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# EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF CARROT (*Daucus carota* L.) CV. PUSA KESAR

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**ABSTRACT**

The present investigation entitled "Effect of Integrated Nutrient Management on Growth and Yield of Carrot (*Daucus Carota* L.) Cv. Pusa Kesar" was conducted during the *rabi* season of 2023–24 at the Horticulture Research Farm No. 1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.). The study aimed to evaluate the effect of organic and inorganic fertilizers dose on growth, yield and quality attributes of carrot under subtropical agro-climatic conditions. The experiment was laid out in a Randomized Block Design comprising twelve treatments of integrated use of organic and inorganic fertilizers with three replications. The results revealed that growth parameters were significantly influenced by different nutrient management practices. Among all treatments, $T_6$ (75% RDF + 10 t $ha^{-1}$ Vermicompost + 15 t $ha^{-1}$ FYM) recorded the maximum plant height (53.05 cm), number of leaves per plant (11.67), leaf length (36.11 cm) and fresh weight of leaves (86.98 g). Yield attributes were also significantly improved under the same treatment, registering the highest root length (18.12 cm), root diameter (80.26 mm), fresh weight of root (81.23 g) and root yield (5.55 kg $plot^{-1}$), which was markedly superior to the control (2.86 kg $plot^{-1}$). The superior performance may be attributed to balanced nutrient availability, improved soil fertility and enhanced microbial activity.

***Keywords*:** Carrot, Vermicompost, FYM, Growth and Yield

## Introduction

Carrot (*Daucus carota* L.), one of the major root vegetable crops in India, holds significant nutritional and economic importance. It is one of the most important economic vegetable root crops. It belongs to kingdom Plantae and family Umbelliferae/Apiaceae, subfamily Apioideae, genus Daucus, section Daucus and species *Daucus carota* (Ismail *et al.*, 2023). Carrot is also known as "Queen Anne's Lace" there are many explanation behind this name some accounts claims that the flower's resemblance to the lace that was fashionable around the time of british. Carrot is beneficial for repairing cellular membranes, improve constipation, strengthen vision and improve immune function that's why it is accounted as "Poor Man's Ginseng" (Ikram *et al*., 2024). It is cultivated widely across diverse states including Haryana, West Bengal, and Punjab, playing a vital role in both fresh consumption and processing industries. India ranks as the second largest vegetable producer globally with vegetable production reaching approximately 207.21 million metric tonnes with an area under cultivation of approximately 11.23 million hectares in 2023-24 (Department of Agriculture and Farmers Welfare, 2024).

Carrot is prized for having abundant amount of beta-carotene (Provitamin A) and it shows anti-carcinogenic effect. (Handelman, 2001; Ebadollahi-Natanzi *et al.*, 2020). Carrot roots have the following composition: 88% water, 1% protein, 7%

carbohydrates, 2% fat, and 2.8% dietary fiber. The simple sugars sucrose, glucose, and fructose make up the majority of the carbohydrates, with a small quantity of starch. It has a high concentration of minerals (1.1 g), riboflavin (0.02 g), thiamine (0.04 g), niacin (0.6 g), phosphorus (530 mg), and vitamin C (3 mg) per 100 g. Raw fresh carrot contain on an average 8285 µg β-carotene/100gm fresh weight. Carrots are also a rich source of vitamin K and vitamin B6, although they are low in other important elements. Carrots provide significant amounts of magnesium, vitamin B6, and folic acid (Ahmad *et al.*, 2004). It also has cooling properties and is beneficial for people with gallstones, constipation and heart disease. It is rich in beta-carotene and improves vision and skin health (Rossi *et al.*, 2007). Carrot root is used as vegetable that works well in pies, stews, and curries. Young roots are used to make the delectable dessert Gajar halwa, and grated roots are often used in salads. Carrot puree is another popular recipe; the roots can be dried and cut into slices and disks. Black carrots are used to make the beverage kanji. Despite its importance, carrot cultivation faces challenges related to excessive fertilizer use, declining soil health, and the constraints of small-scale farming. Integrated nutrient management including organic manures like farmyard manure and Vermicompost offers a sustainable alternative to chemical fertilizers. This approach aims to enhance crop growth, yield and quality by improving soil fertility while minimizing environmental impact. The present study investigates the effects of integrated nutrient management on the vegetative growth and yield of carrot, specifically the Pusa Kesar cultivar.

## Materials and Methods

An experiment was conducted during the winter season of 2023-24 at the Horticulture Research Farm No-1, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow (26°46'18" N latitude, 80°55'22" E longitude, altitude 111 m). The site falls under the humid subtropical climate of the lower Gangetic alluvial plains, characterized by hot dry summers and cool winters. The temperature during season of crop growth varied from 35.8$^0$C (max.) to 7.2$^0$C (min.). The experimental field had sandy loam soil with a pH of 7.8 and 0.2% organic carbon. The experiment was laid out in randomized block design with 12 treatments and three replications. Total numbers of plot were 36 and each plot was 1.2 meters in length and 0.6 meters in width. The row to row and plant to plant distance of the experiment was maintained respectively 30cm and 10cm. The treatments involved in the study were T1 (Control), T2 (Vermicompost), T3 (Farm Yard Manure), T4 (75% RDF + Vermicompost), T5 (75% RDF + FYM), T6 (75% RDF + Vermicompost + FYM), T7 (50% RDF + Vermicompost), T8 (50% RDF + FYM), T9 (50% RDF + Vermicompost + FYM), T10 (25% RDF + Vermicompost), T11 (25% RDF + FYM) and T12 (25% RDF + Vermicompost + FYM). The land was brought to a fine tilth through ploughing and tillage and irrigation channels and bunds were maintained properly. Seeds were sown directly in the field, followed by light irrigation to support germination. Organic manures were applied as a basal dose before sowing to ensure proper decomposition. Full doses of phosphorus and potassium and half dose of nitrogen as per the treatment plan were applied just before sowing, with the remaining nitrogen applied 30 days after sowing. Standard cultural practices were followed throughout the crop growth period. Manual weeding was done in order to keep the soil free from weeds. Earthing up was done twice once at 30 day after sowing and other at 45 days after sowing. All recommended cultural practices were consistently followed throughout the crop growth period. Observations were systematically recorded on vegetative parameters including Plant height, Number of leaves per plant, Length of leaves, Fresh weight of leaves and yield parameters including Root weight, Length of root, Root diameter, Root yield and Dry weight of root.

## Result and Discussion

**Table 1 :** Effects of Integrated Nutrient Management on the Leaves Parameters of Carrot (*Daucus carota* L.) cv. Pusa Kesar

| Treatments | Height of plant (cm) | Number of leaf (cm) | Leaf length (cm) | Fresh weight of leaves (g) |
|---|---|---|---|---|
| $T_1$ | 39.55 | 6.00 | 34.35 | 78.15 |
| $T_2$ | 40.11 | 7.33 | 29.66 | 78.99 |
| $T_3$ | 40.21 | 7.67 | 29.67 | 79.89 |
| $T_4$ | 47.60 | 10.67 | 35.27 | 83.78 |
| $T_5$ | 47.32 | 9.33 | 35.13 | 83.65 |
| $T_6$ | 53.05 | 11.67 | 36.11 | 86.98 |
| $T_7$ | 46.88 | 9.33 | 34.70 | 83.11 |
| $T_8$ | 46.60 | 8.50 | 34.37 | 81.45 |
| $T_9$ | 50.22 | 10.67 | 35.57 | 84.53 |
| $T_{10}$ | 41.58 | 7.67 | 31.00 | 80.32 |
| $T_{11}$ | 42.58 | 8.00 | 32.41 | 80.65 |
| $T_{12}$ | 42.67 | 8.33 | 34.03 | 81.25 |
| **SE(d)** | 0.93 | 1.27 | 0.60 | 1.37 |
| **C.D. at 5%** | 1.89 | 2.58 | 1.21 | 2.77 |

**Table 2 :** Effects of Integrated Nutrient Management on the Roots of Carrot (*Daucus Carota* L.) cv. Pusa Kesar

| Treatments | Root length (cm) | Root Diameter (cm) | Fresh weight of root (g) | Root yield (kg/plot) | Dry weight of root (g) |
|---|---|---|---|---|---|
| $T_1$ | 11.85 | 62.41 | 45.39 | 2.86 | 4.90 |
| $T_2$ | 12.05 | 69.45 | 62.66 | 2.99 | 6.33 |
| $T_3$ | 12.73 | 64.19 | 59.63 | 2.97 | 5.21 |
| $T_4$ | 15.26 | 74.13 | 53.33 | 3.60 | 7.15 |
| $T_5$ | 12.20 | 73.10 | 74.23 | 3.56 | 6.53 |
| $T_6$ | 17.63 | 78.25 | 81.23 | 5.55 | 9.62 |
| $T_7$ | 14.25 | 72.65 | 67.29 | 4.65 | 5.31 |
| $T_8$ | 13.70 | 72.14 | 78.43 | 4.32 | 6.29 |
| $T_9$ | 16.35 | 76.89 | 55.59 | 3.41 | 8.50 |
| $T_{10}$ | 12.96 | 71.85 | 58.23 | 3.96 | 7.39 |
| $T_{11}$ | 13.50 | 69.98 | 68.81 | 3.89 | 6.82 |
| $T_{12}$ | 13.58 | 79.99 | 51.43 | 3.56 | 5.76 |
| SE(d) | 0.25 | 1.11 | 1.15 | 0.06 | 0.09 |
| C.D. at 5% | 0.51 | 2.26 | 2.33 | 0.12 | 0.18 |

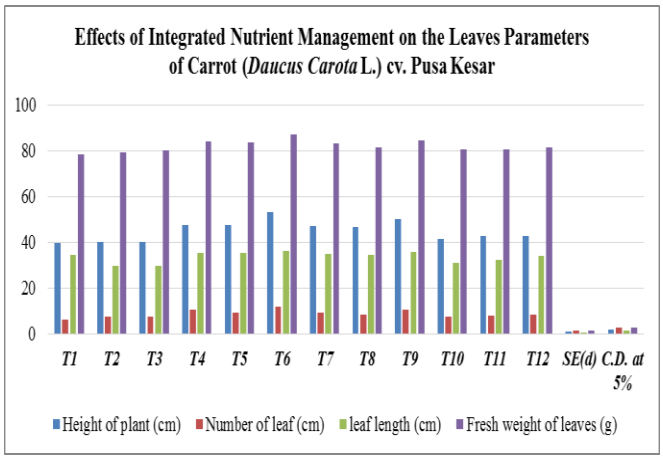


**Fig. 1 :** Effects of Integrated Nutrient Management on the Leaves Parameters of Carrot (*Daucus carota* L.) cv. Pusa Kesar

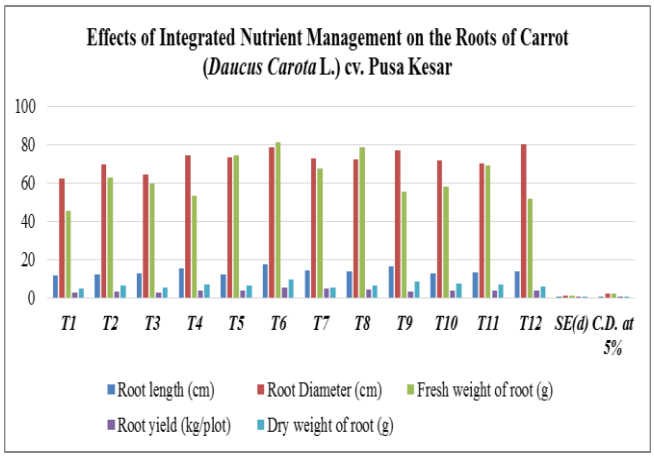


**Fig. 2 :** Effects of Integrated Nutrient Management on the Roots of Carrot (*Daucus Carota* L.) cv. Pusa Kesar

The growth and yield parameters of carrot were significantly influenced by different integrated nutrient management (INM) treatments under Lucknow conditions. The combined application of inorganic fertilizers with organic manures such as vermicompost and farmyard manure (FYM) produced better results compared to sole application of either organic or inorganic nutrient sources. The maximum plant height (53.05 cm) was recorded in $T_6$ treatment, whereas the minimum plant height (39.55 cm) was observed under control ($T_1$). The increased plant height might be due to balanced and continuous supply of nutrients, especially nitrogen which promoted cell division, cell elongation and vegetative growth. Similar findings were reported by Singh *et al.* (2017) and Kirad *et al.* (2010) in carrot. The number of leaves per plant was also significantly affected by INM treatments. Treatment $T_6$ recorded the highest number of leaves per plant (11.67), while the lowest value (6.00) was observed under control treatment. The increased leaf production under integrated nutrient management may be attributed to improved nutrient availability, better photosynthetic activity and enhanced soil physical and biological properties due to the application of vermicompost and FYM. Similar results were reported by Vithwel Kanaujia (2013). Leaf length was significantly influenced by various treatments. The maximum leaf length (36.11 cm) was recorded in $T_6$ treatment, whereas minimum leaf length was recorded under control treatment. The increase in leaf length might be due to the adequate availability of macro and micronutrients supplied through integrated nutrient management, which enhanced vegetative growth and leaf expansion. Similar findings were reported by Singh *et al.* (2017). Fresh weight of leaves was also significantly affected by integrated nutrient management treatments. The highest fresh weight of leaves (86.98 g) was recorded in $T_6$ treatment, while the lowest value (78.15 g) was observed under control. Increased fresh biomass may be due to greater plant height, increased number of leaves and larger leaf area under combined nutrient application. Similar results were observed by Kirad *et al.* (2010) in carrot and Khalid *et al.* (2015) in radish.

Significant differences were also observed among different treatments with respect to yield parameters. The maximum root length (17.63 cm) was recorded in $T_6$ treatment, followed by $T_9$ treatment, while the minimum root length (11.85 cm) was recorded under control treatment. Better vegetative growth and enhanced translocation of photosynthates from source to sink might have contributed to increased root length under integrated nutrient management. Similar observations were reported by Singh et al. (2017),

Kirad *et al.* (2010) and Vithwel Kanaujia (2013). Root diameter was significantly influenced by INM treatments. The maximum root diameter was recorded in $T_6$ treatment, whereas the minimum diameter was observed in control treatment. Improved soil structure, enhanced nutrient availability and better root development under combined application of RDF, vermicompost and FYM may have contributed to increased root girth. Similar findings were reported by Kirad *et al.* (2010) and Vithwel Kanaujia (2013). Fresh weight of root was also significantly affected by integrated nutrient management treatments. Treatment $T_6$ recorded the highest fresh root weight (81.23 g), whereas the minimum fresh root weight (45.39 g) was observed under control treatment. The increase in fresh root weight might be due to increased root length and diameter as a result of better nutrient uptake and translocation of photosynthates. Similar findings were reported by Vithwel Kanaujia (2013) in carrot and Khalid *et al.* (2015) in radish. Root yield per plot was significantly increased by integrated nutrient management treatments. The maximum root yield (5.55 kg/plot) was obtained in $T_6$ treatment, whereas the minimum yield (2.86 kg/plot) was observed under control treatment. Higher root yield under integrated nutrient management may be attributed to increased fresh root weight, better vegetative growth and improved nutrient use efficiency. Similar findings were reported by Vithwel Kanaujia (2013) and Khalid *et al.* (2015). Dry weight of root was also significantly influenced by different nutrient management treatments. The highest dry weight of root (9.62 g) was recorded in $T_6$ treatment, while the minimum dry weight (4.90 g) was recorded under control treatment. Increased dry matter accumulation might be due to improved nutrient uptake, efficient photosynthesis and enhanced carbohydrate synthesis under integrated nutrient management practices. Similar findings were reported by Parthasarathy *et al.* (1999) in radish.

## Conclusion

On the basis of the present investigation, it may be concluded that integrated nutrient management significantly enhanced the growth and yield performance of carrot cv. Pusa Kesar under Lucknow conditions. Among all the treatments, $T_6$ (75% RDF + Vermicompost + FYM) proved to be the best treatment by recording maximum plant height (53.05 cm), number of leaves per plant (11.67), leaf length (36.11 cm) and fresh weight of leaves (86.98 g). The same treatment also produced highest root length (17.63 cm), fresh root weight (81.23 g), root yield (5.55 kg/plot) and dry weight of root (9.62 g) as compared to control. The improvement in growth and yield attributes may be due to balanced nutrient supply and improved soil health through combined application of organic and inorganic nutrient sources. Therefore, application of 75% RDF along with Vermicompost and FYM may be recommended for obtaining higher growth and yield in carrot cultivation.

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