J. Hortic. Sci.
Vol. 21(1), 2026

https://doi.org/10.24154/jhs.v21i1.1993

Short Communication

Evaluation of tropical carrot (*Daucus carota* L.) for yield and quality traits

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ABSTRACT

Forty-eight diverse accessions of tropical carrot were evaluated for yield and quality traits in randomized block design with three replications, during 2018-2019. The analysis of variance revealed that sufficient variation existed among the accessions for all the traits studied. Based on the mean performance, Acc-85 recorded highest root weight (196.7 g) and was found promising for yield (13.9 t/ha). The root length was recorded highest in Acc-54 (23.7 cm), whereas, for quality, the accessions Acc-76, Acc-159 and KSP-135 recorded highest TSS (16° Brix). Total carotenoid content was recorded maximum in Acc-96 and Acc-159 (16.9 mg/100 g), respectively. These accessions can be exploited for their promising traits in carrot breeding.

Keywords: Evaluation, quality, traits, tropical carrot, yield

INTRODUCTION

Carrot (*Daucus carota* L.) is an important root vegetable belongs to the family Apiaceace. Carrot is a diploid species (2n=2x=18) grown globally for its rich nutritional content of vitamin A and carotene (Selvakumar et. al., 2019). Besides yield and yield components or other yield contributing agronomic characters may be utilized for breeding for yield improvement (Zdravkovic et. al., 2011). Yield and its component characters indeed are quantitative in nature and are influenced by all three types of gene actions (Dixit, 1998a,b; Saxena, 2008). The scope of exploitation of hybrid vigour will depend on the direction and magnitude of heterosis, biological feasibilities and the type of gene action involved. For any efficient breeding programme, information about traits is required to accelerate the success rate (Shashikumar et al., 2010).

There are lot of challenges such as increasing and stabilizing carrot production and prices in the country due to lack of high yielding and stable varieties, especially in the tropical types. A long history of carrot selection and the use of diverse parental materials in breeding programmes throughout the world have resulted in considerable variation in available cultivars. An understanding of the extent and nature of genetic variation within a crop species is required for efficient breeding effort (Manisha et al., 2022). Hence, there is a need to develop high yielding genotypes suitable for tropical conditions. Better understanding of traits might aid in the maintenance of long-term selection gain in plants (Chowdhury et al., 2002). Hence, the present study was conducted to evaluate tropical carrot accessions for yield and quality traits.

The present study was conducted at ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru, India during *rabi* season of 2018 to 2019. Forty-eighty accessions of carrot collected from IIHR, Bengaluru, were evaluated for yield and quality traits. Manures and fertilizers were applied as per the recommended rate (Vishnu, 2016). Thinning was done after forty days. The experiment was laid out in a randomized block design with three replications and 5 randomly selected plants were used for recording observations *viz*., plant height (cm), number of leaves, leaf length (cm), root length (cm), root diameter (mm), root weight (g), core diameter (mm), root fresh weight (g), root dry weight (g), total carotenoid content (mg/100 g), TSS (°Brix) and yield (t ha^{-1}). The single factor randomized block design analysis of variance (ANOVA) was done through OP stat.

The mean performance of all accessions for yield and quality traits is presented in Table 1. The plant height varied from 65.7 to 100.7 cm, maximum was recorded in Acc-54 (100.7 cm) which was statistically at par with KSP-135 (95.3 cm), Acc-21C (92.3 cm), Acc-164 (92.2), Acc-145 & Acc-85 (92.0 cm), Acc-152B (90.8 cm) and Acc-167B (90.0 cm). The number of leaves were recorded maximum in Acc-54 and Acc-85 (13), while, least recorded in

Table 1 : Mean performance of carrot accessions for yield and quality traits

Accession	Plant height (cm)	No. of leaves	Leaf length (cm)	Root length (cm)	Root diameter (mm)	Core diameter (mm)	Root weight (g)	Root fresh weight (g)	Root dry weight (g)	Total carotenoid content (mg/100 g)	TSS (°Brix)	Yield (t/ha)
Acc-21C	92.3	8.7	78.3	13	3.2	1.9	76.0	70.0	8	6	13.9	11.63
Acc-22A	85.3	7.3	69	15	4.4	2.4	116.7	73.3	10	5.4	11.2	10.43
Acc-29	76.7	8.7	61	17.7	4.4	1.5	126.7	83.3	11.3	12	11.5	11.2
Acc-50	81.7	8.7	69	14.8	3.8	1.6	85.0	86.7	10	10.1	11.5	11.2
Acc-51	88.3	8	66.3	13.7	4.7	2.4	170.0	86.7	10.3	11	12.3	11.5
Acc-52C	86	12.0	68	17	4.2	3.4	120.0	80.0	10.7	11.8	12.5	12.27
Acc-54	100.7	13.0	76.7	23.7	4.9	2.5	90.0	86.7	10.7	10.6	13.2	11.87
Acc-56B	82.3	10.7	66.7	16	4	1.9	90.0	76.7	12.7	9.7	10.3	11.97
Acc-60	79.3	7.7	66.7	13.7	3.6	1.6	60.0	43.3	8	11.7	11.3	10.17
Acc-64	80.8	7.2	51.3	14.5	2.8	1.7	65.0	93.3	12.7	11.2	12.0	10.83
Acc-72	73	8	59.8	12.8	2.8	1.4	98.3	80.0	11.3	12.8	14.2	11.3
Acc-76	80.8	12.0	62.5	17.7	4.1	1.5	111.7	100.0	10.7	13.6	11.1	11.08
Acc-77	89.7	11.3	65	13.7	2.8	1.2	105.0	90.0	12	9.3	11.8	10.93
Acc-77B	85.8	9.5	52.2	14.7	4.1	2.5	102.5	96.7	13.3	9.4	9.3	13.03
Acc-84	83	11.2	72.2	14.8	4.2	2.5	111.0	100.0	10.7	8.7	10	12
Acc-85	92.0	13.0	73.7	16.7	5.5	3.3	196.7	192.0	14.7	16.0	12.6	13.9
Acc-87	65.7	7.5	51.8	13.8	2.6	1.8	90.0	83.3	8.7	10	12.0	10.28
Acc-88	76.4	9.07	61.9	15	4.2	2.3	108.6	76.9	9.93	13.4	13.9	12.5
Acc-91	79.8	12.8	60.7	20.2	3.9	3	130.0	96.7	10.7	12.6	12.3	11.87
Acc-92	72.3	9.5	60	16.3	3.4	2.1	86.7	86.7	10	15.4	11.4	11.62
Acc-96	82.3	9.2	60.3	14	4	2.2	116.7	96.7	10.3	16.9	12.5	13.2
Acc-105	64.7	9.3	53.7	11.7	3.2	1.3	93.3	70.0	8.3	11.1	12.9	11.97
Acc-113B	84.09	9.2	64.2	14.2	3.5	2.1	103.6	84.8	10.1	9	11.4	10.97
Acc-135	70.8	11.0	54.2	10.8	2.3	1.5	78.5	62.4	6	12.9	11.3	10.8
Acc-135B	70.5	10.0	56.3	12.8	3.3	1.8	85	66.7	8	12.7	11.9	10.37
Acc-144	81	11.9	63.7	17.1	3.7	2.6	112	100.0	8.7	11.6	10.7	11.9
Acc-144B	88.7	8.3	76.3	11.3	3.8	2.2	100.0	93.3	13.3	11.6	11.3	10.67
Acc-145	92	6	78.3	18.3	3.8	2.4	106.7	86.7	10	11.5	14.1	11
Acc-146	84.3	5.7	67.3	14.7	4	2.2	110.0	70.0	7.3	9.8	11	11.47
Acc-147	86.3	8	68.3	16	4.8	3.0	180.0	93.3	10.7	10.6	13.0	10.23
KSP181	65.7	7.5	51.8	13.8	2.6	1.8	70.0	83.3	8.7	10	9.3	10.37
Acc-149	83.7	9	65.7	14.7	5.1	2.9	190.0	86.7	11.3	11.6	11.5	12.53
Acc-152B	90.8	6.2	66.7	14.5	3.8	2.3	118	100.0	6.7	9	12.0	11.48
Acc-152	79.2	6.7	70.3	17.3	4.7	2.8	166.7	100.0	10.7	13.3	12.4	12.4
Acc-154	79.3	5.3	66.7	14.3	3.5	1.9	86.7	53.3	6.7	12.7	13.2	9.15
Acc-156	81.8	7.7	66.3	13.7	4.5	2.6	135.0	90.0	10.7	15.5	11.3	10.13
Acc-159	75	7.7	60.7	13	3.7	2.8	86.7	63.3	8.7	16.9	14.2	10.17
Acc-163B	83.3	10.0	68	15.7	4.5	2.4	123.3	100.0	10	12	10.7	11.3
Acc-164	92.2	6.5	75.2	16	5.1	3.0	170	96.7	10.7	7.8	11.1	13.03
Acc-167B	90.0	8.3	65.2	13.8	4.8	2.6	183.3	96.7	10.7	11.7	12.7	11.05
Acc-261	79.2	6.7	70.3	17.3	4.7	1.6	166.7	100.0	10.7	9.8	11.2	10.17
Acc-278	81.7	9	67.3	16	4.1	1.6	123.3	76.7	9.3	7.1	10.3	10.37
KSP123	75	7.7	60.7	13	4.7	2.8	86.7	63.3	8.7	9.6	11.3	10.13
Bermuda	83	10.7	71	13.7	3.8	2	125	100.0	10	11.6	11.3	11.03
Nevis	89.7	11.3	77	13.7	2.8	2.2	113	90.0	12	12.4	12.0	11.04
KSP 134	88.3	10.7	75.3	13.3	4.1	2.3	123.3	93.3	13.3	0	11	10.7
KSP135	95.3	9.7	79	16.7	4	2	96.7	66.7	9	0	14.2	11.05
Arka Suraj	79.3	7.3	66	13	3	1.4	55.0	46.7	4	11.3	9.9	11.27
CD (0.05)	10.7	3.8	11.3	3.5	1.2	0.9	6.5	8.9	1.4	2.7	2.7	1.97

Acc-154 (5.3). The accession KSP-135 recorded significant highest leaf length (79 cm), which was at par with Acc-21C and Acc-145 (78.3cm), Nevis (77.0cm), Acc-54 (76.7 cm), Acc-144B (76.3 cm), KSP-134 (75.3 cm), Acc-164 (75.2 cm) and Acc-85 (73.7 cm). Root length was found to be maximum in Acc-54 (23.7 cm) which was at par with Acc-91 (20.2 cm), whereas, it was recorded minimum Acc-144B (11.3 cm). Wide range of variability was observed for these traits in different accessions of carrot (Tewatia & Dudi, 1999; Yadav et al., 2009). The root diameter was recorded maximum in Acc-85 (5.5 mm), which was significantly at par with Acc-149 & Acc-164 (5.1 mm), Acc-54 (4.9 mm), Acc-167B (4.8 mm), Acc-51 (4.7 mm) and Acc-163B (4.5 mm). The minimum root diameter was recorded in Acc-87 and KSP 181 (2.6 mm). A significant variation for root diameter has also been reported by Gupta et al. (2006).

The Acc-52C recorded highest core diameter (3.4 mm), at par with Acc-147 and Acc-164 (3 mm), Acc-149 (2.9 mm), Acc-152 (2.8 mm), Acc-167B (2.6 mm) and Acc-54 & Acc-77B (2.5 mm). The Acc-88 had maximum significant root weight (108.6 g) which was at par with Acc-22A & Acc-152 (106.7 g), Acc-156 (105.0 g), Acc-164 (104.7 g) Acc-167B (103.3 g) and Acc-91 (103.0 g). Tewatia & Dudi (1999) and Gupta et al. (2006) also observed wide variation for root weight in carrot genotypes.

The quality traits such as root fresh weight (g), root dry weight (g), total carotenoid content (mg/100 g) and TSS (°Brix) varied in all the accessions studied (Table 1). The Acc-85 recorded maximum root weight (196.7 g), which was statistically at par with Acc-149 (190.0 g), however, Acc-85 recorded minimum root fresh weight (190 g). Further, Acc-85 recorded maximum root dry weight (14.7 g), which was statistically at par with Acc-77B (13.3 g), Acc-144B (13.3 g), KSP-134 (13.3 g), Acc-64 (12.7 g) and Acc-56B (12.7 g). The Acc-159 and Acc-96 recorded highest total carotenoid content (16.9 mg/100 g), which was statistically at par with Acc-85 (16.00 mg/100 g), Acc-156 (15.50 mg/100 g) and Acc-92 (15.4 mg/100 g). The accession KSP 135, Acc-159, Acc-72 recorded highest TSS content (14.20 °Brix), which was statistically at par with Acc-145, Acc-21, Acc-88, Acc-154, Acc-54, Acc-147, Acc-105, Acc-167B, Acc-85, Acc- 96 and Acc-52C, Acc 91 and Acc 51, Acc-152, Nevis, Acc- 64 and Acc-87, Acc-135B, Acc-29 and Acc-149, Acc-92 and Acc-113B and Acc-60, Bermuda, KSP 123, Acc-144B and Acc-156. Yadav et al. (2009) also reported similar variations in dry matter and total soluble solid contents in carrot. The significantly highest yield was recorded in Acc-88 (13.9 t/ha) which was at par Acc-96 (13.2 t/ha) Acc-77B (13.03 t/ha) and Acc-164 (13.03 t/ha), whereas, it was recorded lowest in KSP-134 (10.7 t/ha). Yield was highest in those accessions which recorded highest root weight (Thakur et al., 2012).

CONCLUSION

Tropical carrot accession Acc-85 (196.7 g) showed highest root weight followed by Acc-149 (190.0 g), whereas, highest yield was recorded in Acc-88 (13.9 t/ha). The Acc-76, Acc-159 and KSP-135 recorded highest TSS (16 °Brix), and Acc-96 and Acc-159 (16.9 mg/100 g), respectively recorded maximum total carotenoid content. These accessions can be exploited in of carrot improvement.

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(Received : 26.5.2023; Revised : 21.1.2026; Accepted : 25.1.2026)