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# Effect of integrated nutrient management on quality of carrot (*Daucus carota* L.) var. Pusa Kesar

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**Abstract**
A field experiment was conducted to study the effect of Integrated Nutrient Management (INM) on quality of carrot (*Daucus carota* L.) var. Pusa Kesar at main Experimental Station, Department of Horticulture, BFIT Group of Institutions, Sudhowala, Dehradun, Uttarakhand (U.K), HNB Garhwal Central University during the rabi season of 2018-19. The experiment was laid out in Randomised Block Design (RBD) with 12 treatment combination of organic and inorganic sources of nutrients. The results pertaining to quality parameters indicated a significant increase in TSS, dry weight of roots, carotene and ascorbic in treatment $T_{11}$ (FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) + 50% NPK). On the basis of the investigation, it was concluded that carrot variety Pusa Kesar responded well in terms of quality, by the application of combination of organic manures and inorganic fertilizers in the respective treatments.

**Keywords:** INM, organic, inorganic fertilizer, carrot, *Daucus carota*

## Introduction
Carrot (*Daucus carota* L.) is one of the most important root vegetable which belongs to family Apiaceae and have chromosome number 2n=18. The primary centre of origin of carrot ranges from Afghanistan to Mediterranean region and South-west Asia is the secondary centre of origin. Carrot is a cool season crop. It is an annual herb for root production and biennial for flowering and fruit set. Edible portion in carrot is "enlarged fleshy taproots". Good quality carrot contains maximum cortex and minimum core. The type of inflorescence present in carrot is "compound umbel". Carrot is used as a salad, cooked as vegetables preferably with potatoes and peas. It is cultivated all over India for both forage and human consumption. Carrot juice is becoming popular day by day. A special type of beverage known as kanji is prepared from black carrot and used as appetizer. It is used in making pickles and sweets (Gajar halwa). They have been used to control ulcers, eczema, boil and are used in cosmetics preparations to fight wrinkles. It improves brain health, treating wounds, supporting better digestion, maintaining healthy hair and skin and lowering the risk of diabetes. Vitamin A in carrot helps to prevent vision loss. They provide the major dietary fibre components of food and also a range of micronutrients and antioxidant compounds to protect against cancer. It contains appreciable amount of beta carotene (60-500 ppm); a precursor to vitamin A which prevents infection, some forms of cancer and improves vision, lycopene (50-100 ppm) and lutein (1-5 ppm). The anthocyanin content of black carrot ranges from 1750mg/100g. They also contain vitamin C, $B_1$ (thiamine) and $B_2$ (riboflavin). The taste of carrot is mainly present due to the presence of "glutamic acid". Isocoumarin is responsible for bitter flavour in carrot. Red colour of carrot is due to the presence of lycopene, beta carotene is responsible for orange colour, anthocyanin for purple colour and yellow colour is observed due to the presence of Xanthophylls (lutein). Carrot roots are rich in sucrose *i.e.* ten times more than glucose and fructose. Vegetables that are produced by using organic manures are gaining more importance because of less chemical residues and better taste. Considering the adverse effects on soil health and environment, besides the residual effects, luxurious usage of inorganic fertilizers is not advisable. However carrot yield and nutritional quality are affected by the types of fertilizers applied. Among the chemical constituents of the fertilizers, N plays a dominant role in affecting the nutritional quality. Carrot root yield was improved by hundred percent recommended doses of N, P and K fertilizers compared to application of organic fertilizer alone. As the root vegetables are an exhaustive crop, organic manures alone may not be able to supply the desired amount of nutrients to the crop.

So it has been found that neither the chemical fertilizers nor the organic manures alone can help to achieve sustainable crop production. Instead of this, combined usages of organic manures and inorganic fertilizers *i.e.,* INM (Integrated Nutrient Management) practices will help to improve the soil health and nutrient availability, increase production and help to improve the quality of carrot (Ahmad *et al*., 2015) [1].

## Material and Methods

The present investigation pertaining to the studies on the "Assessment of growth, yield and quality of carrot (*Daucus carota* L.) var. Pusa Kesar under Integrated Nutrient Management" was conducted during 2018-2019 at main Experimental Station, Department of Horticulture, BFIT Group of Institution, Sudhowala, Dehradun, Uttarakhand, HNB Garhwal University. The experiment was conducted in Randomized Block Design (RBD) with three replications and 12 treatment combinations of organic and inorganic sources of nutrients i.e., $T_1$ (FYM 20 t/ha), $T_2$ (Vermicompost 5 t/ha),$T_3$ (FYM 10 t/ha + Vermicompost 2.5 t/ha), $T_4$ (FYM 10 t/ha + 50% NPK + biofertilizer), $T_5$ (Vermicompost 2.5 t/ha + 50% NPK + biofertilizer), $T_6$ (FYM 10 t/ha + biofertilizer), $T_7$ (Vermicompost 2.5 t/ha + biofertilizer), $T_8$ (FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer), $T_9$ (FYM 10 t/ha + biofertilizer (5 kg/ha) + 50% NPK), $T_{10}$ (Vermicompost 2.5 t/ha + biofertilizer (5 kg/ha) 50% NPK), $T_{11}$ (FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) + 50% NPK), $T_{12}$ (Full dose of NPK (60:80:75 kg/ha). The variance of the measure of the variability and is defined as the average of the square deviation from the mean. The analysis of variance was carried out as per methods suggested by Panse and Sukhatme (1989) [7].

## Result and Discussion

A significant increase in quality traits such as TSS, carotene contents, ascorbic acid and dry weight of roots was observed among various treatments. The minimum root forking (5.53%) was observed in treatment $T_{11}$ (FYM 10 t/ha + vermicompost 2.5 t/ha + biofertilizer 2 kg/ha + 50% NPK) (Table 1). The minimum root cracking (2.20%) was observed in treatment $T_4$ (FYM 10 t/ha + 50% NPK + biofertilizer 2 kg/ha) (Table 1). Maximum T.S.S was observed as $9.00^0$Brix in treatment $T_{11}$ (FYM 10t/ha + vermicompost 2.5t/ha + biofertilizer 2kg/ha + 50% NPK) (Table 2). Among all the treatments, maximum dry weight of root (9.60 g) was observed in treatment $T_{11}$ (FYM 10t/ha + vermicompost 2.5 t/ha + biofertilizer 2 kg/ha + 50% NPK) (Table 2). Maximum carotene content (4.53 mg/100g) was recorded in treatment $T_{11}$ (FYM 10 t/ha + vermicompost 2.5t/ha + biofertilizer 2 kg/ha + 50% NPK) and maximum ascorbic acid content (9.60 mg/100g) was recorded in treatment $T_{11}$ (FYM 10t/ha + vermicompost 2.5 t/ha + biofertilizer 2 kg/ha + 50% NPK) (Table 3).

Among all the treatment combinations, treatment $T_{11}$ (FYM 10t/ha + vermicompost 2.5t/ha + biofertilizer 2kg/ha + 50% NPK) proved to be the best for maximum quality traits in carrot. The above findings gave a clear indication that the application of organic manure along with inorganic fertilizers positively influences the quality parameters in carrot. This finding is also in agreement with the findings of Sharma (1997) [9], Jadhao *et al.* (1999) [3], Gupta and Sangar (2000) [2], Singh and Singh (2000) [10], Lyngdoh (2001) [4], Netra Pal (2001) [6], Sunandarani and Mallareddy (2007) [11], Meena *et al.* (2007) [5].

**Table 1:** Influence of different treatments of organic and inorganic sources of nutrients on root cracking percentage and root forking percentage

| Symbol | Treatments | Root cracking percentage | Root forking percentage |
|---|---|---|---|
| $T_1$ | FYM 20 t/ha | 3.45 | 6.03 |
| $T_2$ | Vermicompost 5 t/ha | 2.60 | 7.76 |
| $T_3$ | FYM 10 t/ha + Vermicompost | 2.03 | 7.53 |
| $T_4$ | FYM 10 t/ha + 50% NPK + biofertilizer (2 kg/ha) | 2.20 | 6.80 |
| $T_5$ | Vermicompost 2.5 t/ha + 50% NPK + biofertilizer (2 kg/ha) | 3.75 | 8.46 |
| $T_6$ | FYM 10 t/ha + biofertilizer (2 kg/ha) | 0.66 | 7.66 |
| $T_7$ | Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) | 2.11 | 5.23 |
| $T_8$ | FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) | 1.59 | 5.90 |
| $T_9$ | FYM 10 t/ha + biofertilizer (5 kg/ha) + 50% NPK | 2.51 | 6.70 |
| $T_{10}$ | Vermicompost 2.5 t/ha + biofertilizer (5 kg/ha)+50% NPK | 2.61 | 9.36 |
| $T_{11}$ | FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2.Kg/ha) + 50% NPK | 2.63 | 5.53 |
| $T_{12}$ | Full dose of NPK (60:80:75 Kg/ha) | 2.73 | 3.80 |
| GM | | 2.40 | 6.75 |
| S.Em± | | NS | NS |
| CD at 5% | | NS | NS |

**Table 2:** Dry weight of root (g) and total soluble solids ($^0$brix) as affected by different treatments of organic and inorganic sources of nutrients

| Symbol | Treatments | Dry weight of root (g) | Total soluble solids ($^0$brix) |
|---|---|---|---|
| $T_1$ | FYM 20 t/ha | 4.93 | 9.66 |
| $T_2$ | Vermicompost 5 t/ha | 6.43 | 8.00 |
| $T_3$ | FYM 10 t/ha + Vermicompost | 5.20 | 9.13 |
| $T_4$ | FYM 10 t/ha + 50% NPK + biofertilizer (2 kg/ha) | 7.16 | 8.83 |
| $T_5$ | Vermicompost 2.5 t/ha + 50% NPK + biofertilizer (2 kg/ha) | 8.46 | 8.00 |
| $T_6$ | FYM 10 t/ha + biofertilizer (2 kg/ha) | 5.30 | 8.33 |
| $T_7$ | Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) | 6.30 | 7.33 |
| $T_8$ | FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2 kg/ha) | 7.56 | 8.66 |
| $T_9$ | FYM 10 t/ha + biofertilizer (5 kg/ha) + 50% NPK | 7.33 | 8.83 |
| $T_{10}$ | Vermicompost 2.5 t/ha + biofertilizer (5 kg/ha) + 50% NPK | 7.46 | 7.83 |
| $T_{11}$ | FYM 10 t/ha + Vermicompost 2.5 t/ha + biofertilizer (2.Kg/ha) + 50% NPK | 9.60 | 9.00 |

| | | | |
|---|---|---|---|
| $T_{12}$ | Full dose of NPK (60:80:75Kg/ha) | 6.83 | 7.83 |
| GM | | 6.88 | 8.40 |
| S.Em± | | 0.83 | NS |
| CD at 5% | | 2.45 | NS |

**Table 3:** Ascorbic acid (mg/100g) and carotene (mg/100 g) as affected by different treatments of organic and inorganic sources of nutrients

| Symbol | Treatments | Ascorbic acid (mg/100g) | Carotene (mg/100g) |
|---|---|---|---|
| $T_1$ | FYM 20t/ha | 2.93 | 3.50 |
| $T_2$ | Vermicompost 5t/ha | 4.23 | 3.10 |
| $T_3$ | FYM 10t/ha + Vermicompost | 4.50 | 3.30 |
| $T_4$ | FYM 10t/ha + 50% NPK + biofertilizer (2kg/ha) | 4.13 | 3.13 |
| $T_5$ | Vermicompost 2.5t/ha + 50% NPK + biofertilizer (2kg/ha) | 3.60 | 4.10 |
| $T_6$ | FYM 10t/ha + biofertilizer (2kg/ha) | 3.63 | 3.53 |
| $T_7$ | Vermicompost 2.5t/ha + biofertilizer (2kg/ha) | 3.33 | 3.67 |
| $T_8$ | FYM10t/ha + Vermicompost 2.5t/ha + biofertilizer (2kg/ha) | 4.93 | 3.85 |
| $T_9$ | FYM10t/ha + biofertilizer (5kg/ha) + 50% NPK | 5.33 | 4.16 |
| $T_{10}$ | Vermicompost 2.5t/ha + biofertilizer (5kg/ha)+50% NPK | 5.24 | 3.98 |
| $T_{11}$ | FYM 10t/ha + Vermicompost 2.5t/ha + biofertilizer (2Kg/ha) + 50% NPK | 5.66 | 4.53 |
| $T_{12}$ | Full dose of NPK (60:80:75Kg/ha) | 4.88 | 4.23 |
| GM | | 4.37 | 3.76 |
| S.Em± | | 0.39 | 0.42 |
| CD at 5% | | 0.13 | 0.14 |

## Conclusion

On the basis of present investigation, it was concluded that carrot variety Pusa Kesar responded well in terms of quality traits, by the application of combination of organic manures and inorganic fertilizers. Soil application of FYM 10 t/ha + vermicompost 2.5 t/ha + biofertilizer 2 kg/ha + 30:40:37.5 kg NPK/ha proved to be the best combination for maximum quality traits in carrot when compared with other treatments. The quality of carrot was superior in this treatment.

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