

## Original Research Article

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## Varietal Evaluation of Asiatic Carrot for Yield, Yield Contributing Characters and Economics

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### ABSTRACT

Carrot (*Daucus carota* L.) is cool season crop and grown for its edible roots which are nutritionally rich in beta carotene, anthocyanins and minerals. It is used as salad, cooked vegetable and in juices. Per capita per day consumption of vegetables in India in general is quite low which is one of the major reasons behind malnutrition and vitamin-mineral deficiencies. District Mohali of Punjab falls under sub-mountainous zone where many farmers grow vegetables during *rabi* season and fetch remunerative returns. However it was observed that availability of high yielding carrot varieties along with high consumer preference is lacking. Hence, the present investigation was planned and carried out to find the suitable carrot variety for high root yield, better quality and good returns in Mohali district of Punjab. The present investigation was carried out in five farmer's field during *rabi* 2019-20 to evaluate three genotypes of carrot for root yield and contributing characters. From the results of the On Farm Trial conducted, it was revealed that T<sub>1</sub> (Farmer's practice) gave root yield of 400 Q/ha whereas T<sub>2</sub> (Punjab Black Beauty) gave 450 Q/ha and T<sub>3</sub> (PC-161) gave 575 Q/ha. Thus PC-161 yielded maximum *i.e* 575(Q/ha) along with the maximum B: C ratio (3.87:1) as compared to Punjab Black Beauty *i.e* 3.05:1 and farmers practice with B: C ratio of 2.78:1.

#### Keywords

Carrot, Varietal Evaluation, Yield, BC Ratio, Economics

#### Article Info

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### Introduction

Carrot (*Daucus carota* L.) is a cool season crop grown all over the globe as the edible part of the crop is characterized by its high beta carotene content, a precursor of vitamin A and act as an excellent source of iron, calcium, phosphorus, vitamin B, sugar and folic acid (Rahman *et al.* 2018). Carrot cultivars are broadly classified in two groups

*viz.* Asiatic or Oriental types and European or Temperate types. In India, Carrot cultivars which are grown in Punjab, U.P, Andhra Pradesh, Karnataka, Assam and Haryana belongs to Asiatic group (Ladumor *et al.* 2020). The Asiatic carrots are generally red coloured because of anthocyanin pigment. The consumption of vegetables per capita per day in India is 135 g against the requirement of 300 g per capita per day. Carrot requires

comparatively longer growing season than other root crops. Area under vegetable cultivation and production is quite less in Punjab as compared to other crops. Many farmers of S.A.S. Nagar (Mohali) district of Punjab grow vegetable crops during *rabi* season and fetch good prices. However, carrot cultivation is now gaining popularity among farmers in Punjab. The reason for low productivity of carrot is lack of suitable varieties and their adoption by the farmers. It indicates the necessity to raise the production of vegetables which can be achieved by bringing more area under vegetable cultivation and increasing the productivity as well. Crop diversification is also the need of the hour and it can be achieved through promotion of vegetable cultivation. Carrot is comparatively easy to grow crop and due to its high nutritional value its demand is quite high in the market. But farmers of the district are not much aware about the suitable carrot varieties. There are several factors like variety, time of sowing, nutrition management and irrigation which play a major role in yield and quality production. Among these factors variety plays a predominant role in quality yield production. No systematic study has been conducted to assess the suitability of carrot cultivation in Mohali district, for which standardization of varieties is of immense utility. Hence evaluation of high yielding carrot varieties with good quality is of great importance to enhance the productivity of the crop. Therefore, the present investigation was carried out to find the better variety of carrot in terms of yield and quality along with its cost of cultivation and benefit cost ratio for Mohali district of Punjab.

## **Materials and Methods**

### **Experimental site, treatments and design**

District Mohali of Punjab falls under sub-mountainous zone (30.69°N latitude, 76.72°E longitude) having an average altitude of 316

m from the sea level. The present investigation was carried out in five farmer's field during 2019-20 to evaluate three genotypes of carrot in farmer's field for root yield and component traits. The area under each trial was one acre. The soil of the experimental site was deep, loose and sandy loam. The trial was conducted in randomized block design (RBD) with three replications. The treatments included: T<sub>1</sub>: Farmers Practice or FP, T<sub>2</sub>: Black Beauty & T<sub>3</sub>: PC-161. The Weather data of the experimental site was given in Table 1 for the growing period of the crop.

The land was brought to a fine tilth by repeated ploughing and harrowing. The clods were broken and debris was removed. The soil was levelled and raised beds were prepared. For cultivation of crop, recommended package of practices were followed. The seeds were sown during the month of September. 5 Kg seed per acre was used. The seeds were sown at a spacing of 45 cm between ridges × 7.5 cm between plants. The plant spacing is maintained by manual thinning at the time of true leaf formation. Before fertilizer application, random soil samples were taken from the experimental site and were analyzed. 15 tonnes of well rotten farmyard manure, 55 kg of urea, 75 kg of single superphosphate and 50 kg of muriate of potash was applied in one acre area. All the fertilizers were applied at the time of sowing. 2-3 hoeings were done for weed control. One weeding followed by earthing up about 4-5 weeks after sowing was done. 3-4 irrigations were given to crop including one immediately after sowing. The crop was harvested when roots developed desirable marketable size and colour.

### **Data collection**

Five plants were selected at random from each plot for recording observations like plant length (cm), root length (cm), leaf length (cm)

and root girth (cm). Days taken for harvest were calculated as days from sowing to first harvest. Based on the net plot yield, root yield per hectare was calculated and expressed in quintal (Q) per hectare. % increase was calculated as: % increase= (Increase/original number) × 100.

**Economic analysis**

The cost of cultivation and gross returns were worked out by using prevailing market prices of inputs during the period of investigation. Labour and power cost for different operations such as ploughing, weeding, irrigation, sowing, bed preparation and harvesting etc. along with inputs such as seed and fertilizers were considered as per market price. Net returns were worked out using formula: Net Returns (Rs/ha) =Gross Returns (Rs/ha)-Cost of cultivation (Rs/ha). Benefit-cost ratio (BCR) was worked out by using the following formula. Benefit: Cost ratio (BCR) = Gross return (Rs/ha)/ Total cost of cultivation (Rs/ha).

**Statistical analysis** was done using standard procedure given by Panse and Sukhatme (1985).

**Results and Discussion**

**Root yield and yield contributing characters**

From the results of the investigation conducted (Table 2), it was revealed that T<sub>1</sub>

gave 400 Q/ha yield whereas T<sub>2</sub> gave 450 Q/ha and T<sub>3</sub> gave 575 Q/ha. The data of the trial revealed that T<sub>3</sub> gave maximum yield of carrot 575(Q/ha) along with the maximum B: C ratio (3.87:1) compared to T<sub>2</sub> *i.e* 3.05:1 and T<sub>1</sub> (farmers practice) with B: C ratio of 2.78:1. The higher yield of PC-161 was primarily attributed due to more plant, root and leaf length. It was observed that % increase over check was found to be maximum for PC-161 *i.e*: 43.75 followed by Punjab Black Beauty *i.e* 12.50. It was noticed that, the genotypes which performed better in a unit area were likely to perform better on large scale as the yield per hectare was calculated by multiplying yield per plot with hectare factor. The yield is the result of interaction of the variety to a given agro climatic condition and various management factors. These results are in conformity with those of Verma & Gupta (2005), Kazerani and Salajegheh (2009), Akter and Islam (2011) and Mishra *et al.* 2018.

The variety selected under farmer’s practice took ninety two days for first harvest whereas Punjab Black Beauty took 96 days and PC-161 took minimum 88 days. Highest plant length was recorded in PC-161 (64 cm) followed by Punjab Black Beauty (60 cm) and Farmer’s practice (56 cm).The results are in close proximity with the findings of Rajan and Markos (2008) and Malek *et al.* 2012 in which he studied the effect of varieties on plant height of carrot. This might be due to genetic phenomenon of these varieties.

**Table.1** Weather Data of the district in growing season of crop

| Month          | Temp (Max) | Temp (Min) | Average Rainfall (mm) |
|----------------|------------|------------|-----------------------|
| September 2019 | 33.8       | 22.9       | 4.23                  |
| October 2019   | 30.9       | 18.7       | 0.0                   |
| November 2019  | 26.2       | 13.5       | 1.3                   |
| December 2019  | 17.4       | 8.4        | 44.9                  |
| January 2020   | 17.9       | 8.0        | 2.10                  |

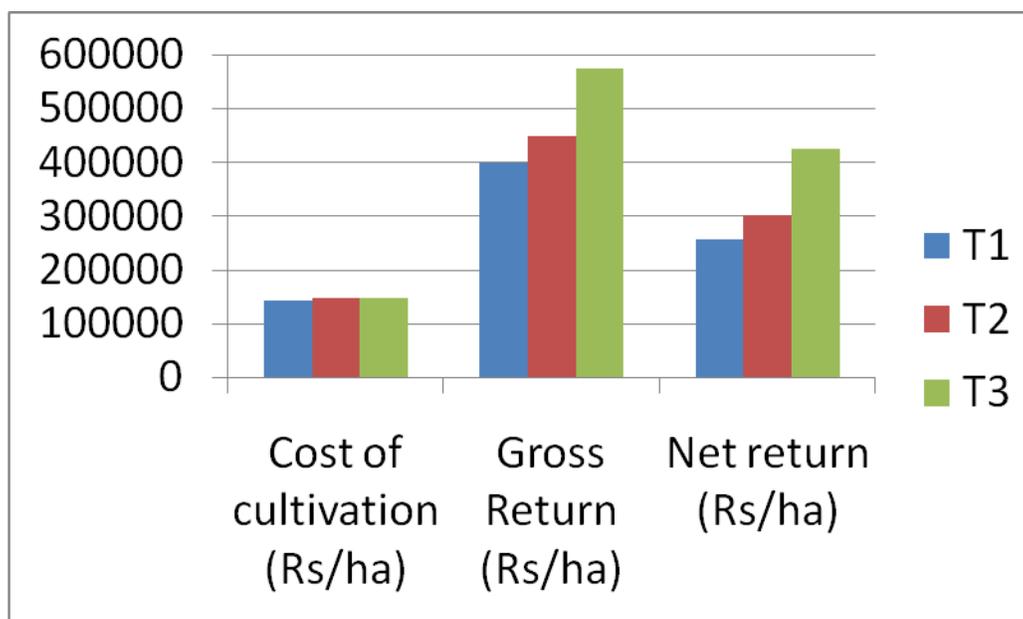
**Table.2** Mean performance of different carrot varieties for root yield and growth traits

| Treatments/<br>Observations<br>recorded | Days<br>taken for<br>harvest | Plant<br>length<br>(cm) | Root<br>length<br>(cm) | Leaf<br>length<br>(cm) | Root<br>girth<br>(cm) | Root<br>yield<br>(q/ha) | % increase<br>over check |
|---|------------------------------|-------------------------|------------------------|------------------------|-----------------------|-------------------------|--------------------------|
| T1                                      | 92                           | 56                      | 24                     | 32                     | 2.92                  | 400                     |                          |
| T2                                      | 96                           | 60                      | 26                     | 34                     | 3.10                  | 450                     | 12.50                    |
| T3                                      | 88                           | 64                      | 28                     | 36                     | 2.82                  | 575                     | 43.75                    |
| S E(m)                                  | 1.33                         | 1.76                    | 2.52                   | 1.00                   | 0.05                  | 8.33                    |                          |
| CD@0.05                                 | 5.38                         | NA                      | NA                     | NA                     | 0.19                  | 33.60                   |                          |

**Table.3** Economic returns from different varieties of Carrot

| Treatments/Observations<br>recorded | Cost of<br>cultivation<br>(Rs/ha) | Gross<br>Return<br>(Rs/ha) | Net return<br>(Rs/ha) | B:C ratio |
|-------------------------------------|-----------------------------------|----------------------------|-----------------------|-----------|
| T1                                  | 1,43,750                          | 4,00,000                   | 2,56,250              | 2.78      |
| T2                                  | 1,47,500                          | 4,50,000                   | 3,02,500              | 3.05      |
| T3                                  | 1,48,750                          | 5,75,000                   | 4,26,250              | 3.87      |

**Fig.1** Economic returns of carrot varieties



The augmentation in plant height is the result of intensive cell division and cell enlargement which in turn is influenced by protein synthesis. Therefore any variation in cell metabolism can consequently affect the plant height (Sharma *et al.* 2016). Maximum root

length was recorded in PC-161 (28 cm) followed by Punjab Black Beauty (26 cm) and Farmer's practice (24 cm). Similar trends were also observed for leaf length which is an important growth character. In PC-161 maximum leaf length of 36 cm was recorded

followed by Punjab Black Beauty (34 cm) and Farmer's practice (32 cm). Root girth is another important trait. Punjab Black Beauty was found to be having maximum root girth of 3.10 cm followed by FP (2.92 cm) and PC-161 (2.82 cm). Such variations among varieties could also be attributed to genetic background of varieties which bears a strong influence on the growth potential of plant. Similar findings were reported by Sharma *et al.* 2016 and Sharma *et al.* 2018. According to the opinion of Karklelien (2008), the desirable carrot from the view point of its demand, should have root length about 18-22 cm and root diameter about 3.6-4.1 cm.

### **Economics**

The economic analysis describes the methods used in analyzing the economic behaviour and the application of the results obtained to solve the economic problems. The input and output prices of commodities prevailed during the year of demonstration were taken for calculating cost of cultivation, net returns and benefit cost ratio. Net profit /ha also depends upon the availability of labour and a suitable market for the disposal of produce. Results of the present investigation (Table 3) revealed that T<sub>1</sub> gave net return of Rs. 2,56,250/ha with B: C ratio of 2.78:1 whereas T<sub>2</sub> gave net return of Rs. 3,02,500/ha with B: C ratio of 3.05:1 and T<sub>3</sub> gave net return of Rs. 4,26,250/- with B: C ratio of 3.87:1. The total cost of production was maximum for PC-161 (Rs. 1, 48,750/-) followed by Punjab Black Beauty (Rs.1, 47,500/-) and Farmer's practice (Rs. 1, 43,750/-). Gross return was found to be maximum for PC-161 Rs. 5,75,000/- followed by Punjab Black Beauty (Rs. 4,50,000/-) and Farmer's practice (Rs. 4,00,000/-). The results are in line with results of Kale 2002, Singh and Bankar 2006, Verma 2007 and Singh *et al.* 2007 who also studied economics of vegetable cultivation. Similar studies were also carried out by Sharma *et al.*

2018 in carrot and Parmar *et al.* 2018 who made an economic evaluation of tomato.

From the results of present investigation it was concluded that adoption of carrot variety PC-161 is most suitable for cultivation in Mohali district of Punjab as it gave highest yield along with highest returns per unit area as compared to the other varieties being grown by the farmers in the district. The overall performance of PC-161 was superior to other varieties and found most suitable for cultivation in the district. Higher yield, long sized roots and earliness are some of the characters which might be responsible for increase in profit of carrot growing farmers. In addition to this market acceptability and consumer preference of this variety is quite satisfactory.

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