



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; 11(12): 4710-4713  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 15-09-2022

Accepted: 18-10-2022

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## Effect of organic manures and micronutrients on seed production of carrot (*Daucus carota* L.)

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#### Abstract

The experiment was conducted during 2021-22 in *rabi* season. The field study to assess the effects of organic manures and micronutrients on seed production of carrot (*Daucus carota* L.) cv. Pusa Rudhira was carried out at Horticulture farm, SKNCOA, Jobner, Rajasthan, India. The study revealed that the application of Poultry manure @ 2.5 t/ha significantly increased the plant height (41.95 cm), Number of shoots per plant (12.71), chlorophyll content (1.11 mg/100 g), days to 50% umbel initiation (134.50 days), number of umbels per plant (17.30), number of seed per umbel (1177.35), diameter of umbel (16.71 cm), seed weight per plant (8.43 g), days to seed maturity (185.27 minimum days) and seed yield per hectare (6.24 q/ha). Similarly, the spray of ZnSO<sub>4</sub> @ 0.5% to the carrot crop significantly increased the plant height (40.60 cm), number of shoots per plant (12.49), chlorophyll content (1.07 mg/100 g), days to 50% umbel initiation (133.51 days), number of umbels per plant (16.30), number of seed per umbel (1175.30), diameter of umbel (16.10 cm), seed weight per plant (8.39 g), days to seed maturity (184.12 days) and seed yield per hectare (6.21 q/ha).

**Keywords:** Carrot, organic manures, micronutrients, seed production

#### Introduction

Carrot (*Daucus carota* L.) is a most important vegetables of Apiaceae family having chromosome number  $2n = 18$  ( $x = 9$ ). It is originated from South West Asia. Carrot is an annual crop grown for root production and biennial for seed production. The inflorescence of carrot is 'compound Umbel' and the edible part of carrot is modified root (conical form) which develop in soil. Fruit type of carrot is schizocarp and seed are spiny and in 1 gm seed having 500-1000 crop of carrot (Singh and Bahadur, 2015) [14]. Carrot seeds are used as fragrances, stimulants and digestive agents. They help with kidney diseases or kidney related disease, edema, nerve tension, aphrodisiacs, and uterine pain.

In carrot, for seed production two methods may be employed *viz.* (i) seed to seed method and (ii) root to seed method. In order to maintain high genetic purity and to obtain high vigour and viability of seed root to seed method is followed. This technique allows selecting true to type and healthy roots for replanting of stocklings. But farmer's quite often use seed for planting produced from seed-to-seed method where the rate of genetic deterioration is faster due to no scope for selection of healthy true to type roots.

Farm manure is a decomposed mixture of bovine manure and urine that contains straw and bedding as bedding and leftovers from cattle feed. FYM helps improve and maintain soil fertility. Vermicompost is a nutrient- rich, microbiologically- active organic amendments that results from the interactions between earthworms and microorganisms during the breakdown of organic matter. Poultry manure as an organic matter is especially important because it regulates and improves soil fertility and contains all major nutrients and most micronutrients (Warman, 1986) [15].

Boron is the essential micro nutrients required for dividing tissue development and glucose metabolism (Siddiky *et al.*, 2007) [13]. Zinc affects many plant functions such as hormonal movement, active salt intake, flowering and fruiting processes, pollen germination, carbohydrate and nitrogen metabolism, and plant water balance. Iron is essential for chlorophyll synthesis. It acts as an oxygen carrier and is a component of a particular enzyme and protein. It plays an important role in the synthesis of carotenoids in carrots.

#### Materials and Methods

The experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner

(Jaipur) during *Rabi* season 2021-22. In Rajasthan, this region falls under agro-climatic zone-III A (Semi-Arid Eastern Plains). The experiment was laid out in Factorial Randomized Block Design with four treatments of organic manures (control, FYM @ 10 t/ha, vermicompost @ 3.5 t/ha and poultry manure @ 2.5 t/ha) and foliar spray of micronutrients (control, FeSO<sub>4</sub> @ 0.5 percent, Borax @ 0.5 percent and ZnSO<sub>4</sub> @ 0.5 percent). The crop geometry was kept at 50 x 30 cm and all the required cultural operations were followed to raise the good crop. Five plants were tagged in each plot to record observations. Observations were recorded plant height (cm), number of shoots per plant, chlorophyll content (mg/100 g), days to 50% umbel initiation, number of umbels per plant, number of seed per umbel, diameter of umbel, seed weight per plant, days to seed maturity and seed yield per hectare (q/ha). The data obtained from the trial were subjected to statistical analysis which are presented in tabular form.

## Results and Discussion

### Effect of organic manures

#### Growth attributes

In the current study, that application of poultry manure @ 2.5 t/ha significantly higher than control and treatment O<sub>1</sub> except vermicompost @ 3.5 t/ha is statistically at par with it resulted in significantly increased growth attributing characters, viz., plant height (41.95cm), number of shoots per plant(12.71), chlorophyll content (1.11mg /100 g), days to 50% umbel initiation (134.50 minimum days significant).

This could be attributed to the improvement in soil structure and enhanced nutrient and moisture availability and uptake that may have favoured plant growth due to application of organic manure. The poultry manure showed significantly higher leaf area which could be due to increased cell division and elongation resulting in increased leaf expansion, more number of leaves due to beneficial influence of bio-fertilizers which release growth promoting substances and enhances the availability of nitrogen (Mog, 2007) [9]. Duncan (2005) [3] noted that chicken manure was an organic fertiliser that contained all the macronutrients and most of the micronutrients needed for crop growth. Highest length of leaves due to organic manure provide the micronutrients such as zinc, copper, iron and manganese etc. in the adequate amount to the plant (Bhattarai and Maharjan, 2013) [1]. Similar findings have been reported by (Kumar *et al.*, 2014) [1] in radish.

#### Seed yield attributes

Application of increasing doses of poultry manure 2.5 t/ha significantly increased number of umbels per plant (17.30), number of seed per umbel (1177.35), Diameter of umbel per plant (16.71 cm), seed weight per plant(8.43 g), days to seed maturity(185.27 minimum days significant) and seed yield per hectare (6.24 q/ha) of carrot. Enhanced vegetative growth in terms of number of branches per plant provide more sites for the translocation of photosynthates and ultimately resulted in increased number of yield attributes. The beneficial effect of poultry manure on yield attributes may probably due to enhanced supply of macro as well as micronutrients during entire growing season which led to higher assimilation of food and its subsequent partitioning in sink. The availability and optimum supply of nutrients of plants favourably influenced the flowering and seed formation, which ultimately increased the umbel per plant and seed per umbel. The result was in conformity with Yadav *et al.* (2007) in mungbean. The

significant differences in seed yield under the influences of poultry manure was largely a function of improved growth and the consequent increase in different yield attributes as mentioned above. Further, poultry manure increases the activities of N fixing bacteria and increase rate of humification. Humic acid in poultry manure enhanced the availability of both native and added micro nutrients in soil and thus plant growth, yield attributes and yield. As seed yield of a crop is function of yield attributes, such as higher number of umbels per plant seed per umbel due to poultry manure increased seed yield of carrot.

### Effect of micronutrients

#### Growth attributes

The results of the present investigation revealed that the response of micronutrients on growth attributes viz., plant height (40.60 cm), number of shoots per plant (12.49), chlorophyll content (1.07 mg/100 g), days to 50% umbel initiation (133.51 days) were significantly increased in the treatment M<sub>3</sub> (ZnSO<sub>4</sub> @ 0.5%).

Zinc is essential micronutrients which play a vital role in various enzymatic and physiological activities such as protein metabolism, gene expression, structural and functional integrity of bio membranes and photosynthetic carbon metabolism (Catmak, 2000). It also regulates the auxin concentration in plants and is an essential component of enzymes viz. Alcohol dehydrogenase, carbonic anhydrase, super oxide dismutase which are needed for root development and increasing the absorption of CO<sub>2</sub> per leaf area unit and thus increasing the chlorophyll content and photosynthesis. Similar findings have also been reported by Marschner, 1995 and Sharma 2002.

#### Seed yield attributes

The significantly enhanced number of umbels per plant (16.30), number of seed per umbel (1175.30), diameter of umbel per plant (16.10 cm), seed weight per plant (8.39 g), days to seed maturity (184.12 days) and seed yield per hectare (6.21 q/ha), were observed with the foliar application of different micronutrients. The application of ZnSO<sub>4</sub> @ 0.5 percent gave significantly maximum increase in seed yield and yield attributes of carrot over control.

The significant effect of zinc application on these yield attributes may be ascribed to catalytic or stimulatory effect of zinc on most of the physiological and metabolic processes of the plant. Zinc also acts as a metal activator and is an essential component of enzymes such as proteinase and peptidase which are responsible for assimilation of nitrogen. It also helps in chlorophyll formation and plays an important role in nitrogen metabolism. There by resulting in to increased uptake of nitrogen by the plant. Zinc has also been reported to play an important role in regulating the auxin concentration in plant. Beside this zinc also enhances the absorption of essential elements by increasing the cation exchange capacity of root. Thus, the application of zinc in a soil, efficient in zinc content, improved the overall growth and development of plant. These results are in close conformity with Yadav (1990) [17] who reported significant increase in yield attributing character and yield of carrot due to application of zinc. The increase in these yield attributes and yield due to application of zinc were also reported by Maliwal *et al.* (1985) [7], Jat (1990) [5], Sharma (1992) [12], Kalidasu (2008), Sharangi *et al.* (2009) [10] and Dwivedi *et al.* (2001) [4] in different crops.

**Table 1:** Effect of organic manures and micronutrients on growth attributes of carrot.

Treatments	Plant height (cm)	Number of shoots per plant	Chlorophyll content (mg/100 g)	Days to 50% umbel initiation
<b>Organic manures</b>				
O <sub>0</sub> - Control – no manure	30.79	9.76	0.86	158.98
O <sub>1</sub> - Farm yard manure (10t/ha)	38.84	11.35	0.95	150.45
O <sub>2</sub> - Vermicompost (3.5 t/ha)	41.01	12.48	1.06	136.40
O <sub>3</sub> - Poultry manure (2.5 t/ha)	41.95	12.71	1.11	134.50
SEm±	0.67	0.22	0.02	2.49
CD (P=0.05)	1.93	0.64	0.05	7.12
<b>Foliar spray of micronutrients at 45 DAS</b>				
M <sub>0</sub> - Control – no spray	34.87	10.30	0.89	160.03
M <sub>1</sub> - FeSO <sub>4</sub> @ 0.5%	39.68	12.14	1.06	151.30
M <sub>2</sub> - borax @ 0.5%	37.44	11.36	0.96	135.49
M <sub>3</sub> - ZnSO <sub>4</sub> @ 0.5%	40.60	12.49	1.07	133.51
SEm±	0.67	0.22	0.02	2.49
CD (P=0.05)	1.93	0.64	0.05	7.12

**Table 2:** Effect of organic manures and micronutrients on seed yield attributes of carrot

Treatments	Number of umbels per plant	Number of seed per umbel	Diameter of umbel (cm)	Seed weight per plant (g)	Days to seed maturity	Seed yield (q/ha)
<b>Organic manures</b>						
O <sub>0</sub> - Control – no manure	10.50	862.26	10.33	5.50	210.19	4.07
O <sub>1</sub> - Farm yard manure (10 t/ha)	12.10	922.34	14.83	7.14	201.19	5.29
O <sub>2</sub> - Vermicompost (3.5 t/ha)	16.70	1133.68	15.99	8.17	187.27	6.05
O <sub>3</sub> - Poultry manure (2.5 t/ha)	17.30	1177.35	16.71	8.43	185.27	6.24
SEm±	0.25	18.30	0.26	0.13	3.37	0.10
CD (P=0.05)	0.71	52.40	0.76	0.38	9.64	0.28
<b>Foliar spray of micronutrients at 45 DAS</b>						
M <sub>0</sub> - Control – no spray	11.50	865.46	11.23	5.81	211.28	4.30
M <sub>1</sub> - FeSO <sub>4</sub> @ 0.5%	13.20	924.37	15.02	6.88	202.20	5.10
M <sub>2</sub> - borax @ 0.5%	15.60	1130.50	15.52	8.16	186.32	6.04
M <sub>3</sub> - ZnSO <sub>4</sub> @ 0.5%	16.30	1175.30	16.10	8.39	184.12	6.21
SEm±	0.25	18.30	0.26	0.13	3.37	0.10
CD (P=0.05)	0.71	52.40	0.76	0.38	9.64	0.28

## Conclusion

On the basis of one year experiment results, it may be concluded that the treatment O<sub>3</sub> (Poultry manure @ 2.5 t/ha) was found significantly better in terms of seed yield. The treatment combination O<sub>3</sub>M<sub>3</sub> (poultry manure @ 2.5 t/ha and ZnSO<sub>4</sub> @ 0.5%) was better in terms of seed yield (7.17q/ha).

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