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RG Ladumor
P.G. Student, Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India

BM Nandre
Assistant Professor, Department of Horticulture, College of Agriculture, S. D. Agricultural University, Tharad, Gujarat, India

MK Sharma
Assistant Professor, Department of Horticulture, College of Agriculture, S. D. Agricultural University, Tharad, Gujarat, India

VR Wankhade
Assistant Professor, Department of Horticulture, C.P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

PC Joshi
Assosiate Professor, Department of Horticulture, C.P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

Corresponding Author:
BM Nandre
Assistant Professor, Department of Horticulture, College of Agriculture, S. D. Agricultural University, Tharad, Gujarat, India

Effect of different date of sowing on growth, yield and quality of carrot (*Daucus carota* L.)

RG Ladumor, BM Nandre, MK Sharma, VR Wankhade and PC Joshi

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Abstract
The present investigation, effect of different date of sowing on growth, yield and quality of carrot (*Daucus carota* L.) was carried out at Horticulture farm, College of Horticulture, S. D. Agricultural University, Jagudan Gujarat during *rabi* season 2017-18, comprising three dates of sowing 1st October (d_1), 15th October (d_2) and 1st November (d_3) was statistically analyzed with randomized block design for growth, yield and quality parameters of carrot and are summarized below. The date of sowing 15th October (d_2) significantly increased plant height (16.49, 40.28 and 68.64 cm) and number of leaves (3.74, 8.82 and 10.60) at 30, 60 DAS and at harvesting time respectively, weight of root (72.10 g), root yield per plot (6.44 kg), root yield per ha (20.44 t), productivity per day (247.70 kg), root length (22.31 cm), collar diameter (37.62 mm), volume of root (75.32 cc), total soluble solid (8.00°B), reducing, non-reducing and total sugar (4.40, 3.50 and 7.90%, respectively). All parameters showed a decreasing trend as sowing date was delayed.

Keywords: Carrot, date of sowing, growth, quality and yield

Introduction
Carrot a member of family Umbeliferae (Apiaceae) is a popular cool season root vegetable in India. Punjab, U.P, Andhra Pradesh, Karnataka, Assam and Haryana are the important states in carrot production. Based on the climatic requirements; carrot cultivars are broadly classified into two groups' *viz.*, Asiatic or Oriental types and European or Temperate types. Most of the carrot cultivars grown in India belongs Asiatic types are annual and produce seed freely in plains. The world-wide consumption of carrot has been increased over the years due to good source of vitamin A along with the fair amount vitamin B and C. The area under this vegetable crop is increasing rapidly but the production per unit area is very poor. One of the major factors responsible for low yield of this crop is its climatic limitations. Temperature higher than 28 ^{0}C was reported to reduce top growth and also the root become strong flavored. Changes in the environmental condition including day and night temperature associated with sowing date affect carrot yield and quality. It is difficult to raise good quality carrot roots because of excessive forking and slitting, if crop grown too early in season. Growth and yield pattern of plants are affected by change in climatic conditions so time of sowing is one of the most important factors should be taken into consideration by the cultivators, which influence the vegetative growth, yield and quality of carrot.

Materials and Methods
The experiment entitled, effect of different date of sowing on growth, yield and quality of carrot (*Daucus carota* L.) was undertaken during *rabi* season 2017-18 at Horticulture farm, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat, comprising three dates of sowing 1st October (d_1), 15th October (d_2) and 1st November (d_3). To raise the crop recommended package of practices was followed. The effect of different date of sowing treatments was studied and observations were recorded for growth, yield and quality parameters *viz*., plant height (at 30, 60 DAS and at harvesting time), number of leaves (30, 60 DAS and at harvesting time), weight of root, root yield per plot, root yield per hectare, productivity per day, root length, collar diameter, volume of root, total soluble solid and reducing, non-reducing and total sugar. The experiment was laid out in RBD design with three replications and mean data were subjected to statistical analysis following analysis of technique (Panse and Sukhatme, 1985) [7].

Results and Discussion

Growth parameters

Plant height (cm) at 30, 60 DAS and at harvesting time

Plant height was significantly influenced by varying sowing times at 30, 60 DAS and harvesting time (Table 1). The significantly maximum plant height at 30, 60 DAS and at harvesting time (16.49, 40.28 and 68.64 cm, respectively) was found in treatment d_2 (15th October) which was statistically at par with treatment d_1 (1st October) at 60 DAS (36.69 cm) only. Such results are obtained on account of favourable conditions available during the growing period and also early sowing possibly attributed to maximum photosynthesis with longer growth period than the later plantings which also faced severe winter months after planting causing cessation of growth, Lavanya *et al*. (2017) [5]. Also this might be due to favourable conditions prevailing during the growing period when plant grows earlier, Latha *et al.* (2012) [4]. Similar results were reported by Alam *et al.* (2010) [1] in radish.

Table 1: Effect of different date of sowing on growth parameters

Treatment	Plant height (cm)			Number of leaves		
	At 30 DAS	At 60 DAS	At harvesting time	At 30 DAS	At 60 DAs	At harvesting time
Date of sowing						
d_1 : 1st October	14.53	36.69	58.82	3.23	8.37	10.07
d_2 : 15th October	16.49	40.28	68.64	3.74	8.82	10.60
d_3 : 1st November	14.19	34.85	51.88	3.15	7.66	9.17
S. Em. ±	0.47	1.05	1.92	0.10	0.22	0.27
C. D. at 5%	1.83	4.14	7.55	0.39	0.85	1.04
C. V. %	10.72	9.75	11.18	10.08	9.08	9.22

Number of leaves at 30, 60 DAS and harvesting time

Significantly maximum number of leaves at 30, 60 DAS and harvesting time (3.74, 8.82 and 10.60, respectively) (Table 1) was recorded with treatment d_2 (15th October), which was statistically at par with 60 DAS and harvesting time (8.37 and 10.07) with treatment d_1 (1st October). The increase in number of leaves in October planting may be due to favourable growing conditions which might have resulted in luxuriant growth of these vegetative characters, Patel *et al*. (2015) [8]. The number of leaves per plant increased might be due to optimum temperatures that prevailed during vegetative growth period which resulted in greater photosynthetic activity and higher mobilization of assimilate. Higher production of leaves per plant was observed at ambient temperatures, Priyanka *et al.* (2018) [9]. Similar results are in conformity with findings of Patel *et al*. (2015) [8] in sugar beet and Lavanya *et al*. (2017) [5] in radish.

Yield parameters

Weight f root

The data presented in Table 2 revealed that weight of root was significantly influenced by varying sowing times and d_2 (15th October) produced maximum root weight (72.10 g), being at par with d_1 (1st October) (68.96 g). A gradual decrease root weight was noted with delayed sowing time, which proved a negative correlation and short growing period with limited vegetative growth of late sown crop. Carrot is a photo and thermo sensitive crop. Growth of root was developed under a sustainable environmental condition. Later sowing could not provide their suitable environmental conditions to grow up properly. So earlier sowing was best for higher fresh weight of root, Kabir *et al.* (2013) [3]. The higher root weight per plant were due to more number of leaves and leaf area for photosynthesis and efficient utilization of these photosynthates, might have enhanced the weight of root, Patel *et al.* (2015) [8]. The result corroborate with finding of Salah *et al*. (2005) [11] and Patel *et al.* (2015) [8] in sugar beet and Alam *et al.* (2010) [1] in radish.

Table 2: Effect of different date of sowing on yield parameters

Treatment	Weight of root (g)	Root yield per plot (kg)	Root yield per hectare (t)	Productivity per day (kg)
Date of sowing				
d_1 : 1st October	68.96	6.00	19.05	214.30
d_2 : 15th October	72.10	6.44	20.44	247.70
d_3 : 1st November	60.72	5.03	15.98	180.31
S. Em. ±	1.72	0.23	0.72	9.35
C. D. at 5%	6.74	0.90	2.84	36.69
C. V. %	8.85	13.59	13.57	15.12

Yield per plot (kg)

Data in Table 2 clearly showed that influences of varying sowing times on root yield per plot were found significant. Significantly maximum root yield per plot (6.44 kg) was recorded treatment d_2 (15thOctober), which was statistically at par with (6.00 kg) with treatment d_1 (1st October).

The variation in root yield per plot at varying sowing times may be due to more favourable environmental condition for development in earlier sowing and also vigorous vegetative growth resulted by more photosynthates and favourable weather conditions might have helped to increase yield. The increase in root yield with October sowing might be attributed to the good weather conditions that promoted photosynthesis and improved growth of beet root, hence increase root yield, Patel *et al.* (2015) [8]. The increase in total root yield due to its positive correlation with root diameter and root weight this type of differences was also reported by Alam *et al.* (2010) [1] in sugar beet and Ebrahimi *et al.* (2013) [2] in radish. There is a corresponding reduction in the yield of roots with the delay in the sowing of carrots after November. This might be due to very low temperatures during later sowings, which turn energy from vegetative phase to reproductive phase, Latha *et al.* (2012) [4] in carrot.

Yield per hectare

Data clearly showed (Table 2) that varying sowing times with respect to root yield per hectare were found significant variation. The significantly maximum root yield per hectare (20.44 t) was obtained with treatment d_2 (15th October), and found statistically at par with treatment d_1 (1st October) (19.05 t) while, minimum root yield per hectare (15.98 t) was obtained with treatment d_3 (1st November).

Productivity per day

Data presented in Table 2 clearly showed that influences of varying sowing times with respect to productivity per day were found significant. Significantly maximum productivity per day (247.70 kg) was recorded with treatment d_2 (15th October), which was at par with treatment d_1 (1st October) (214.30 kg). While, minimum productivity per day (180.31 kg) was obtained with treatment d_3 (1st November).

Quality parameters

Root length

Significantly highest root length (22.31 cm) was observed in treatment d_2 (15th October), which was statistically at par (20.02 cm) with treatment d_1 (1st October). This might be due to gradual decrease in temperature during later part of season in November, which influenced early transition of the plants from vegetative to reproductive phase. Also, up take of more nutrients and rate of photosynthesis was higher than other plants so that vegetative growth was increased and the carrot roots were rich in carbohydrate, Kabir *et al.* (2013) [3]. Such results are obtained on account of favourable conditions available during the growing period and also early sowing possibly attributed to maximum photosynthesis with longer growth period than the later plantings which also faced severe winter months after planting causing cessation of growth, Latha *et al.* (2012) [4] in carrot. Present results are in conformity with Latha *et al.* (2012) [4] and Kabir *et al.* (2013) [3] in carrot.

Table 3: Effect of different date of sowing on quality parameters

Treatment	Root length (cm)	Collar diameter (mm)	Volume of root (cc)	TSS (°B)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
Date of sowing							
d_1 : 1st October	20.02	35.87	70.73	7.66	3.94	3.09	7.03
d_2 : 15th October	22.31	37.62	75.32	8.00	4.40	3.50	7.90
d_3 : 1st November	18.60	31.40	55.69	7.19	4.23	3.22	7.45
S. Em. ±	0.67	0.88	1.49	0.10	0.04	0.04	0.07
C. D. at 5%	2.62	3.45	5.85	0.38	0.16	0.16	0.27
C. V. %	11.39	8.71	7.67	4.34	3.27	4.32	3.15

Collar diameter

Significantly maximum collar diameter of root (37.62 mm) was observed in treatment d_2 (15th October) and found statistically at par (35.87 mm) with treatment d_1 (1st October). The rapid increase in collar diameter of root was because of more vigorous growth in earlier sowing, which supplies more photosynthates from leaves to roots, Patel *et al.* (2015) [8]. A similar result of more root diameter was reported by Alam *et al.* (2010) [1] in radish and Patel *et al.* (2015) [8] in sugar beet.

Volume of root

Maximum volume of root (75.32 cc) was recorded with treatment d_2 (15th October) which was statistically at par (70.73 cc) with treatment d_1 (1st October). Early sowing resulted in higher size of root because of congenial growing condition and leads to maximum volume of root these results are conformity with the finding of Mirecki, (2005) [6] in brussels sprout.

Total soluble solid

Data indicated that varying sowing times had significant effect on TSS content (8.00°B) and was measured highest with d_2 (15th October), which was statistically at par (7.66 °B) with treatment d_1 (1st October), while, lowest TSS (7.19 °B) was found in d_3 (1st November). The higher TSS in early sowing might be due to low temperature with short day length during root growth and development. The results are corroborated with the finding Priyanka *et al.* (2018) [9] in radish.

Reducing, non-reducing and total sugar

Significantly maximum (4.40, 3.50 and 7.89 %) and minimum (3.94, 3.09 and 7.02 %) reducing, non-reducing and total sugar content was observed in treatment d_2 (15th October) and d_3 (1st November), respectively. Early sowing significantly increased quality parameters such as reducing, non-reducing and total sugars compared to late date of sowing affected on quality parameter, these findings are in close accordance with the findings of Refay (2010) [10] in sugar beet.

Conclusion

It is concluded form the present investigation, that carrot should be sown on 15th October for higher growth, yield and quality under North Gujarat condition.

References

1. Alam M, Farooque AM, Nuruzzaman M, Jamal Uddin AFM. Effect of sowing time on growth and yield of three radish (*Raphanus sativus* L.) varieties. Bangladesh Research Publication Journal. 2010; 3(3):998-1006.
2. Ebrahimi M, Hassandokht MR, Payvast GH. Effect of sowing dates on some quantitative and qualitative traits of three landraces of black radish (*Raphanus sativus* var. niger). Adv. Environ. Bio. 2013; 7(1):136-140.
3. Kabir A, Ali A, Waliullah MH, Rahman MM, Rashid A. Effect of spacing and sowing time on growth and yield of carrot (*Daucus carota* L.). International Journal of Sustainable Agriculture. 2013; 5(1):29-36.
4. Latha M, Reddy SS, Vani S, Reddy R. Studies on the Effect of Sowing dates on Growth and Root Yield of Certain Carrot (*Daucus carota* L.) Cultivars. Agriculture: Towards a New Paradigm of Sustainability, 2012, 116-119p.
5. Lavanya AVN, Vani VS, Reddy PSS, Shashikala P. Effect of sowing dates and spacing on growth and root yield of radish cv. Pusa Chetki. Int. J Pure App. Bio Sci. 2017; 5(4):1774-1779.

6. Mirecki N. The influence of planting date on growth rate of brussels sprout (*Brassica oleracea var. gemmifera*) in Agro-Ecological Conditions of the Zeta Plain. Acta Agriculture Serbica. 2005; 20(X):47-57.
7. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers 4th ed., ICAR, New Delhi, 1985.
8. Patel HT, Sharma MK, Varma LR. Effect of planting date and spacing on growth, yield and quality of beet root (*Beta vulgaris* L.) cultivars under north Gujarat climatic condition. Int. J Agril. Sci. Res. 2015; 5(4):119-126.
9. Priyanka M, Swarajya Lakshmi K, Reddy SSP, Reddy DS, Bala Krishna M. Interaction effect of varieties and sowing dates on growth and quality of radish in Southern agro climatic zone of Andhra Pradesh. Int. J Pure App. Bio Sci. 2018; 6(5):227-231.
10. Refay YA. Root yield and quality traits of three sugar beet (*Beta vulgaris* L.) varieties in relation to sowing date and stand densities. World Journal Agricultural Science. 2010; 6(5):589-594.
11. Salah A, Khalil ME, El-Sayed Gamal S, Authman Adel M. Effect of sowing date, nitrogen fertilizer and row space on yield and quality of sugar beet crop. Annals of Agriculture Science, Moshtohor. 2005; 43(1):11-24.