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EFFECT OF DATE OF SOWING ON GROWTH AND YIELD OF CARROT CULTIVARS UNDER RAYALASEEMA REGION OF ANDHRA PRADESH, INDIA

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ABSTRACT

An experiment was conducted at Department of Vegetable Science, College of Horticulture, Anantharajupeta, during *rabi* 2023-24 to evaluate the effect of sowing date on growth, yield and quality of carrot cultivars under Rayalaseema region of Andhra Pradesh. The study was carried out with four sowing dates *viz.* 1st fortnight of November (S₁), 2nd fortnight of November (S₂), 1st fortnight of December (S₃) and 2nd fortnight of December (S₄) on five cultivars *viz.* Kashi Arun (V₁), Kashi Krishna (V₂), Pusa Vrishti (V₃), Kuroda (V₄) and Early Nantes (V₅). Maximum plant height, number of primary branches, secondary branches, total fresh weight, root length, root diameter, root fresh weight, root shoot ratio, root yield per plot and root per hectare was observed highest on 2nd fortnight of November sowing. All the parameters had shown a decreasing trend with the delay in the sowing date. Among the cultivars, Kashi Arun performed best with respect to plant height, number of primary and secondary branches. But cultivar Kuroda has recorded highest total fresh weight and yield attributes like root length, root weight, root diameter, root shoot ratio, root yield per plot and root yield per hectare. Treatment combination of cultivar Kuroda sown on 2nd fortnight of November was recorded with highest root length, root diameter, root shoot ratio, root weight, root yield per plot and root yield per hectare and lowest core diameter. However, plant height, number of primary branches and secondary branches were found highest with a combination of cultivar Kashi Arun sown on 2nd fortnight of November.

Key words : Carrot sowing dates, Cultivars, Growth and Root yield.

Introduction

Carrot (*Daucus carota* L.), a member of the *Apiaceae* family is a popular root vegetable cultivated throughout the world for its fleshy edible roots. It is considered to be native of Afghanistan. Carrots are incredibly versatile in culinary applications. They're commonly used raw in salads or cooked in various dishes like soups, stews and curries.

Their rich content of phytochemicals and functional compounds like dietary fibre, carotenoids, flavonoids, phenolic acids, vitamins, minerals and polyphenols make them incredibly nutritious. The presence of beta-carotene, a precursor to vitamin A, further enhances their nutritional value (Sharma *et al.*, 2020). Carrot production in India is

16.9 lakh MT under area of 1.08 lakh ha (NHB, 2021-22).

One of the major factors responsible for the low yield of carrots is its climatic limitations. Environmental conditions, including day and night temperatures associated with sowing date affect carrot yield and quality. Therefore, cultivators must consider sowing time as a critical factor that influences the vegetative growth, yield, and quality of carrots. The yield of any crop can be enhanced by choosing improved varieties and even a modest increase is highly valued by cultivars. Hence, suitable varietal selection is also a crucial factor in carrot production. Rayalaseema region is a scarce rainfall zone of Andhra Pradesh and no suitable carrot varieties were

recommended. This region experiences maximum rainfall from the North-East monsoon during the *rabi* season, contributing to suboptimal carrot production due to improper cultivar selection and time of sowing. Keeping in view the above facts, the current study was conducted to determine the best cultivar and ideal sowing time for high yield.

Materials and Methods

A field experiment was conducted at College of Horticulture, Anantharajupeta, Rly Kodur, Anamaya district, during the period from November 2023 to March 2024. This location comes under Rayalaseema region of Andhra Pradesh. The trial was designed using a Factorial Randomized Block Design and replicated thrice. Factor-1 consisting of four different sowing dates *viz.*, S_1 -1st fortnight of November, S_2 -2nd fortnight of November, S_3 -1st fortnight of December and S_4 -2nd fortnight of December. Factor-2 consisting of five carrot cultivars: Kashi Arun (V_1), Kashi Krishna(V_2), Pusa Vrishti(V_3), Kuroda (V_4), Early Nantes (V_5) and their interaction was studied. All the cultural practices were followed as per the recommended practices. Data was recorded on different growth and yield parameters like plant height (cm), number of primary and secondary branches, total fresh weight, root length (cm), root diameter (cm), core diameter (cm), root weight (cm), root shoot ratio, yield per plot (kg), yield per hectare (t). The data gathered on various growth and yield parameters were analysed using the means of each treatment. The statistical analysis of the collected data followed the standard method of analysis of variance, as outlined by Panse and Sukhatme (1985).

Results and Discussion

Effect of sowing dates and cultivars and their interaction on growth Parameters

The data pertaining to growth parameters in carrot as influenced by dates of sowing and cultivars and their interaction is presented in Table 1.

Plant height (cm) : Plant height of carrot cultivars was significantly influenced by dates of sowing, cultivars and their interaction at various crop growth stages. Maximum and minimum plant height (28.51, 59.99 cm and 26.61, 54.42 cm) was observed from 2nd fortnight of November and 2nd fortnight of December at 60 DAS and at harvest, respectively. Favourable meteorological conditions, *i.e.*, sunshine, optimum temperatures, rainless period and favourable day length compared with early and late sowing dates might have produced better plant height (Sahu *et al.*, 2018). Among the cultivars, maximum plant height (31.98 and 64.94 cm) was observed with the

cultivar Kashi Arun. While, minimum plant height (21.56 and 46.05 cm) was observed in cultivar Early Nantes at 60 DAS and at harvest. The highest plant height (35.00 cm and 68.97 cm) was observed from a treatment combination of Kashi Arun sown on the 2nd fortnight of November (S_2V_1) and the lowest plant height (21.10 cm and 41.20 cm) was observed in Early Nantes sown on 2nd fortnight of December at 60 DAS and at harvest. Similar results showing significant interaction between sowing date and cultivars were reported by Kabir *et al.* (2013) in carrot, Shoma *et al.* (2014) in carrot, Shehata *et al.* (2017), Karakan *et al.* (2019) in carrot, Singh *et al.* (2021) in radish, Kaur and Singh (2022) in radish and Giri *et al.* (2024) in carrot.

Number of primary and secondary branches :

Date of sowing and cultivars showed significant effect on primary and secondary branches at 60 DAS and at harvest. Significantly, Highest number of primary branches and secondary branches (5.55, 7.59 and 47.95, 111.4) was recorded with 2nd fortnight of November and the lowest number of primary branches were found on 2nd fortnight of December sowing (4.94, 6.29 and 39.68, 69.36) at 60 DAS and at harvest. Increase in the number of branches at mid-November might be on account of favourable conditions available during the growing period possibly attributed to maximum photosynthesis. Among the Cultivars, Kashi Arun recorded maximum number of primary branches and secondary branches (6.09, 8.38 and 51.98, 96.63) at 60 DAS and at harvest respectively. While, minimum number of primary branches and secondary branches (3.95, 5.27 and 34.96, 56.45) were observed with Early Nantes at 60 DAS and at harvest, respectively. Interaction effect of sowing dates and cultivars was found non-significant on primary branches at 60 DAS but, varied significantly at harvest. However, interaction between sowing date and cultivars was observed significant on number of secondary branches at 60 DAS and at harvest. Significantly highest (9.04) and lowest (4.63) number of primary branches were observed with Kashi Arun sown during 2nd fortnight of November (S_2V_1) and Early Nantes sown at 2nd fortnight of December (S_4V_5) at harvest respectively. Whereas, secondary branches were observed highest (55.73 and 114.40) with cultivar Kashi Arun sown on 2nd fortnight of November(S_2V_1) at 60 DAS and at harvest. While, lowest number of secondary branches were observed from Early Nantes sown on 2nd fortnight of December at 60 DAS and Early Nantes sown on 1st fortnight of December (S_4V_5) at harvest. Prevailing weather and a variety grown for a particular area also jointly reflected the growth and yield expression of a variety. These results

Table 1 : Effect of sowing dates, cultivars and their interaction on growth parameters of carrot.

Treatments	Plant height (cm)		No. of primary branches		No. of secondary branches		Total fresh weight(g)
	60 DAS	At harvest	60 DAS	At harvest	60 DAS	At harvest	
Factor 1 (Sowing dates)							
S ₁ (1 st fortnight of November)	27.10	55.58	5.07	6.43	42.01	77.57	107.23
S ₂ (2 nd fortnight of November)	28.51	59.99	5.55	7.59	47.95	86.25	118.07
S ₃ (1 st fortnight of December)	28.41	57.07	5.34	7.39	45.55	81.87	115.63
S ₄ (2 nd fortnight of December)	26.61	54.42	4.94	6.29	39.68	69.36	89.37
SEm(±)	0.44	0.81	0.09	0.15	0.47	0.95	1.16
CD (P=0.05)	1.26	2.32	0.26	0.43	1.35	2.72	3.34
Factor 2 (Cultivars)							
V ₁ (Kashi Arun)	31.98	64.94	6.09	8.38	51.98	96.63	96.98
V ₂ (Kashi Krishna)	31.06	64.03	5.96	8.23	48.18	89.53	101.05
V ₃ (Pusa Vrishti)	31.64	60.83	5.37	6.98	46.06	84.16	106.2
V ₄ (Kuroda)	23.16	47.98	4.75	5.77	37.83	67.05	119.73
V ₅ (Early Nantes)	21.56	46.05	3.95	5.27	34.96	56.45	112.27
SEm(±)	0.49	0.9	0.10	0.17	0.53	1.06	1.30
CD (P=0.05)	1.41	5.19	0.27	0.47	1.51	3.04	3.37
Interaction (Factor 1 × Factor 2)							
S ₁ V ₁	32.13	63.70	5.73	8.07	51.63	94.80	96.03
S ₁ V ₂	32.00	66.3	5.63	7.93	43.43	86.03	100.90
S ₁ V ₃	30.37	60.70	5.23	5.2	42.30	81.73	105.70
S ₁ V ₄	24.00	42.23	4.77	5.73	37.73	65.90	119.60
S ₁ V ₅	21.47	44.97	3.97	5.20	34.97	59.40	113.93
S ₂ V ₁	35.00	68.97	6.57	9.40	55.73	111.40	108.73
S ₂ V ₂	28.90	65.77	5.93	8.60	52.76	93.70	112.43
S ₂ V ₃	34.37	60.67	5.90	8.00	50.43	86.40	118.13
S ₂ V ₄	22.63	53.37	4.87	6.17	41.97	74.37	128.87
S ₂ V ₅	21.63	51.20	4.47	5.77	38.87	65.37	122.17
S ₃ V ₁	29.40	63.03	6.37	9.10	50.97	99.20	102.47
S ₃ V ₂	33.40	62.77	6.13	8.70	52.33	100.47	121.80
S ₃ V ₃	33.87	60.70	5.33	7.73	51.9	94.67	116.43
S ₃ V ₄	23.33	52.03	4.93	5.97	37.26	65.00	120.97
S ₃ V ₅	22.03	46.83	3.93	5.47	35.30	50.03	116.50
S ₄ V ₁	31.40	64.07	5.67	6.93	49.60	81.10	80.70
S ₄ V ₂	29.93	61.30	6.13	7.67	44.17	77.93	80.13
S ₄ V ₃	27.97	61.23	5.00	7.00	39.60	73.83	82.13
S ₄ V ₄	22.67	44.30	4.44	5.20	34.33	62.93	109.47
S ₄ V ₅	21.10	41.20	3.43	4.63	30.70	51.0	94.42
SEm(±)	0.98	1.81	0.20	0.33	1.05	2.11	2.60
CD (P=0.05)	2.81	5.19	NS	0.95	3.03	6.08	7.47

are in accordance with those of Mengistu and Yamoah (2010) in carrot.

Total fresh weight (g) : Total fresh weight was found to be significantly influenced by dates of sowing, cultivars and their interaction effect. Total fresh weight was found maximum (118.07 g) in the carrots sown on

2nd fortnight of November (S₂) and the lowest total fresh weight (89.37 g) was recorded on 2nd fortnight of December sowing (S₄). Early and late sowings gave lowest total fresh weight of the plant where as the highest total fresh weight at 2nd fortnight of November might be due to higher plant height, no. of primary and secondary

branches and root fresh weight resulted in increased total fresh weight of the plant. Among the cultivars, maximum total fresh weight (119.73 g) was observed with Kuroda and the lowest fresh weight (96.98 g) was observed in cultivar Kashi Arun. Total fresh weight (128.87 g) was observed from cultivar Kuroda sown on 2nd fortnight of November (S_2V_4). Whereas, the lowest total fresh weight (80.13 g) was obtained with the combination of cultivar Kashi Krishna sown on 2nd fortnight of December (S_4V_2). Prevailing weather coupled with suitable cultivar might have increased the total fresh weight of the Kuroda sown on 2nd fortnight of November (Nandal *et al.*, 2008) in carrot.

Effect of sowing dates and cultivars and their interaction on yield Parameters

The data pertaining to yield and yield attributing parameters in carrot as influenced by dates of sowing and cultivars and their interaction is presented in Table 2.

Root length of carrot cultivars was significantly influenced by dates of sowing and their interaction. The highest root length (14.43 cm) was observed in carrot sown on 2nd fortnight of November followed by 1st fortnight of December (13.74 cm) and the lowest (12.15 cm) root length was observed with seeds sown on the 2nd fortnight of December. Root length was found highest on mid-November sowing period might be due to favourable environmental conditions available during the root growth period. These results were in agreement with the finding of Latha *et al.* (2015) in carrot, Lavanya *et al.* (2017), Sahu *et al.* (2018), Singh *et al.* (2021) in radish and Giri *et al.* (2024). Among the cultivars, highest root length (14.42 cm) was obtained by cultivar Kuroda followed by Early Nantes (13.98 cm) and the lowest root length (12.20 cm) was recorded with cultivar Kashi Arun. Increased root length in the varieties might be due to genetic makeup and it was in conformity with Karakan *et al.* (2019) in carrot and Kaur and Singh (2022) in radish. Maximum root length (15.83 cm) was observed in variety Kuroda sown on 2nd fortnight of November (S_2) and minimum root length (10.10 cm) was observed in the treatment combination of variety Kashi Arun sown on 2nd fortnight of December (S_4V_1). Variation in the interaction effect between sowing date and cultivar might be due to the response of cultivars to the environmental conditions during early sowing (Ladumor *et al.*, 2020).

Dates of sowing and their interaction had significant effect on root diameter of carrot cultivars. Maximum diameter of the root (3.00 cm) was observed when the seeds were sown on 2nd fortnight of November (S_2). While, the minimum root diameter (2.85 cm) was observed

with carrots sown on 2nd fortnight of December (S_4). Increase in the diameter of the roots was due to the more vigorous growth observed with sowing on 2nd fortnight of November. Similar findings were observed by Karakan *et al.* (2019) in carrot, Singh *et al.* (2021) in radish and Giri *et al.* (2024) in carrot. Among the cultivars root diameter was found maximum (3.10 cm) with Kuroda followed by Early Nantes (3.03 cm) and the minimum root diameter (2.72 cm) was obtained from cultivar Kashi Arun. Maximum root diameter (3.26 cm) was recorded with treatment combination of Kuroda sown on 2nd fortnight of November (S_2V_4) and lowest root diameter (2.60 cm) was found with the treatment combination of Kashi Arun sown on 1st fortnight of November (S_1V_1). Similar findings were reported by Priyanka *et al.* (2018), Kaur and Singh (2022).

Dates of sowing and their interaction had significant effect on core diameter of carrot cultivars. The lowest core diameter (1.10 cm) was observed on 2nd fortnight of November sowing and the highest core diameter (1.32 cm) was found in the seeds sown on 2nd fortnight of December. Significant effect of sowing date on the core diameter might be due to the higher accumulation of photosynthates in the cortex due to appropriate environmental conditions, which reduced the core size. Similar findings were observed by Nandal *et al.* (2008). Among the cultivars, cultivar Kuroda (1.05 cm) was recorded with lowest core diameter followed by Early Nantes (1.13 cm) and the highest core diameter (1.37 cm) was recorded in variety Kashi Arun. These results were in agreement with the findings of Asmitha *et al.* (2017). Interaction effect between date of sowing and cultivar had significant effect on core diameter. Minimum core diameter (0.88 cm) was obtained from with a combination of Kuroda sown on 2nd fortnight of November (S_2V_4) and Cultivar Kashi Arun sown on 2nd fortnight of December (S_2V_4) was recorded with highest core diameter (1.50 cm). Significant interaction between the date of sowing and cultivar might be the result of higher photosynthetic rate of the cultivar at different sowing dates. Maximum fresh weight of root (57.35 g) was obtained from 2nd fortnight of November and minimum fresh weight of root (49.38 g) was found on 2nd fortnight of December. These results are in conformity with Kabir *et al.* (2013) in carrot, Lavanya *et al.* (2017), Sahu *et al.* (2018), Singh *et al.* (2021) in radish and Giri *et al.* (2024) in carrot. Among the cultivars, significantly highest fresh weight of root (60.45 g) obtained by variety Kuroda and minimum fresh weight of the root (43.88 g) was obtained by variety Kashi Arun. Fresh weight of root (67.03 g) was observed highest in the treatment combination of

Table 2 : Effect of sowing dates, cultivars and their interaction on yield parameters of carrot.

Treatments	Root length (cm)	Root diameter (cm)	Core diameter (cm)	Root weight (g)	Root shoot ratio	Root yield per plot (kg)	Root yield per hectare (t)
Factor 1 (Sowing dates)							
S ₁ (1 st fortnight of November)	13.03	2.87	1.26	50.17	0.69	1.85	6.45
S ₂ (2 nd fortnight of November)	14.43	3.00	1.1	57.35	0.80	2.46	7.72
S ₃ (1 st fortnight of December)	13.74	2.97	1.25	56.89	0.73	1.98	7.07
S ₄ (2 nd fortnight of December)	12.15	2.85	1.32	49.38	0.65	1.83	6.26
SEm(±)	0.20	0.03	0.02	0.78	0.02	0.03	0.07
CD(P=0.05)	0.56	0.09	0.05	2.24	0.05	0.09	0.22
Factor 2 (Cultivars)							
V ₁ (Kashi Arun)	12.2	2.72	1.37	43.88	0.57	1.65	5.69
V ₂ (Kashi Krishna)	12.7	2.82	1.33	49.10	0.70	1.74	6.21
V ₃ (Pusa Vrishti)	13.38	2.95	1.29	55.50	0.71	1.89	6.74
V ₄ (Kuroda)	14.42	3.1	1.05	60.45	0.84	2.55	8.04
V ₅ (Early Nantes)	13.98	3.03	1.13	58.30	0.79	2.30	7.70
SEm(±)	0.22	0.04	0.02	0.87	0.02	0.03	0.08
CD(P=0.05)	0.63	0.1	0.06	2.51	0.05	0.10	0.25
Interaction (Factor 1 × Factor 2)							
S ₁ V ₁	12.00	2.60	1.37	42.6	0.43	1.37	4.98
S ₁ V ₂	11.00	2.87	1.44	45.57	0.66	1.47	5.43
S ₁ V ₃	12.23	2.90	1.40	53.10	0.69	1.53	6.50
S ₁ V ₄	14.97	3.05	1.03	55.00	0.85	2.50	7.87
S ₁ V ₅	14.97	2.96	1.07	54.57	0.82	2.38	7.46
S ₂ V ₁	12.30	2.77	1.30	43.63	0.58	2.05	6.68
S ₂ V ₂	13.37	2.74	1.29	55.53	0.67	2.16	7.30
S ₂ V ₃	15.00	3.09	1.07	59.60	0.81	2.45	7.64
S ₂ V ₄	15.83	3.26	0.88	67.03	1.02	2.92	8.73
S ₂ V ₅	15.63	3.16	0.98	60.97	0.93	2.70	8.24
S ₃ V ₁	14.40	2.68	1.34	53.30	0.69	1.58	6.23
S ₃ V ₂	14.70	2.95	1.38	54.40	0.70	1.67	6.30
S ₃ V ₃	13.53	3.14	1.22	57.17	0.68	1.71	6.77
S ₃ V ₄	13.27	3.05	1.13	60.80	0.79	2.80	8.10
S ₃ V ₅	12.80	3.04	1.22	58.77	0.81	2.13	7.93
S ₄ V ₁	10.10	2.86	1.50	36.00	0.56	1.62	4.87
S ₄ V ₂	11.73	2.73	1.22	40.90	0.76	1.64	5.80
S ₄ V ₃	12.77	2.67	1.48	52.13	0.66	1.86	6.03
S ₄ V ₄	13.6	3.05	1.16	58.97	0.68	2.04	7.45
S ₄ V ₅	12.53	2.95	1.26	58.9	0.6	1.98	7.16
SEm(±)	0.44	0.07	0.04	1.74	0.04	0.07	0.17
CD(P=0.05)	1.25	0.2	0.12	5.01	0.11	0.19	0.5

cultivar Kuroda sown on 2nd fortnight of November (S₂V₄). While, Minimum fresh weight of root (36.00 g) was recorded by the cultivar Kashi Arun sown during 2nd fortnight of December (S₄V₁). These results are in accordance with that of Shoma *et al.* (2014), Karakan *et al.* (2019) in carrot and Kaur and Singh (2022) in radish.

Root-shoot ratio

Date of sowing significantly affected the root shoot ratio. Maximum root shoot ratio (0.80) was observed with 2nd fortnight of November sowing and the minimum root shoot ratio (0.65) was observed on 2nd fortnight of December sowing. Higher root shoot ratio on 2nd sowing

date might be due to improved growth parameters like plant height, number of branches, high total fresh weight of root (Latha *et al.*, 2015). Cultivar Kuroda recorded highest root shoot ratio (0.84) among all the cultivars and lowest root shoot ratio (0.57) was obtained by cultivar Kashi Arun. Highest root shoot ratio (1.02) was obtained from the cultivar Kuroda sown on 2nd fortnight of November (S_2V_4) and lowest root shoot ratio (0.43) was obtained from the cultivar Kashi Arun sown during 1st fortnight of November (S_1V_1). The present results were in conformity with the finding of Priyanka *et al.* (2018), Kaur and Singh (2022) in radish.

Yield per plot (kg) : Yield per plot was significantly influenced by dates of sowing, cultivars and their interaction. Maximum root yield per plot (2.46 kg) was obtained from 2nd fortnight of November sowing and minimum root yield per plot (1.83 kg) was obtained from 2nd fortnight of December. Increase in root yield with November sowing might be due to the better plant stand and favorable environmental conditions for growth and development of root. Similar findings were observed by Singh *et al.* (2021) in radish and Giri *et al.* (2024). Kuroda cultivar recorded highest root yield per plot (2.55 kg) followed by Early Nantes (2.30 kg). While, the minimum root yield per plot (1.65 kg) was recorded from the cultivar Kashi Arun. This difference might be due to 'genetic composition in the expression of growth potential (Latha *et al.*, 2015). Maximum yield per plot (2.92 kg) was obtained from treatment combination of cultivar Kuroda sown on 2nd fortnight of November (S_2V_4). Combined effect of Cultivar Kashi Arun sown during 2nd fortnight of December (S_4V_1) gave the lowest root yield per plot (1.37 kg). This might be due to the presence of optimum environmental conditions available for the genotype which resulted in the production of higher root length, root diameter and root weight by the genotype Kuroda under optimum sowing date. These results are in accordance with the findings of Shoma *et al.* (2014) in carrot, Hafiz *et al.* (2015) in broccoli, Evakordor and Mehera (2018), Priyanka *et al.* (2018), Al-Juboori *et al.* (2019) and Kaur and Singh (2022) in radish.

Root yield per hectare (t) : Dates of sowing, cultivars and their interaction effect had significant effect on root yield per hectare. Maximum root yield per hectare (7.72 t) was obtained from carrots sown on 2nd fortnight of November and the lowest root yield per hectare was obtained from 2nd fortnight of December sowing (6.26 t). Root yield per plot was gradually decreased in the later sowings due to high temperature resulting in early transition of plants from vegetative to reproductive phase. Similar findings were observed by Ladumor *et al.* (2020)

and Giri *et al.* (2024) in carrot. Among the cultivar Kuroda has recorded with maximum yield per hectare (8.04 t) and the lowest yield per hectare (5.69 t) was obtained from cultivar Kashi Arun. Treatment combination of cultivar Kuroda sown on 2nd fortnight of November (S_2V_4) was recorded with highest yield per hectare (8.73 t). Cultivar Kashi Arun sown during 2nd fortnight of December (S_4V_1) recorded lowest root yield per hectare (4.87 t). similar results were reported by Latha *et al.* (2015), Karabacak and Esiyok (2018) in carrot, Al-Juboori *et al.* (2019) in radish and Kaur and Singh (2022) in radish.

Conclusion

Findings from the current study indicated that growth and yield parameters were significantly influenced by dates of sowing, cultivar and their interaction. All the vegetative and yield parameters were observed highest from the carrot seeds sown on 2nd fortnight of November. Yield was reduced with the delay in the sowing date under Rayalaseema region of Andhra Pradesh. Among the cultivars Kashi Arun was found to be superior in terms of growth parameters. However, cultivar Kuroda performed best with respect to yield attributes compared to other cultivars. Combination of cultivar Kuroda sown on 2nd fortnight of November was recorded with highest root yield.

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