



## Performance of Carrot (*Dacus carota* L.) Varieties for Yield and its Associated Characters

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### ABSTRACT

The experiments were conducted to study the performance of three carrot varieties PCP-2, PCY-2 and Punjab Black Beauty during *Rabi* season of 2020-21 at four locations of district Tarn Taran and three varieties PCO-4, Arka Suraj and Early Nantes in district Amritsar during *Rabi* season of 2021-22 using randomized block design for yield and its contributing traits. The root colour of variety PCP-2 was purple with orange flesh, PCY-2 was yellow and for variety Punjab Black beauty it was purple. The varieties PCO-4, Arka Suraj and Early Nantes were orange in colour. Maximum average root yield was recorded in variety PCP-2 (517.54 q/ha) which also showed less forking (0.69%) followed by variety PCY-2 (508.40 q/ha) and variety Punjab Black Beauty (473.10 q/ha) in district Tarn Taran. The varieties PCO-4 showed maximum average yield (441.66q/ha) less forking (0.49%) followed by varieties Early Nantes (392.00q/ha) and Arka Suraj (362.33q/ha) at district Amritsar.

**Key Words:** Carrot, Colour, Forking, Root, Variety, Yield.

### INTRODUCTION

Carrot (*Daucus carota* L.) is an important root vegetable crop which is taken raw as well as in cooked form. Main states where carrots are grown in India are Uttar Pradesh, Karnataka, Assam, Punjab, Haryana and Andhra Pradesh. The varietal selection for sowing at optimum time is the important factor for successful carrot growth and production (Latha *et al*, 2014). The area under root crops in Punjab is about 28.07 thousand ha with production of 699.61 thousand tones. (Anonymous, 2023). The yield and growth of carrots varieties are affected by cultivar performance and change in climatic conditions of the area, and accordingly suitable cultivar and their sowing time are most important criteria which should be given into consideration by the varieties, that influence the growth of vegetative traits, its yield, quality and chemical compositions of carrot crop (Ladumor *et al*, 2020). The selection of right cultivars for sowing at right time is the important factor for successful production of carrot (Latha *et al*, 2014).

The climatic conditions in the several crops, its growing seasons and locations may affect the adaptability and stability of those

cultivars. The selection of carrot varieties which is heat tolerant and resistance to diseases and insect pests has resulted in an increase in crop production area in regions (Resende *et al*, 2016). Carrots are grown both in Tarn Taran and Amritsar district of Punjab. At Tarn Taran, it is grown in various places like Chabhal, Patti, Tarn Taran and Khadoor Sahib blocks, whereas at Amritsar it is grown in Attari block. Most of the farmers in these places use local seed or self made seed of previous crop grown in area as local germplasm.

The objectives of this study include evaluation of different varieties of carrot showing good response in terms of yield and its associated characters at districts Tarn Taran and Amritsar of Punjab.

### MATERIALS AND METHODS

The present study was conducted with two different experiments in which three different varieties of carrot were evaluated at four different locations of district Tarn Taran during 2020-2021 and Krishi Vigyan Kendra Amritsar during 2021-2022. The Tarn Taran district is located in semi arid region of Punjab located at 30.9°N 75.85°E with a mean height of 244 m (798 ft). The first experiment was conducted at Tarn Taran. Three varieties of carrot were PCP-2, PCY-2 and Punjab black beauty were evaluated during *Rabi* season of

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2020-21 at four different locations of Tarn Taran.

The Amritsar district is located in sub humid region of Punjab at 32.02°N and 75.24°E with a mean height of 241 m (791 ft). The Amritsar, city is located in northern Punjab state of India at north western side. The second experiment was conducted at Amritsar. Three varieties PCO-4, Arka Suraj and Early Nantes were evaluated at Krishi Vigyan Kendra Amritsar during 2021-2022. The carrot crop requires seed rate of 10 to 12.5 kg for one hectare of area. The seeds were sown at distance of 45 cm between row to row and 7.5 cm between plants to plants. The crop spacing is regulated by thinning at the proper time of main leaf formation. Thinning of carrot has been done for production of superior quality roots. About 37.5 t of farmyard manure 137.5 kg of urea, 187.5 kg of single superphosphate and 125 kg muriate of potash were applied per hectare. All the fertilizers were applied at sowing time. Carrot grows slowly in the beginning and cannot compete with weeds. The unwanted weeds were controlled by 2-3 hoeing. The type of soil of the experimental field was almost loam sand at all the locations and has well irrigated facilities. The data of ten randomly selected plants about various observations were recorded for different characters like plant height, days to maturity, root yield, number of leaves on the per plant basis, core thickness, root weight, root length, root diameter, forking and root color. Since the two experiments were conducted during different years, the data recorded on various observations for each treatment were analysis as per "Analysis of variance" as recommended by Panse and Sukhatme (1984) using randomized block design with two factors and one factor for first experiment and second experiment, respectfully.

### RESULTS AND DISCUSSION

The result of first experiment at four different locations of Tarn Taran is presented in Table 1. The plant height of different carrot varieties ranges from 63.71 to 97.86 cm. The maximum plant height was recorded by variety Punjab Black Beauty *i.e.*, 79.12cm, 75.49cm and 74.48cm in locations 1,2 and 3 while variety PCY-2 recoded maximum plant height 97.86 cm in location 4. The variation in plant height of varieties

may be due to genotypic as well as phenotypic structure of cultivars in carrot and radish as reported by Latha *et al* (2014) and Malek and Mohammed (2011).

The days to maturity ranged from 90.99 to 97.87 d. A maximum day to maturity was recorded by variety PCY-2 which was 97.87, 97.71, 97.67 and 98.45 d, respectively in all the four locations. The number of leaves ranged from 7.45 to 8.81. Maximum numbers of leaves were recorded by variety Punjab Black Beauty which was 8.41 and 8.57 in location 1 and 4, while variety PCY-2 which was 8.60 in location 2 and variety PCY-2 showed 8.81 leaves in location 3, respectively. The difference of number of leaves per plant as affected by the time of sowing was due to the variation in the climatic conditions during growth period (Kabir *et al*, 2013) and also the sowing of early carrot which imparts maximum photosynthesis with longer growth period as compared to the crop sown late (Lavanya *et al*, 2014).

The weight of roots of different varieties ranged from 1008.43g to 1144.20g. The variety PCP-2 recorded maximum fruit weight of 1144.20g, 1139.40g, 1139.60g and 1143.06g at all the four locations. The root length varied from 22.40 to 26.54 cm. The maximum root length was recorded by variety PCP-2 which were 26.54 cm, 26.00cm, 25.91 cm and 25.37cm at all the four locations.

The diameter of roots varied from 3.03 cm to 3.54 cm. The maximum root diameter was recorded by variety Punjab Black Beauty which was 3.38 cm in location 1 while variety PCY-2 showed 3.54cm, 3.37cm and 3.54 cm of root diameter in location 2, 3 and 4 respectively. The present results were supported by Kabir *et al* (2013), Kandil *et al* (2013) and Ali *et al* (2016).

The yield of different varieties of carrot roots were 471.23q/ha to 526.72 q/ha. The maximum root yield was recorded by variety PCP-2 which were 526.723 q/ha, 521.23q/ha, 511.31q/ha and 510.89q/ha in all the four locations, respectively. The minimum root yield was recorded by variety Punjab Black Beauty which were 473.24q/ha, 471.23q/ha, 475.10q/ha and

472.82q/ha, respectively in all the locations. Such results were obtained on account of favorable conditions available during the growing period and also early sowing possibly attributed to maximum photosynthesis with longer growth period than the later plantings (Ladumor *et al*, 2020). Present results were in conformity with findings of Dahiya *et al* (2007), Latha *et al* (2014) in carrot and Kumar (2022) in French beans and Cluster beans.

The forking in carrot is considered as undesirable character and it ranged between 0.60 to 2.63. The minimum forking was recorded by variety PCP-2 which were 0.88, 0.65, 0.60 and 0.63, respectively in all locations. The root colour of variety PCP-2 was Purple with orange flesh, PCY-2 it was yellow and for variety Punjab Black beauty it was purple.

The variety PCP-2 yielded best in all the location of district Tarn Taran followed by variety PCY-2 and Punjab Black Beauty. These varieties also showed less forking and doubling which is considered as undesirable root character in carrot. This difference due to varieties was associated with vigorous growth, development and sound genetic makeup of the variety (Latha *et al*, 2014). Such variability in root yield per hectare of carrot is also in conformity with the earlier findings reported by Pervez *et al* (2003) Ladumor *et al* (2020) in carrot. The yield in all the varieties is due to good plant stand attributed the favourable climatic conditions during growth and development of roots (Lavanya *et al*, 2014). The results showing similar findings was also reported by Dahiya *et al* (2007), Latha *et al* (2014) and Ladumor *et al* (2020) in various varieties of carrot. Al-Sayed *et al* (2012) investigated about harvest dates effect on sugar beet for the root yield and quality of various sugar beet varieties. Pervez *et al* (2003) studied various radish varieties which were grown during the years 2001 and 2002 to compare their yield potential and to find out high yielding better cultivar.

The data (Table 2) represented interaction effects of locations and variety showing mean

values. In this table the grouping were done as represented by group A, group B, group C, group CD, group D, group E, group F, group fg and group g. The interactions with same letters were not significantly different from each other. Thus, the variety PCP-2 at location 3, 4, and 2 were grouped in CD was not differing significantly, while others differ significantly.

The results of second experiment conducted at Amritsar is presented in Table 3 which indicated that maximum plant height was obtained by variety Early Nantes 64.85cm while minimum of variety PCO-4 62.24cm. The minimum days to maturity was obtained by variety PCO-4 90.95 days and maximum days 94.66 days for Early Nantes. The number of leaves was maximum for variety Early Nantes 8.36 while minimum for variety Arka Suraj 7.92. The root weight was minimum for variety Arka Suraj 1010.93 g while maximum for variety PCO-4 1149.46g. The root length was minimum for variety Arka Suraj 26.23 cm while maximum for variety PCO-4 28.03cm. The root diameter was minimum for variety Early Nantes 3.47 cm while maximum for variety PCO-4 3.70cm.

The root yield of different varieties ranges from 362.33 to 441.66q/ha. The maximum root yield was obtained in variety PCO-4 having average yield of 441.66 q/ha. These varieties also showed less forking (0.49%) which is considered as undesirable root character in carrot. This difference due to varieties is associated to healthy growth and potential genetic structure of the variety.

## CONCLUSION

It was concluded that the variety PCP-2 was more favorable variety at different locations of district of Tarn Taran. This variety showed purple colour with orange flesh and yielded best. The variety PCO-4 showed highest yield having orange colour in district Amritsar. In both of districts most of the desi varieties were grown by farmers and these varieties showed colour variation, high yield and less forking as compared to other varieties.

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**Table1. Effect of different varieties under different locations for yield and its and its associated characters of carrot in district Tarn Taran.**

| Varieties           | Plant Height (cm) | Date of Maturity | Number of Leaves | Root Weight (g) | Root Length (cm) | Root Diameter (cm) | Root Yield (q/ha) | Core Thickness (cm) | Forking (%) |
|---------------------|-------------------|------------------|------------------|-----------------|------------------|--------------------|-------------------|---------------------|-------------|
| <b>Location 1</b>   |                   |                  |                  |                 |                  |                    |                   |                     |             |
| Punjab black beauty | 79.12             | 90.47            | 8.41             | 1079.56         | 24.60            | 3.38               | 473.24            | 0.98                | 2.53        |
| PCP-2               | 69.12             | 94.20            | 7.70             | 1144.20         | 26.54            | 3.11               | 526.72            | 0.84                | 0.88        |
| PCY-2               | 67.62             | 97.87            | 8.24             | 1019.33         | 23.60            | 3.31               | 512.56            | 0.93                | 1.16        |
| <b>Location 2</b>   |                   |                  |                  |                 |                  |                    |                   |                     |             |
| Punjab black beauty | 75.49             | 91.37            | 8.49             | 1074.83         | 24.68            | 3.31               | 471.23            | 0.93                | 2.63        |
| PCP-2               | 68.66             | 91.49            | 8.02             | 1139.40         | 26.00            | 3.32               | 521.23            | 0.75                | 0.65        |
| PCY-2               | 67.33             | 97.71            | 8.60             | 1017.8          | 23.36            | 3.54               | 509.98            | 0.85                | 1.28        |
| <b>Location 3</b>   |                   |                  |                  |                 |                  |                    |                   |                     |             |
| Punjab black beauty | 74.48             | 91.25            | 8.54             | 1067.30         | 23.64            | 3.30               | 475.10            | 0.95                | 2.48        |
| PCP-2               | 66.22             | 92.39            | 7.45             | 1139.60         | 25.91            | 3.36               | 511.31            | 0.84                | 0.60        |
| PCY-2               | 63.71             | 97.67            | 8.81             | 1008.43         | 22.40            | 3.37               | 508.87            | 0.85                | 1.15        |
| <b>Location 4</b>   |                   |                  |                  |                 |                  |                    |                   |                     |             |
| Punjab black beauty | 90.47             | 90.99            | 8.57             | 1074.50         | 25.04            | 3.03               | 472.82            | 0.98                | 2.50        |
| PCP-2               | 70.20             | 92.58            | 7.87             | 1143.06         | 25.37            | 3.53               | 510.89            | 0.85                | 0.63        |
| PCY-2               | 97.86             | 98.45            | 8.42             | 1013.30         | 23.71            | 3.54               | 502.20            | 0.85                | 1.41        |
| SE(d)               | 0.44              | 0.61             | 0.26             | 0.63            | 0.35             | 0.22               | 1.60              | 0.02                | 0.12        |
| SE(m)               | 0.31              | 0.43             | 0.18             | 0.44            | 0.25             | 0.16               | 1.13              | 0.01                | 0.09        |
| CV                  | 0.73              | 1.37             | 3.89             | 0.07            | 3.57             | 8.30               | 3.32              | 3.12                | 10.48       |

**Table 2. Interaction effects of treatments (Location x Varieties) under different locations in district Tarn Taran.**

| Interactions      | Mean   | Groups |
|-------------------|--------|--------|
| LOC1 PCP -2       | 526.72 | A      |
| LOC2 PCP -2       | 521.23 | B      |
| LOC1 PCY -2       | 512.56 | C      |
| LOC3 PCP -2       | 511.31 | CD     |
| LOC4 PCP -2       | 510.89 | CD     |
| LOC2 PCY -2       | 509.98 | CD     |
| LOC3 PCY -2       | 508.87 | D      |
| LOC4 PCY -2       | 502.20 | E      |
| LOC3 BLACK BEAUTY | 475.10 | F      |
| Loc1 black beauty | 473.24 | fg     |
| Loc4 black beauty | 472.82 | fg     |
| Loc2 black beauty | 471.23 | g      |

\* Location x Varieties with same letters are not significantly different

**Table 3. Effect of different varieties on yield and its and its associated characters of carrot in district Amritsar.**

| Varieties    | Plant Height (cm) | Days to Maturity | Number of Leaves | Root Weight (10 roots) | Root Length (cm) | Root Diameter (cm) | Root Yield (q/ha) | Core Thickness (cm) | Forking (%) |
|--------------|-------------------|------------------|------------------|------------------------|------------------|--------------------|-------------------|---------------------|-------------|
| Arka Suraj   | 62.39             | 92.90            | 7.92             | 1010.93                | 26.23            | 3.60               | 362.33            | 0.87                | 1.16        |
| Early Nantes | 64.85             | 94.66            | 8.36             | 1080.33                | 29.95            | 3.47               | 392.00            | 0.94                | 1.47        |
| PCO-4        | 62.24             | 90.95            | 8.03             | 1149.46                | 28.03            | 3.70               | 441.66            | 0.88                | 0.49        |
| SE(d)        | 0.85              | 0.53             | 21.67            | 1.09                   | 0.29             | 0.34               | 0.66              | 0.02                | 0.01        |
| SE(m)        | 0.60              | 0.37             | 15.32            | 0.77                   | 0.20             | 0.24               | 0.47              | 0.02                | 0.00        |
| CV           | 1.66              | 0.70             | 158.24           | 0.12                   | 1.28             | 11.67              | 0.20              | 3.94                | 1.23        |

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