

Studies on the Effect of Sowing dates on Growth and Root Yield of Certain Carrot (*Daucus carota* Linn.) Cultivars

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ABSTRACT

An experiment was conducted at College of Horticulture, Venkataramannagudem, West Godavari (Dist.) during the period from November 2010 to March 2011 to study the effect of various sowing dates on growth and root yield of certain carrot cultivars. The study was carried out with four different sowing dates viz., November 10th, November 25th, December 10th and December 25th and with three cultivars namely Pusa Kesar, Pusa Rudhira and Kuroda Improved (Local check). All the growth parameters like plant height, number of primary and secondary branches, root shoot ratio, root length, root diameter and core thickness were found maximum with 10th November sowing. All parameters showed a decreasing trend as sowing date was delayed. In the present experiment, November 10th sowing gave the highest yields of (172.82 q ha⁻¹) compared to the lowest yields of (67.98 q ha⁻¹) by 25th December sowing. The varieties also showed significant differences among themselves in terms of both growth and yield parameters. Both growth parameters and the root yield was found to be maximum with Kuroda Improved (Local variety) irrespective of dates of sowing. Highest yield (149.16 q ha⁻¹) was obtained with the Kuroda Improved (Local variety), followed by Pusa Rudhira (121.39 q ha⁻¹), and the lowest (111.49 q ha⁻¹) was with Pusa Kesar. Interaction between the two factors did not show any effect on the growth parameters like number of primary and secondary branches. Except number of primary and secondary branches, all the growth parameters like plant height, root shoot ratio, root length, root diameter, core thickness and yield were better with early sowing on 10th November with Kuroda Improved (Local variety).

Keywords: Carrot (*Daucus carota* Linn.); sowing date; root yield; Optimum time

1. INTRODUCTION

Amongst the root vegetables, carrot (*Daucus carota* Linn.) is the popular cool season vegetable. 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. Changes in environmental condition including the day and night temperatures associated with planting date affect carrot yield and quality.

Many agronomic practices need to be adjusted to maximize yield and quality of carrot roots. Among them, time of sowing is one of the most important factors, which influences the vegetative growth, quality of carrot and ultimately the yield. Carrot is very sensitive to temperature and photoperiod. That is the reason why the root yield has been greatly affected by different sowing dates.

Yield of any crop can be increased up to substantial quantity by using improved varieties. The varieties fail to give best performance if there is slight deviation in their sowing time. Proper sowing time again depends on the varieties and prevailing environment. Selection of right varieties for sowing at optimum time is the key factor for successful carrot production. There is a need to find out the best time of sowing and suitable variety for high yields under late sown conditions, if sowing is delayed due to reasons beyond control. Keeping this in view, the present investigation was undertaken to ascertain the best sowing date and suitable varieties giving high yield coupled with better root quality.

2. MATERIALS AND METHODS

The study was undertaken during *rabi* 2010-2011 at College of Horticulture and Research Institute, Dr. Y.S.R.H.U, Venkataramannagudem, West Godavari district of Andhra Pradesh. The experiment was laid out in split plot design with four different dates of sowing and three varieties and replicated thrice. The main plots were devoted to sowing dates (10th November, 25th November, 10th December, 25th December) whereas, subplots were assigned to *the carrot cultivars viz., Pusa Kesar, Pusa Rudhira and Kuroda Improved (Local variety) cultivar*. Total 12 treatmental combinations were evaluated to find out the optimum sowing date and suitable variety with high yields and best quality roots. The plot size of 3.6 m x 1.8 m was taken with a gross plot area of 351.9 m².

Seeds were sown in the plots as per the experimented sowing dates. After 25 days from sowing at (4 leaf stage), the plants were thinned to leave one plant per hill. Irrigation applied once in every four days intervals using flood irrigation system. Data on growth attributes viz., plant height, number of primary and secondary branches were collected at 20 days intervals upto 60 days after sowing where the crop shows the maximum growth. Other parameters data was taken at the time of harvest. Data were subjected to statistical analysis of variance according to the methods described by Panse and Sukhatme (1967).

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The data reflected significant variations in plant height among all the dates and varieties as observed at 60 days after sowing with the highest value being in D1 – 10th November (44.41 cm)

followed by the treatments D2-November 25th (42.29cm) and D3-December 10th (36.77cm), however D3 found to be on par with D4. The treatment D4-December 25th recorded minimum height of plant (35.56cm). This might be due to favourable conditions prevailing during the growing period when planted earlier i.e., 10th November and also due to longer growth experienced by plants resulted from the seeds sown earlier (10th November). Similar results were obtained under different climatic conditions as influenced sowing time by Kanwar (1993) and Gill and Gill (1995). Regarding varieties, significantly maximum plant height was observed with the variety Kuroda Improved (Local variety) (44.28cm) and minimum plant height was observed with the variety Pusa Kesar (34.59cm). While, the plant height was found significantly maximum in treatment combination D₁V₃ (10th November sowing with Kuroda Improved (Local variety)) due to interaction (Table 1).

Other growth characters like number of primary and secondary branches per plant, root-shoot ratio, root length, root diameter and core thickness were recorded highest in D₁ – 10th November among the four dates of sowing (Table 1 & 2). 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. Similar results were made by Joshi et al. (1975).

With regard to varieties, Kuroda Improved (Local variety) exhibited maximum vegetative growth in all characters followed by varieties Pusa Rudhira and Pusa Kesar. This denotes that these differences due to varietal response might be due to genetic composition in the expression of growth potentials. Prevailing weather and a variety grown for a particular area also jointly reflected the growth and yield expression of a variety.

While, all the vegetative characters were found significantly maximum in treatment combination D₁V₃ (10th November sowing with Kuroda Improved (Local variety) due to interaction (Table 1 & 2).

3.2 Yield Parameters

Root yield per plot and per hectare were significantly affected by different dates of sowing. Considering the date of sowing November-10th gave the highest root yield per plot and per hectare. It was found that root yield was gradually decreased in the later sowings. 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. Many workers under different climatic conditions also reported the influence of time of planting on root yield per hectare *viz.* Malik *et al.* (1999), Gill and Gill (1995) and Alam

et al. (2010). In the present study, 10th November sowing resulted significantly maximum yield followed by 25th November. Drastic reduction in yield was noted from 10th December and 25th December sowings. The size of individual roots was found to be very small and the mean root weight was also reduced. As the sowing date was delayed, environmental conditions becoming adverse and affected the plant growth, yield and root quality. Among the varieties, Kuroda Improved (Local variety) has recorded the highest yield followed by Pusa Rudhira and Pusa Kesar. This varietal difference is attributed to vigorous growth and potential genetic makeup of the variety (Arthirani *et al.*, 2008). Pusa Rudhira was reported to be best in terms of quality which might be due to its genetic makeup. The interaction between the dates of sowing and varieties had a significant effect on root yield of carrot (Table 2). The variety Kuroda Improved (Local variety) which was sown on 10th-November (D1V3) exhibited highest root yield (200.61 q ha⁻¹) than any other combinations, and it was followed by the treatment combination of D2V3 (169.75 q ha⁻¹). However the treatment combination of Pusa Kesar with final sowing date i.e., D4V1 recorded significantly lowest root yield (46.55 q ha⁻¹). The experiment results revealed that all the growth characters like plant height, number of primary and secondary branches per plant, plant weight, root-shoot ratio and root yield were maximum in treatment combination D₁V₃. Therefore, the early sowing on 10th November with Kuroda Improved (Local variety) is recommended for the coastal region of Andhra Pradesh.

Table 1. Effect of sowing dates on growth attributes of carrot (*Daucus carota* Linn.) cultivars.

Sowing dates	Root length (cm)				Root diameter (cm)				Core thickness (cm)				Yield (q ha ⁻¹)			
	Varieties															
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean
D ₁ (10 th November)	12.76	15.03	16.50	14.76	3.92	4.20	4.46	4.19	2.16	2.49	2.67	2.44	155.86	161.98	200.61	200.61
D ₂ (25 th November)	11.90	14.60	15.96	14.15	3.66	3.94	4.32	3.97	1.69	1.97	2.13	1.93	165.12	154.32	169.75	169.75
D ₃ (10 th Decmeber)	11.46	13.96	14.83	13.42	3.30	3.47	3.50	3.42	1.38	1.44	1.52	1.44	78.44	101.90	136.26	136.26
D ₄ (25 th December)	10.56	11.90	13.30	11.92	2.22	2.36	2.80	2.46	0.94	0.85	1.00	0.93	46.55	67.38	90.02	90.02
Mean	11.67	13.87	15.15		3.27	3.49	3.77		1.54	1.69	1.83		111.49	121.39	149.16	
Interaction effect																
Source	D	V	D x V	V x D	D	V	D x V	V x D	D	V	D x V	V x D	D	V	D x V	V x D
S.Em ±	0.13	0.08	0.19	0.22	0.04	0.03	0.07	0.07	0.03	0.02	0.05	0.05	2.24	1.68	3.54	3.88
CD at 5%	0.45	0.26	0.62	0.56	0.15	0.10	0.22	0.21	0.10	0.07	0.16	0.16	7.73	5.03	10.68	11.26

Table 2. Effect of sowing dates on yield and yield attributes of carrot (*Daucus carota* Linn.) cultivars.

Sowing dates	Plant height				No. of primary branches				No. of secondary branches				Root shoot ratio			
	Varieties															
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean
D ₁ (10 th November)	37.86	45.40	49.97	44.41	11.7	12.4	13.8	12.6	113.7	129.3	142.4	128.4	1.22	1.31	1.62	1.38
D ₂ (25 th November)	36.18	42.82	47.86	42.29	11.0	11.8	13.2	12.1	102.7	114.3	134.1	117.1	1.12	1.22	1.53	1.29
D ₃ (10 th Decmeber)	32.84	37.53	39.93	36.77	9.8	11.0	12.7	11.2	94.1	101.5	122.4	106.1	0.98	1.09	1.24	1.10
D ₄ (25 th December)	31.47	35.87	39.35	35.56	8.5	10.4	11.7	10.2	86.1	93.5	108.3	96.0	0.86	0.93	1.03	0.94
Mean	34.59	40.41	44.28		10.02	11.4	12.9		99.2	109.6	126.9		1.04	1.14	1.35	
Interaction effect																
Source	D	V	D xV	V xD	D	V	D xV	V x D	D	V	D xV	V xD	D	V	D xV	V x D
S.Em ±	0.49	0.36	0.77	0.85	0.10	0.11	0.21	0.17	1.71	1.53	3.03	2.95	0.01	0.02	0.03	0.02
CD at 5%	1.70	1.10	2.47	234	0.35	0.34	NS	NS	5.89	4.58	NS	NS	0.04	0.05	0.09	0.10

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