh and Bisong (2011). Application of organic manures to the soil, physical condition of the soil will be improved by the better aggregation of soil particles (Samanda singh *et al.*, 1988)^[4].

The maximum leaf length was recorded At 25 DAS, 50 DAS and harvest under T₄: Poultry manure (12.35, 18.31, 28.45), followed by T₈: FYM + Neem cake (11.73, 17.65, 27.48), whereas the minimum leaf length was observed in the treatment T₉. The increased leaf length under poultry manure treatment may be attributed to improved nutrient availability, enhanced soil structure, and better uptake of essential nutrients, which promoted vigorous vegetative growth. Similar results were also reported by Sapkota *et al.* (2019)^[5].

Leaf width was significantly influenced by different organic nutrient management treatments in beetroot variety "Rosy Red-555". The maximum leaf width was recorded At 25 DAS, 50 DAS and harvest under T₄: Poultry manure (6.79, 13.56, 19.09), followed by T₈: FYM + Neem cake (5.81, 12.27, 18.29), whereas the minimum leaf width was observed in the treatment T₉. The improvement in leaf width under poultry manure treatment may be due to balanced nutrient supply and improved soil health, which enhanced cell expansion and overall vegetative growth of the plants.

Yield and Quality Parameters

Root length was significantly influenced by different organic nutrient management treatments in beetroot variety "Rosy Red-555". The maximum root length was recorded under T₄: Poultry manure (13.24), followed by T₈: FYM + Neem cake (12.83), whereas the minimum root length was observed in the treatment T₉. The increased root length under poultry manure treatment may be attributed to improved soil aeration, better nutrient availability, and enhanced root development resulting from favorable soil physical and biological conditions. Similar results were also reported by (Zhang *et al.* 2020, Ghildyal and Gupta, 1991 and Arulmozhan, 1996)^[7].

Root diameter was significantly influenced by different organic nutrient management treatments in beetroot variety "Rosy Red-555". The maximum root diameter was recorded under T₄: Poultry manure (6.91), followed by T₈: FYM + Neem cake (6.65), whereas the minimum root diameter was observed in the treatment T₉. Similar results were also reported by (Okokoh and Bisong 2011)^[3].

Root weight (g) was significantly influenced by different organic nutrient management treatments in beetroot variety "Rosy Red-555". The maximum root weight was recorded under T₄: Poultry manure (141.0), followed by T₈: FYM + Neem cake (135.33), whereas the minimum root weight was observed in the treatment T₉.

The highest harvest index was recorded under T₄: Poultry manure (79.32), followed by T₈: FYM + Neem cake (76.32), whereas the lowest harvest index was observed in the control treatment T₉. The increase in harvest index under poultry manure treatment may be attributed to efficient partitioning of photosynthates towards root development and better utilization of nutrients, resulting in higher economic yield.

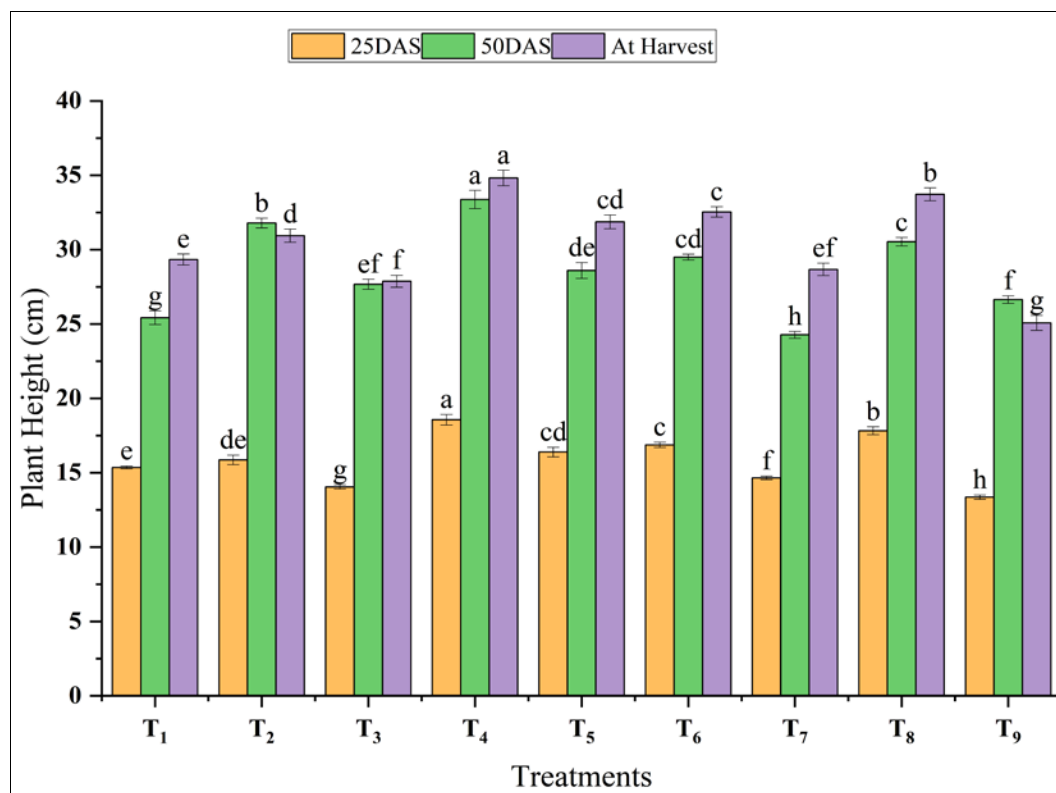


Fig 1: Effect of Treatments on Plant Height under Different Harvesting Regimes

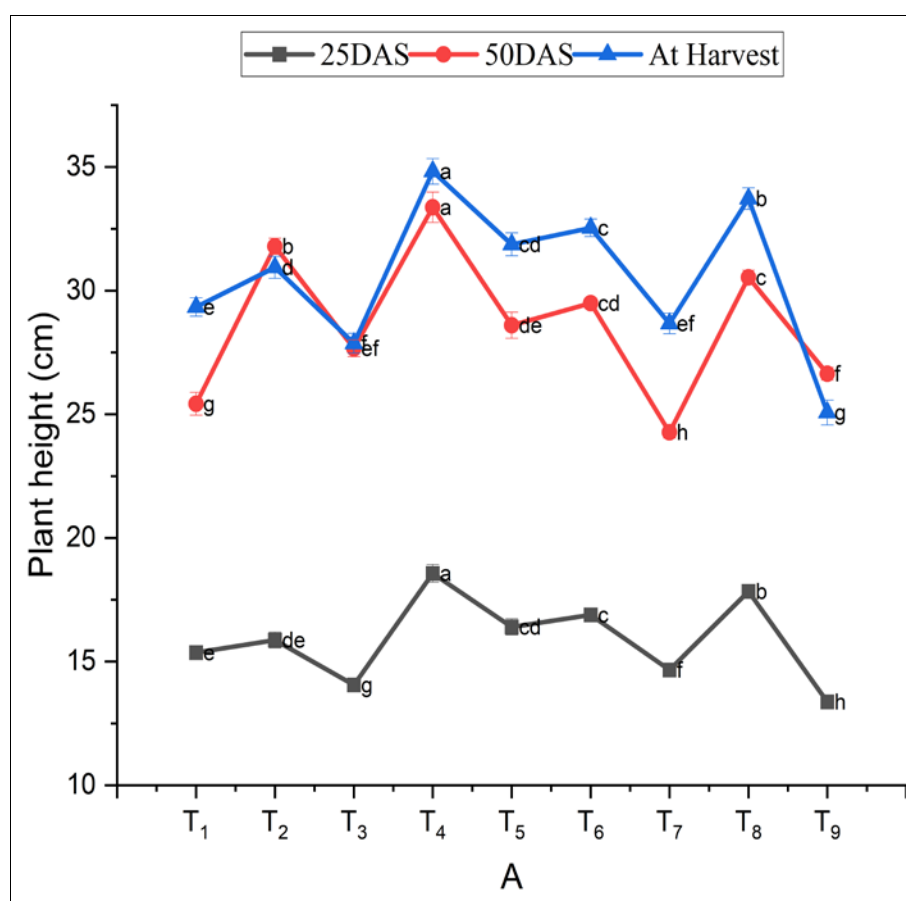


Fig 2: Effect of Treatments on Plant Height at Different Assessment Periods

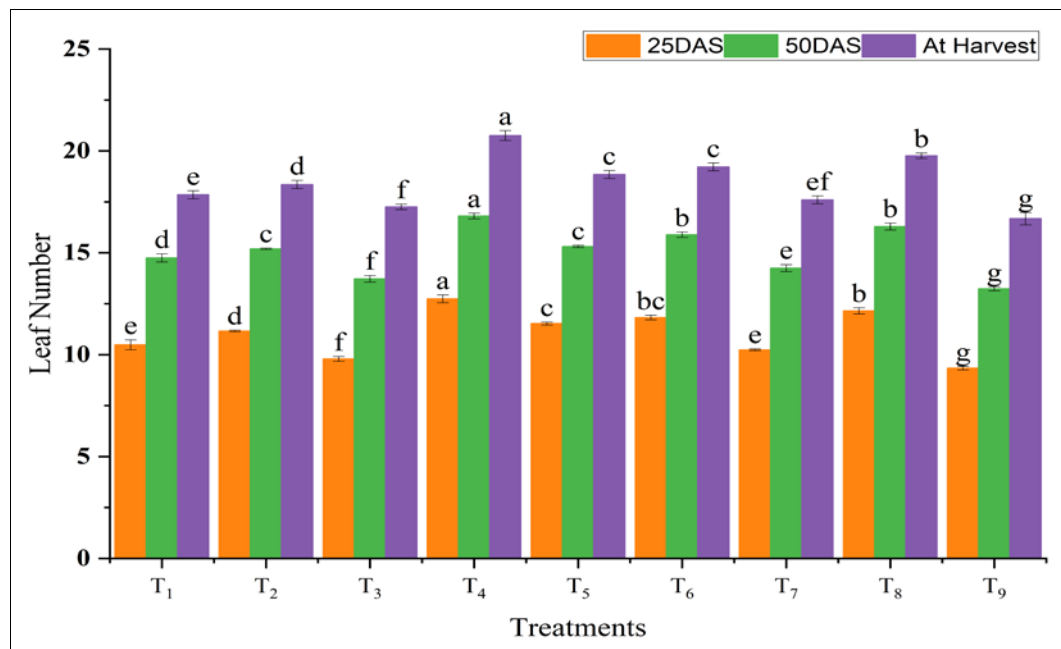


Fig 3: Effect of Treatments on Leaf Yield Under Different Harvesting Regimes

Table 1: Effect of different organic nutrient sources on plant height of beetroot at different growth stages.

Treatments	Plant Height (cm)			
	Symb	25DAS	50DAS	At Harvest
(Control)	T ₁	15.363	25.423	29.337
(FYM @ 20 t/ha, 100% RDF)	T ₂	15.870	31.787	30.940
(Vermicompost @ 5 t/ha, 100% RDF)	T ₃	14.053	27.667	27.870
(Poultry manure @ 8 t/ha, 100% RDF)	T ₄	18.570	33.367	34.820
(Neem cake @ 2 t/ha, 100% RDF)	T ₅	16.400	28.600	31.870
(FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	T ₆	16.883	29.493	32.537
(Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	T ₇	14.660	24.273	28.670
(FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	T ₈	17.833	30.537	33.720
(FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	T ₉	13.367	26.637	25.070
SE(d)		0.283	0.53	0.479
SE(m)		0.2	0.375	0.338
CD		0.599	1.123	1.015
CV(%)		2.179	2.265	1.92

Table 2: Influence of organic nutrient sources on beetroot (*Beta vulgaris* L.) leaf count at different growth stages

Treatment	Leaf Number			
	Symb	25 DAS	50 DAS	At Harvest
(Control)	T ₁	10.49	14.750	17.85
(FYM @ 20 t/ha, 100% RDF)	T ₂	11.16	15.193	18.35
(Vermicompost @ 5 t/ha, 100% RDF)	T ₃	9.79	13.723	17.25
(Poultry manure @ 8 t/ha, 100% RDF)	T ₄	12.74	16.807	20.75
(Neem cake @ 2 t/ha, 100% RDF)	T ₅	11.53	15.310	18.84
(FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	T ₆	11.82	15.887	19.22
(Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	T ₇	10.24	14.247	17.60
(FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	T ₈	12.15	16.287	19.76
(FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	T ₉	9.34	13.237	16.68
SE(d)		0.171	0.201	0.201
SE(m)		0.121	0.142	0.142
CD		0.363	0.426	0.427
CV(%)		1.901	1.635	1.335

Table 3: Influence of organic nutrient sources on beetroot (*Beta vulgaris* L.) leaf length at different growth stages

Treatment	Leaf Length (cm)			
	Symb	25 DAS	50DAS	At Harvest
(Control)	T ₁	9.72	14.93	24.83
(FYM @ 20 t/ha, 100% RDF)	T ₂	10.29	15.74	25.28
(Vermicompost @ 5 t/ha, 100% RDF)	T ₃	8.28	13.35	23.41
(Poultry manure @ 8 t/ha, 100% RDF)	T ₄	12.35	18.31	28.45
(Neem cake @ 2 t/ha, 100% RDF)	T ₅	10.80	16.31	25.95
(FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	T ₆	11.24	16.92	26.63
(Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	T ₇	9.31	14.25	24.17
(FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	T ₈	11.73	17.65	27.48
(FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	T ₉	7.52	12.14	22.24
SE(d)		0.17	0.259	0.288
SE(m)		0.12	0.183	0.203
CD		0.361	0.548	0.61
CV(%)		2.056	2.041	1.388

Table 4: Influence of organic nutrient sources on beetroot (*Beta vulgaris* L.) leaf width at different growth stages

Treatment	Leaf Width (cm)			
	Symb	30DAS	60DAS	At Harvest
(Control)	T ₁	4.44	10.12	15.72
(FYM @ 20 t/ha, 100% RDF)	T ₂	4.89	10.86	16.27
(Vermicompost @ 5 t/ha, 100% RDF)	T ₃	3.69	9.35	14.55
(Poultry manure @ 8 t/ha, 100% RDF)	T ₄	6.79	13.56	19.09
(Neem cake @ 2 t/ha, 100% RDF)	T ₅	5.34	11.33	16.85
(FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	T ₆	5.58	11.75	17.43
(Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	T ₇	3.92	9.72	15.11
(FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	T ₈	5.81	12.27	18.29
(FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	T ₉	3.35	8.78	13.26
SE(d)		0.083	0.191	0.285
SE(m)		0.059	0.135	0.202
CD		0.176	0.406	0.605
CV(%)		2.086	2.159	2.145

Table 5: Response of beetroot root parameters (length, diameter, and weight) to varied organic nutrient management practices.

Treatment	Symb	Root Length (cm)	Root Diameter (cm)	Root Weight (g)
(Control)	T ₁	11.57 ± 0.31 e	5.97 ± 0.200 e	109.33 ± 1.35 f
(FYM @ 20 t/ha, 100% RDF)	T ₂	11.64 ± 0.33 e	6.13 ± 0.172 de	116.73 ± 2.01 e
(Vermicompost @ 5 t/ha, 100% RDF)	T ₃	10.87 ± 0.38 g	5.58 ± 0.171 g	98.26 ± 0.30 gh
(Poultry manure @ 8 t/ha, 100% RDF)	T ₄	13.35 ± 0.46 a	6.91 ± 0.185 a	141.00 ± 4.18 a
(Neem cake @ 2 t/ha, 100% RDF)	T ₅	11.95 ± 0.42 d	6.24 ± 0.164 d	123.33 ± 2.61 d
(FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	T ₆	12.34 ± 0.43 c	6.42 ± 0.171 c	129.67 ± 3.17 c
(Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	T ₇	11.14 ± 0.33 f	5.75 ± 0.157 f	102.67 ± 0.76 g
(FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	T ₈	12.83 ± 0.44 b	6.65 ± 0.102 b	135.33 ± 3.68 b
(FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	T ₉	10.54 ± 0.31 h	5.32 ± 0.067 h	94.33 ± 0.10 h
SE(d)		0.106	0.077	2.108
SE(m)		0.075	0.054	1.491
CD		0.224	0.162	4.469
CV(%)		1.098	1.536	2.212

Table 6: Response of harvest index (%) to different organic nutrient sources in beetroot (*Beta vulgaris* L.).

Treatment	Harvest Index (%)
T ₁ (Control)	66.89 ± 1.94 e
T ₂ (FYM @ 20 t/ha, 100% RDF)	69.04 ± 2.42 d
T ₃ (Vermicompost @ 5 t/ha, 100% RDF)	63.13 ± 0.81 f
T ₄ (Poultry manure @ 8 t/ha, 100% RDF)	79.32 ± 0.45 a
T ₅ (Neem cake @ 2 t/ha, 100% RDF)	70.67 ± 1.56 cd
T ₆ (FYM @ 10 t/ha + Vermicompost @ 2.5 t/ha, 50% + 50%)	71.32 ± 1.86 c
T ₇ (Vermicompost @ 2.5 t/ha + Poultry manure @ 4 t/ha, 50% + 50%).	64.73 ± 0.79 f
T ₈ (FYM @ 10 t/ha + Neem cake @ 1 t/ha, 50% + 50%)	76.32 ± 1.55 b
T ₉ (FYM @ 6.67 t/ha + Vermicompost @ 1.67 t/ha + Poultry manure @ 2.67 t/ha (33% each))	60.92 ± 0.77 g
SE(d)	0.979
SE(m)	0.692
CD	2.076
CV(%)	1.734

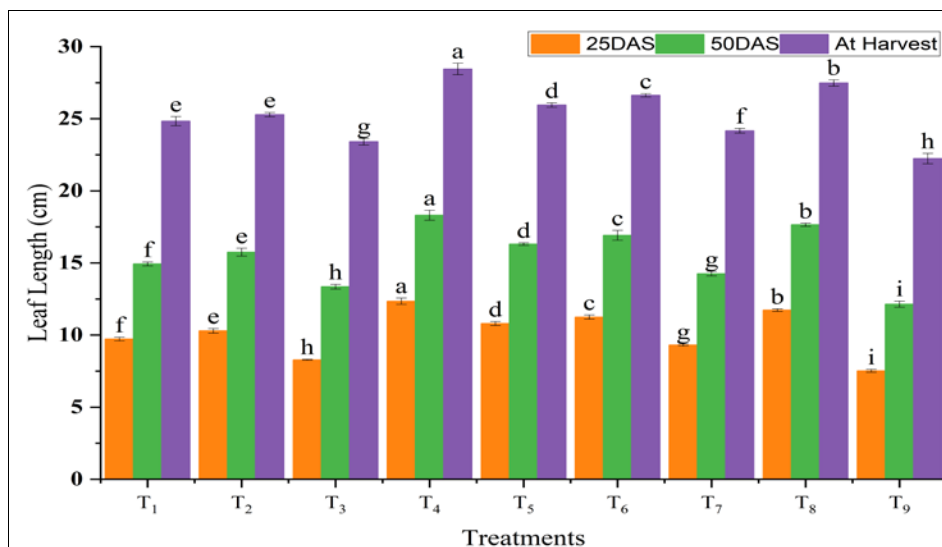


Fig 5: Effect of Treatments on Leaf Length at Different Observation Periods

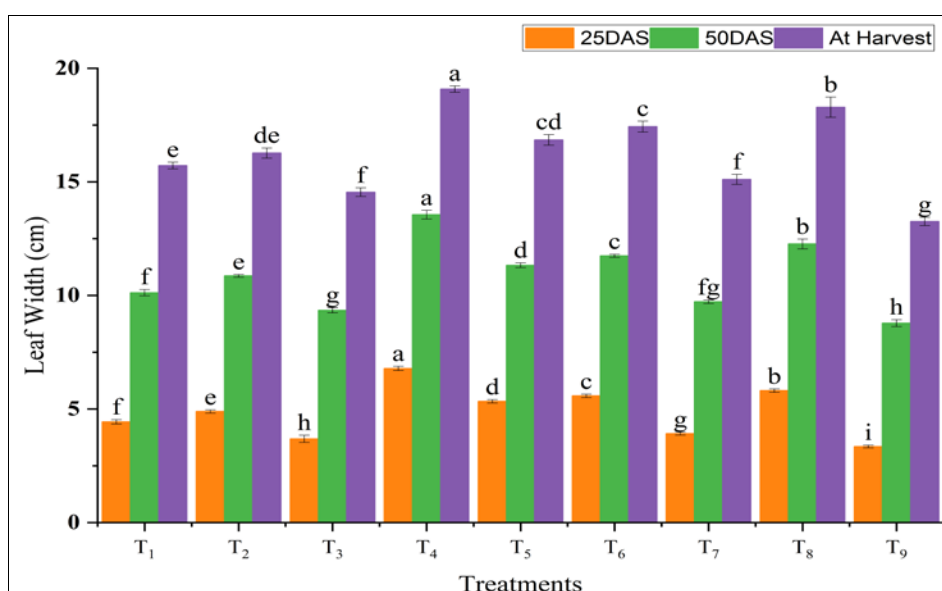


Fig 6: Effect of Treatments on Leaf Width at Different Observation Periods

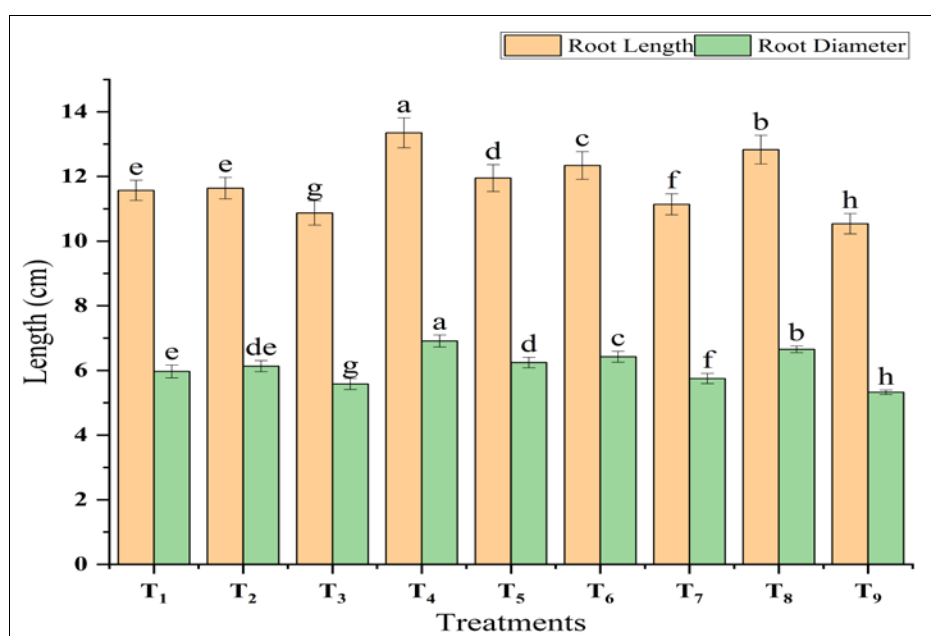


Fig 7: Effect of Treatments on Root Length and Root Diameter

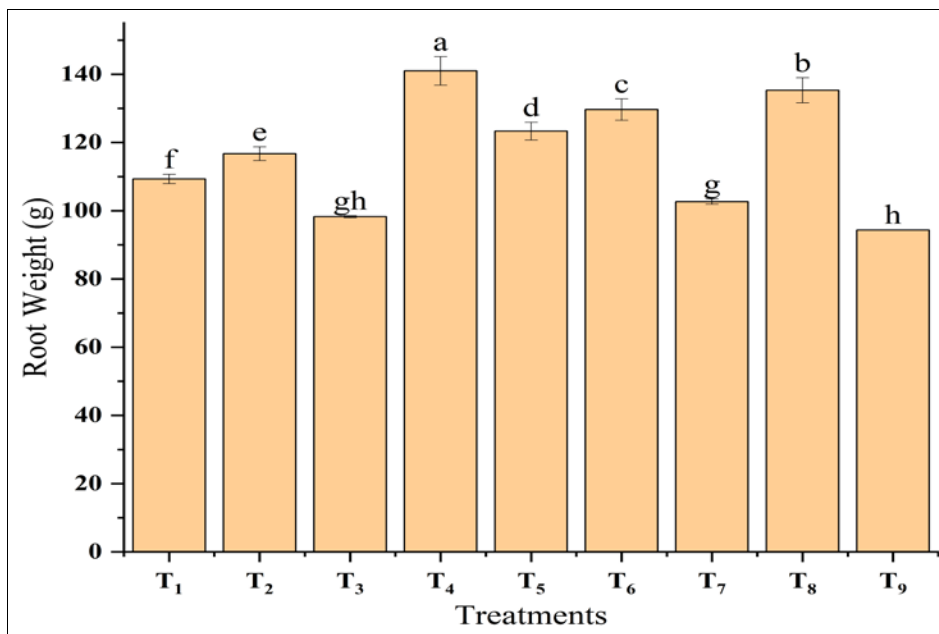


Fig 8: Effect of Different Treatments on Root Weight (g)

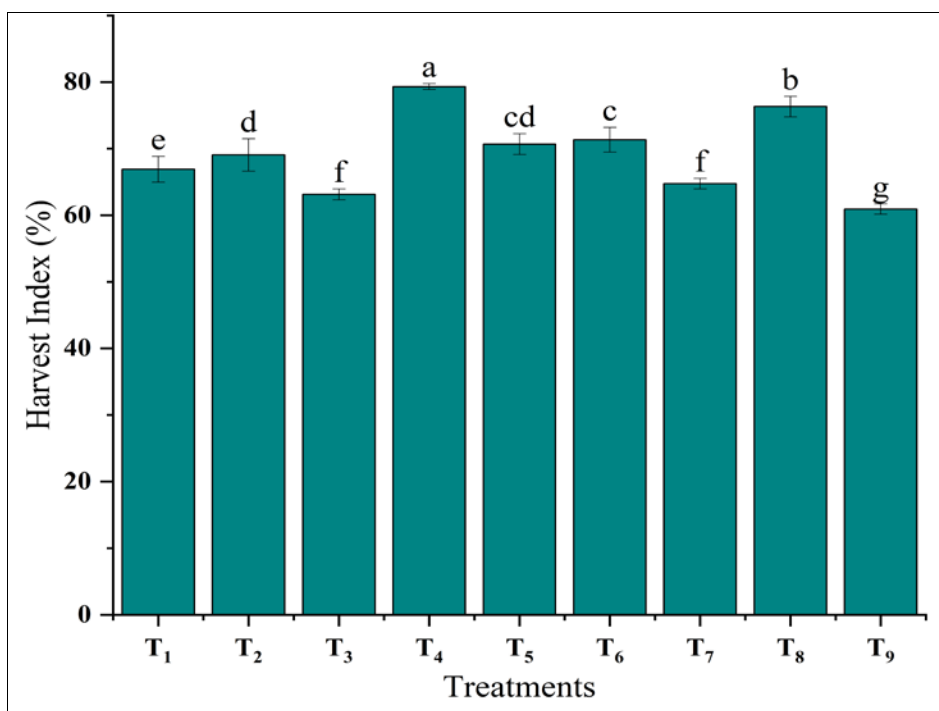


Fig 9: Effect of Different Treatments on Harvest Index (%)

Conclusion

Based on the results of the present investigation, it may be concluded that organic nutrient management treatments significantly improved growth and yield parameters in beetroot variety “Rosy Red-555”. Among the nine treatments evaluated, T₄: Poultry manure @ 8 t/ha proved to be the most effective treatment, followed by T₈: FYM @ 10 t/ha + Neem cake @ 1 t/ha. These treatments significantly enhanced plant height, number of leaves per plant, leaf length, leaf width, root length, root diameter, root weight, and harvest index compared to the control treatment. The superior performance under poultry manure application may be attributed to improved nutrient availability, enhanced soil fertility, better microbial activity, and efficient utilization of nutrients by the crop. Therefore, application of poultry

manure @ 8 t/ha can be recommended as an effective organic nutrient management practice for improving growth, yield, and productivity of beetroot under the agro-climatic conditions of Jhansi.

References

- Katel S, Upadhyay K, Mandal HR, Yadav SPS, Kharel A, Rijan R. Nanotechnology for agricultural transformation: a review. *Fundamental and Applied Agriculture*. 2021;6(4):403-414. doi:10.5455/faa.127296.
- Ministry of Agriculture & Farmers Welfare, Government of India. [Reference details not provided].
- Okokoh SJ, Bisong BW. Effect of poultry manure and

- urea-N on flowering occurrence and leaf productivity of *Amaranthus cruentus* in Calabar. Journal of Applied Sciences and Environmental Management. 2011;15(1):13-15.
4. Samandasingh, Virendrakumar, Singh Y. Organic manures: the only cure for better crop and soil health. Farmer and Parliament. 1988:23-29.
 5. Sapkota A, Sharma MD, Giri HN, Shrestha B, Panday D. Effect of organic and inorganic sources of nitrogen on growth, yield, and quality of beetroot varieties in Nepal. Nitrogen. 2021;2:378-391. doi:10.3390/nitrogen2030026.
 6. Tihamiyu A, *et al.* Effect of sources of organic manure on growth and yields of okra (*Abelmoschus esculentus* L.). Sokoto, Nigeria: Usmanu Danfodiyo University; 2012.
 7. Zhang P, Yang F, Zhang H, Liu L, Liu X, Chen J, Wang X, Wang Y, Li C. Beneficial effects of biochar-based organic fertilizer on nitrogen assimilation, antioxidant capacities, and photosynthesis of sugar beet (*Beta vulgaris* L.) under saline-alkaline stress. Agronomy. 2020;10:1562. doi:10.3390/agronomy10101562.