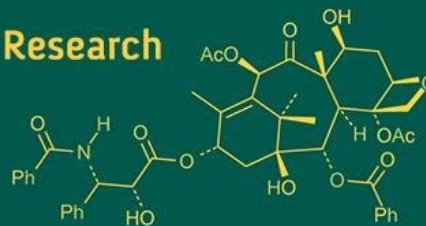


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(3): 424-427
www.biochemjournal.com
Received: 22-12-2025
Accepted: 28-01-2026

Satyam Gautam
Horticulture (Vegetable
Science), BAU, Sabour, Bihar,
India

Sangeeta Shree
Horticulture (Vegetable
Science), BAU, Sabour, Bihar,
India

Kamal Kant
Horticulture (Vegetable
Science), BAU, Sabour, Bihar,
India

Vijay Kumar Singh
Horticulture (Vegetable
Science), BAU, Sabour, Bihar,
India

Corresponding Author:
Sangeeta Shree
Horticulture (Vegetable
Science), BAU, Sabour, Bihar,
India

Influence of biofertilizers and organic manures on growth and yield of carrot under integrated nutrient management

Satyam Gautam, Sangeeta Shree, Kamal Kant and Vijay Kumar Singh

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i3Sf.7896>

Abstract

A field experiment was conducted to evaluate the effect of integrated nutrient management on growth and yield of carrot (*Daucus carota* L.) at Vegetable Research Farm, Bihar Agricultural University, Sabour, during the *rabi* season of year 2023-2024. The carrot variety, Carrot Desi Red was used as experimental material and experiment was laid out in a randomized block design with twenty treatments having three replications. Observations were recorded on plant height, number of leaves per plant, leaf length, fresh weight of leaves, root length, root diameter, fresh weight of root, root yield per plot, root yield per hectare. The data were statistically analysed as per procedure as suggested by Panse and Sukhatme. It was found that the Treatment T₁₉ [50% RDF + 50% RDN through vermicompost (2.8 t ha⁻¹) + PSB + *Azotobacter* recorded the maximum growth parameters and root yield (18.94 kg), while the lowest values were observed in the control. The improved performance was attributed to balanced nutrient supply, improved soil properties through vermicompost and enhanced nutrient availability due to biofertilizers. The results indicate that integrated nutrient management significantly enhances growth and yield of carrot.

Keywords: Biofertilizers, organic manures, carrot and integrated nutrient management

Introduction

Carrot (*Daucus carota* L.) is one of the major vegetable crops grown throughout the world (Cho *et al.*, 2021) [1] and considered to be an important economical vegetable as it has large yield per unit area (Sikora *et al.* 2020) [5]. It is an excellent source of β -carotene, vitamins, dietary fiber and essential minerals, making it an important component of a balanced diet and valued for its high nutritional and medicinal properties. From therapeutic point of view carrot is more useful in curing human diseases especially eye sight (Nagraj *et al.*, 2020) [4].

Afghanistan represents the center of diversity of the anthocyanin carrot and is believed to be its primary center of origin before the ninth century (Manisha *et al.*, 2022) [3]. Regular consumption of carrot contributes significantly to improving nutritional security due to its high antioxidant content and health-promoting compounds. In many countries, including India, carrot is cultivated extensively during the winter season and forms an important commercial crop for both fresh consumption and processing industries. The productivity and quality of carrot are greatly influenced by soil fertility and nutrient management practices. Conventional vegetable production systems often rely heavily on chemical fertilizers to achieve higher yields. However, excessive and imbalanced use of inorganic fertilizers has led to several problems such as soil degradation, nutrient imbalance, decline in soil microbial activity and environmental pollution. These concerns have increased the interest in sustainable nutrient management approaches that maintain soil health while ensuring optimum crop productivity.

Integrated Nutrient Management (INM) has emerged as a promising strategy for sustainable vegetable production. INM involves the judicious and combined use of chemical fertilizers, organic manures and biofertilizers to supply plant nutrients in an efficient and environmentally friendly manner. The application of organic manures such as farmyard manure, vermicompost and compost improves soil physical properties, enhances soil organic carbon and promotes beneficial microbial activity. These amendments also improve soil

structure, water holding capacity and nutrient availability, thereby creating a favorable environment for root development and plant growth.

Biofertilizers play a vital role in improving nutrient availability and enhancing crop productivity in integrated nutrient management systems. Microbial inoculants such as *Azotobacter*, *Azospirillum* and phosphate solubilizing bacteria enhance nutrient uptake through biological nitrogen fixation, solubilization of insoluble phosphates and production of growth promoting substances. The combined use of biofertilizers with organic manures can further enhance nutrient use efficiency and reduce the dependency on chemical fertilizers. Integrated use of organic and inorganic fertilizers can improve crop productivity and sustain soil fertility (Hammad *et al.* 2020)^[2].

In root crops like carrot, balanced nutrition is particularly important because nutrient availability directly influences root development, size, shape and quality. The integration of biofertilizers and organic manures with inorganic fertilizers not only improves plant growth and yield but also enhances quality attributes such as carotene content, total soluble solids and storage potential. Moreover, integrated nutrient management practices help in sustaining soil fertility and productivity over the long term.

Considering the increasing demand for sustainable agricultural practices and high-quality vegetable produce, the evaluation of integrated nutrient management strategies in carrot cultivation has become essential. Therefore, the present study was undertaken to investigate the influence of biofertilizers and organic manures on growth and yield of carrot under integrated nutrient management conditions. The findings of this study are expected to provide insights into efficient nutrient management practices for improving productivity and maintaining soil health in carrot cultivation.

Materials and Methods

The present investigation was conducted in the vegetable research farm of the Department of Horticulture (Vegetable Science), Bihar Agricultural University, Sabour, during the *rabi* season of year 2023-2024. The Laboratory Works were conducted in the departmental laboratory. Bihar Agricultural University, Sabour is located on the broad Indo-Gangetic plain of North India at longitude 87°2'42" East and latitude 25°15'40" North, at an altitude of 46 metres above mean sea level. The carrot variety, Carrot Desi Red was used as experimental material and experiment was laid out in a randomized block design with twenty treatments having three replications. The soil of the experimental site was sandy loam having soil pH 6.5, organic carbon 0.44% and available N, P and K content of 201, 20.00 and 276 kg ha⁻¹ respectively. The total twenty treatments consist (Table-1:) viz. T₁ (RDF (N:P:K-120:60:60 kg/ha)- (Control) through chemical fertilizer), T₂ (75% RDF + 25% RDN through FYM(6t/ha), T₃(50% RDF + 50% RDN through FYM (12t/ha), T₄(25% RDF + 75% RDN through FYM (18t/ha), T₅(75% RDF + 25% RDN through PM (0.9t/ha), T₆(50% RDF + 50% RDN through PM (1.8t/ha)), T₇(25% RDF + 75% RDN through PM (2.7t/ha), T₈(75% RDF + 25% RDN through VC (1.4t/ha), T₉(50% RDF + 50% RDN through VC (2.8t/ha), T₁₀ (25% RDF +75% RDN through VC (4.2t/ha), T₁₁(RDF (N:P: K-120:60:60 kg/ha) + PSB +

Azotobacter), T₁₂(75% RDF + 25% RDN through FYM (6t/ha) + PSB +*Azotobacter*),T₁₃(50% RDF + 50% RDN through FYM (12t/ha) + PSB + *Azotobacter*, T₁₄(25% RDF + 75% RDN through FYM (18t/ha) + PSB + *Azotobacter*), T₁₅(75% RDF + 25% RDN through PM (0.9t/ha) + PSB + *Azotobacter*, T₁₆(50% RDF + 50% RDN through PM (1.8t/ha) + PSB + *Azotobacter*),T₁₇(25% RDF + 75% RDN through PM (2.7t/ha) + PSB + *Azotobacter*),T₁₈(75% RDF + 25% RDN through VC (1.4t/ha) + PSB + *Azotobacter*),T₁₉(50% RDF + 50% RDN through VC (2.8t/ha) + PSB + *Azotobacter*),T₂₀(25% RDF +75% RDN through VC (4.2t/ha) + PSB + *Azotobacter*). Biofertilizers (*Azotobacter* and PSB) were inoculated to seeds prior to sowing as seed treatment method. Seeds were sown at the spacing of 30 x 10cm. The data were recorded on five plants per treatment per plot in each replication on growth and yield parameters. Observations were recorded on plant height, number of leaves per plant, leaf length, fresh weight of leaves, root length, root diameter, fresh weight of root, root yield per plot, root yield per hectare. The data were statistically analysed using analysis of variance (ANOVA) for RBD following the standard procedure as suggested by (Panse and Sukhatme, 1985)^[8].

Results and Discussion

According to the present study, integrated nutrient management had significant effect on growth parameters of carrot (Table 2 & 3). The perusal of the data revealed that plant height that treatment T₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + *Azotobacter* (10 ml/kg of seed)] recorded significantly maximum plant height (65.38 cm) and it was at par with treatments T₁₃ (63.51 cm), T₁₇ (61.38 cm) and T₉ (60.42 cm) while the minimum plant height (42.96 cm) was recorded with control T₁.It was also found that treatment T₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + *Azotobacter* (10 ml/kg of seed)] recorded significantly maximum leaf length (45.00 cm) which was statistically on equal footing with treatment T₁₃, giving the leaf length of 43.23 cm while the minimum leaf length (27.36 cm) was recorded with control T₁.The number of leaves per plant was significantly affected due to various treatments and is evident from the table that treatment T₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + *Azotobacter* (10 ml/kg of seed)] recorded significantly maximum number of leaves per plant(14.30) while the minimum no of leaves per plant (7.20) was recorded with control T₁. The fresh weight of leaves/plant obtained was significantly higher and maximum in case of the treatment T₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + *Azotobacter* (10 ml/kg of seed)] fresh weight of leaves/plant (38.33 g) while the minimum fresh weight of leaves/plant (26.12g) was recorded with control T₁.

The maximum increase in plant height was due to readily availability of required quantities of nitrogen, which is being a constituent of amino acids, nucleotides, nucleic acids, a number of coenzymes, auxins, cytokinin's and alkaloids, resulted in increased cell elongation, cell enlargement and cell division. Moreover, the higher plant height could be due to certain growth promoting substances secreted by the biofertilizers i.e., *Azotobacter* and phosphate solubilizing bacteria, which in turn, might have led to better root development, better transportation of water, uptake and

deposition of nutrients. The results are in accordance with the findings of (Singh *et al.*, 2017) ^[9] and (Kirad *et al.*, 2010) ^[7] in carrot. More number of leaves per plant and maximum leaf length could be due to timely supply of all nutrients resulted in luxurious vegetative growth of plant. Moreover application of vermicompost helped in development of the physical, chemical and biological properties of soil which helps in better nutrient absorption and utilization by plant. Seed inoculation of biofertilizers might have helped to increase the biological nitrogen fixation and availability of phosphorous required for strong vegetative growth, ultimately led to production of more number of leaves per plant and maximum leaf length. Similar results were also reported by (Singh *et al.*, 2017) ^[9], (Kirad *et al.*, 2010) ^[7] and (Vithwel Kanaujia, 2013) ^[10] in carrot. Maximum fresh weight of leaves might be due to higher plant height, more number of leaves and maximum leaf area of this treatment as compared to the rest of treatments. The results are comparable with those of (Singh *et al.*, 2017) ^[9], (Kirad *et al.*, 2010) ^[7] in carrot and (Khalid *et al.*, 2015) ^[6] in radish

The root length obtained was significantly affected due to various treatments. It is evident from the data that treatment T₁₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + Azotobacter (10 ml/kg of seed)] recorded significantly maximum root length (18.87cm) which shared statistical similarity with treatments T₁₃, T₁₇ and T₉ producing the root length of 18.34 cm, 18.11 cm and 17.92 cm, respectively while the minimum root length (13.08 cm) was recorded with control T₁. The root diameter obtained was also significantly affected due to various treatments and it was found that the treatment T₁₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + Azotobacter (10 ml/kg of

seed)] recorded significantly maximum root diameter (4.78 cm) which shared statistical similarity with treatment T₁₃ producing the Root diameter of 4.57 cm while the minimum root diameter (2.01cm) was recorded with control T₁. Significant difference was observed in case of root weight due to various treatments. It is evident from the data that treatment T₁₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + Azotobacter (10 ml/kg of seed)] recorded significantly maximum root weight (118.00 g) which was statistically equal to treatment T₁₃, T₁₇ and T₉ producing the root weight of 116.22 g, 112.00 g and 110.33 g while the minimum root diameter (77.00 g) was recorded with control T₁. The data showed that yield of root obtained was significantly affected due to various treatments. It is evident from the data that treatment T₁₉ [50% RDF + 50% RDN through VC (2.8t/ha) + PSB + Azotobacter (10 ml/kg of seed)] recorded significantly maximum yield of root (18.94 kg) which was statistically on equal footing with treatment T₁₃ and T₁₇ producing the root yield of 18.21 kg and 17.95 kg respectively, while the minimum yield of root (8.30 kg) was recorded with control T₁.

Higher vegetative growth under integrated application of nutrients might have helped in synthesis of greater amount of food materials which was later translocated into developing root resulting in increased root length, root diameter and root weight. Similarly maximum fresh weight of root (118 g) was also recorded under treatment T₁₉ (50% RDF + 50% RDN through VC (2.8t/ha) + PSB + Azotobacter (10 ml/kg of seed)) which was at par with T₁₃, T₁₇ and T₉. This might be due to higher root length and root diameter. These results are comparable with the reports of (Vithwel Kanaujia, 2013) ^[10] in carrot and (Khalid *et al.*, 2015) ^[6] in radish.

Table 1: Treatment Detail

Sl. No.	Treatment	Details
1	T ₁	RDF (N:P:K-120:60:60 kg/ha) – Control through chemical fertilizer
2	T ₂	75% RDF + 25% RDN through FYM (6 t/ha)
3	T ₃	50% RDF + 50% RDN through FYM (12 t/ha)
4	T ₄	25% RDF + 75% RDN through FYM (18 t/ha)
5	T ₅	75% RDF + 25% RDN through PM (0.9 t/ha)
6	T ₆	50% RDF + 50% RDN through PM (1.8 t/ha)
7	T ₇	25% RDF + 75% RDN through PM (2.7 t/ha)
8	T ₈	75% RDF + 25% RDN through VC (1.4 t/ha)
9	T ₉	50% RDF + 50% RDN through VC (2.8 t/ha)
10	T ₁₀	25% RDF + 75% RDN through VC (4.2 t/ha)
11	T ₁₁	RDF (N:P:K-120:60:60 kg/ha) + PSB + Azotobacter
12	T ₁₂	75% RDF + 25% RDN through FYM (6 t/ha) + PSB + Azotobacter
13	T ₁₃	50% RDF + 50% RDN through FYM (12 t/ha) + PSB + Azotobacter
14	T ₁₄	25% RDF + 75% RDN through FYM (18 t/ha) + PSB + Azotobacter
15	T ₁₅	75% RDF + 25% RDN through PM (0.9 t/ha) + PSB + Azotobacter
16	T ₁₆	50% RDF + 50% RDN through PM (1.8 t/ha) + PSB + Azotobacter
17	T ₁₇	25% RDF + 75% RDN through PM (2.7 t/ha) + PSB + Azotobacter
18	T ₁₈	75% RDF + 25% RDN through VC (1.4 t/ha) + PSB + Azotobacter
19	T ₁₉	50% RDF + 50% RDN through VC (2.8 t/ha) + PSB + Azotobacter
20	T ₂₀	25% RDF + 75% RDN through VC (4.2 t/ha) + PSB + Azotobacter

Table 2: Effect of integrated nutrient management on Plant height(cm) and number of leaves per plant

Treatment	Plant height (cm)	Number of leaves per plant	Leaf length (cm)	Weight of leaves
T ₁	42.96	7.20	27.36	26.12
T ₂	45.35	9.30	29.22	30.00
T ₃	57.31	12.92	37.33	37.00
T ₄	48.46	10.13	29.98	31.22
T ₅	43.12	8.20	28.21	27.11
T ₆	55.23	12.11	32.19	36.11
T ₇	54.12	11.44	32.11	35.98
T ₈	49.31	10.28	30.12	33.11
T ₉	60.42	13.41	38.23	37.22
T ₁₀	43.56	8.82	28.92	28.87
T ₁₁	43.02	7.91	27.83	26.66
T ₁₂	46.53	9.87	29.62	30.60
T ₁₃	63.51	14.24	43.23	38.11
T ₁₄	52.11	10.94	30.33	34.22
T ₁₅	43.21	8.41	28.46	27.66
T ₁₆	56.24	12.22	35.62	36.52
T ₁₇	61.38	13.92	40.12	37.98
T ₁₈	53.43	11.23	31.25	35.30
T ₁₉	65.38	14.30	45.00	38.33
T ₂₀	44.11	9.10	29.11	26.12
CD	5.24	5.11	5.92	3.83

Table 3: Effect of INM on yield parameters of carrot

Treatment	Root length(cm)	Root diameter(cm)	Fresh weight of root(g)	Yield per Plot(kg/plot)	Yield per hectare(t/ha)
T ₁	13.08	2.01	77.00	13.09	218.30
T ₂	14.82	2.61	83.56	14.79	246.60
T ₃	17.28	3.98	107.11	16.09	268.30
T ₄	15.33	2.86	87.77	16.02	267.00
T ₅	13.78	2.11	78.43	15.22	253.80
T ₆	16.92	3.67	102.20	15.12	252.00
T ₇	16.51	3.52	100.00	14.89	248.33
T ₈	15.90	3.00	90.63	14.70	245.00
T ₉	17.92	4.03	110.33	17.22	287.00
T ₁₀	14.13	2.32	79.98	15.31	255.30
T ₁₁	13.46	2.06	77.37	15.40	256.83
T ₁₂	15.06	2.72	84.10	15.64	260.83
T ₁₃	18.34	4.57	116.22	18.21	303.50
T ₁₄	16.04	3.11	92.56	16.50	275.00
T ₁₅	14.00	2.16	79.21	14.22	237.16
T ₁₆	17.02	3.80	105.31	15.99	266.66
T ₁₇	18.11	4.23	112.00	17.95	299.33
T ₁₈	16.22	3.32	97.11	16.23	270.66
T ₁₉	18.87	4.78	118.00	18.94	315.66
T ₂₀	14.37	2.49	81.67	14.61	243.66
CD	6.39	5.98	6.75	5.79	6.90

References

- Cho Y, Kim B, Lee J, Kim S. Construction of a high-resolution linkage map and chromosomal localization of the loci determining major qualitative traits in onion (*Allium cepa* L.). *Euphytica*. 2021;217(1):1-12.
- Hammad HM, Khaliq A, Abbas F, Farhad W, Fahad S, Aslam M, *et al.* Comparative effects of organic and inorganic fertilizers on soil organic carbon and wheat productivity under arid region. *Communications in Soil Science and Plant Analysis*. 2020;51(10):1406-1422.
- Manisha KP, RV G, MVD. Genetic diversity study in tropical carrot (*Daucus carota* L.). *Journal of Horticultural Sciences*. 2022;17(1):83-87. doi:10.24154/jhs.v17i1.1397.
- Nagraj GS, Jaiswal S, Harper N, Jaiswal AK. Carrot. In: *Nutritional composition and antioxidant properties of fruits and vegetables*. 2020. p. 323-337.
- Sikora J, Niemiec M, Tabak M, Komorowska M. Assessment of the efficiency of nitrogen slow-release fertilizers in integrated production of carrot depending on fertilization strategy. *Sustainability*. 2020;12(5):1982.
- Khalid M, Yadav MP, Amar S, Yadav BK. Studies on the effect of integrated nutrient management on growth and yield attributing characters of radish (*Raphanus sativus* L.). *Annals of Horticulture*. 2015;8(1):81-83.
- Kirad KS, Barch S, Singh DB. Integrated nutrient management on growth, yield and quality of carrot. *Karnataka Journal of Agricultural Sciences*. 2010;23(3):542-543.
- Panse VG, Sukhatme PV. *Statistical methods for agricultural workers*. 2nd ed. New Delhi: ICAR; 1961.
- Singh DP, Kumar S, Maji S, Pandey VK. Studies on integrated nutrient management on growth, yield and quality of carrot (*Daucus carota* L.). *International Journal of Agriculture Sciences*. 2017;8(51):2187-2188.
- Vithewal, Kanaujia SP. Integrated nutrient management on productivity of carrot and fertility of soil. *SAARC Journal of Agriculture*. 2013;11(2):173-181.