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Effect of spacing and seed soaking with GA₃ on growth, yield and quality of carrot

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Abstract : A field experiment was conducted at the Horticulture Farm, Head Department of Horticulture, Dr. Panjabrao Deshmukh Agriculture University, Akola, Maharashtra, India, during *Rabi* 2010-2011 to study effect of spacing and seed soaking with GA₃ on yield and quality of carrot. The treatments comprised three plant to plant spacings viz., 45cm x 5cm (S₁), 45cm x 10cm (S₂) and 45cm x 15cm (S₃) and five levels of GA₃ with control i.e. control (water soaking) (G₁), 20ppm (G₂), 30ppm (G₃), 40ppm (G₄) and 50ppm (G₅), were arranged in a Factorial Randomized Block Design (FRBD) with three replications. The plant height, number of branches, fresh weight of leaves, fresh weight of root, length of root, diameter of root, root shoot ratio, yield of root per plot and per hectare and TSS content of carrot roots, all were significantly influenced by GA₃ application. With every level of GA₃, generally these characters showed favourable response. The average maximum root yield of 276.14 q/ha was recorded with the application of GA₃ at 50ppm concentration. The spacing effect were also found significant for all the above characters. However, maximum plant height, yield/ plot and yield per hectare were found maximum in close spacing S₁ whereas, number of branches, fresh weight of leaves, fresh weight of root, diameter and length of root, root : shoot ratio and TSS were recorded maximum at wider spacing (S₃) and maximum length of root (20.83cm) was found at medium spacing (S₂). The interactions of spacing and GA₃ were significant only for yield per plot and per hectare and height of plant when the closer spacing (45 x 5cm) (S₁) combines with higher levels of GA₃ 50ppm (G₅).

Key words : Carrot, Spacing, Gibberellic acid

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Among the root crops, carrot (*Daucus carota* L.) is a popular vegetable and in recent years has assumed greater importance being a rich source of carotene - a precursor of vitamin A. Plant population affects the plant growth, development and yield. In case of closer spacing, competition among plants is more and the development of carrot is badly affected. Similarly at wider spacing, individual plants will yield more but per hectare yield may be reduced due to low plant population. Therefore, a suitable plant population must be worked out at which average yield per hectare is maximum. Apart from so many factors, growth regulators may be an important tool for the increasing productivity as well as the quality of the produce to manifolds as the role of plant growth regulators in various physiological and biochemical processes are well known. Thus, the present investigation was carried out to determine the optimum spacing with optimum concentration of GA₃ with a view to get maximum yield

without imparting its quality and resulting in better returns.

RESEARCH METHODS

Field experiment was conducted during *Rabi* of 2010-2011 at Horticulture farm, Head Department of Horticulture, Dr. Panjabrao Deshmukh Agriculture University, Akola, Maharashtra, India. Three spacing; 45cm x 5 cm, 45cm x 10cm, 45cm x 15cm and five levels of GA₃; 0 (Water soaking), 20ppm, 30ppm, 40ppm and 50ppm were tested in all possible combinations in a Factorial Randomized Block Design having three replications. The growth substances were applied by soaking carrot seed for 24 hrs with different combinations of GA₃. The seeds were sown as per the fifteen treatment combinations. Subsequent irrigation, culture practices and plant protection measures were carried out as and when required for all plots.

Observations on various growth and yield attributes

were recorded on five randomly selected plants and further subjected to statistical analysis.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1 :

Plant height (cm):

Different GA₃ levels, spacing and interaction between two factors significantly affected the plant height (Table 1). Highest plant height of 54.28cm was observed at 50ppm (G₅) concentration of GA₃ while lowest value of 50.36cm was observed in control (G₁). Similar results were obtained by Joshi and Singh (1982) in carrot. As regard spacing, the highest plant height of 55.38cm was recorded at 5cm spacing and 10cm spacing (53.14cm), which were statistically at par with each other and these results are in conformity with the Kanwar (1993) in radish.

It could be observed from the mean values of interactions that maximum plant height of 58.56cm was observed at GA₃ 50ppm concentration with 5 cm spacing. The plant height is directly contributed to the plant vigour and hence it is of great importance.

Root yield per plot (kg):

Observations recorded on root yield per plot were analyzed and results obtained are presented in Table 1. It

showed highly significant results for GA₃ levels, spacing and interaction. Mean value in relation to different GA₃ concentration indicated significantly superiority of 50ppm over lower concentrations *i.e.* 40ppm, 30ppm, 20ppm and control. Treatment 50ppm (G₅) produced maximum root yield (6.25kg) followed by 40ppm and 30ppm whereas, minimum root yield per plot was produced by control. The similar result was found by Chakraborty and Choudhari (2008) in garlic. It was observed from the mean value of different spacing that maximum root yield of 7.37 kg and 5.12 kg per plot were produced at 5cm and 10cm spacing, respectively.

In case of interactions maximum root yield (8.29 kg) per plot was produced by GA₃ 50ppm concentration with 5cm spacing followed by 40ppm with 5cm spacing, 30ppm with 5cm spacing, 20ppm with 5cm. It is the fact that yields is related to number of plant per plot, root weight, root diameter, root length and root size.

Root yield per ha (q):

Data recorded on yield of roots per hectare were subjected to statistical analysis and results obtained are presented in the Table 1, which demonstrated highly significant results for different GA₃ concentrations, spacing as well as interaction between two factors. Mean values for different GA₃ concentrations declared superiority of 50ppm (G₅) over all other treatments and decreased with lower GA₃ concentration. The results are

Table 1: Yield and quality characters of carrot as influenced by spacing and concentrations of gibberellic acid

Treatments	Height of plant (cm) at harvest	No. of branches /plant	Fresh weight of leaves (g)	Fresh weight of root (g)	Length of root (cm)	Diameter of root (cm)	Root : Shoot ratio	Yield /plot (kg)	Yield /ha (q)	TSS
Spacing										
S ₁ - 45cm x 5cm	55.38	9.79	76.60	78.48	19.12	3.24	0.98	7.37	311.40	9.51
S ₂ - 45cm x 10cm	53.14	10.59	79.72	83.27	20.83	3.57	1.03	5.12	227.79	9.85
S ₃ - 45cm x 15cm	50.79	10.98	95.00	10.13	17.89	4.21	1.07	2.84	134.56	10.29
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
C.D. (P=0.05)	2.03	0.80	4.44	5.47	1.51	0.30	0.06	0.40	13.54	0.62
Concentration of gibberellic acid										
G ₁ - Control	50.36	8.70	68.47	55.85	14.60	2.89	0.81	4.06	175.65	9.07
G ₂ - 20ppm	53.07	9.35	76.16	73.56	17.05	3.26	0.95	4.66	204.71	9.32
G ₃ - 30ppm	54.19	10.53	83.74	92.80	19.57	3.79	1.09	5.13	226.22	10.11
G ₄ - 40ppm	53.63	11.77	93.17	105.43	21.69	4.18	1.11	5.347	240.20	10.33
G ₅ - 50ppm	54.28	12.22	97.33	113.82	23.50	4.26	1.19	6.25	276.14	10.61
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
C.D. (P=0.05)	2.62	1.03	5.72	7.05	1.94	0.39	0.08	0.53	17.50	0.80
Interaction (S x G)										
'F' test	Sig.	NS	NS	NS	NS	NS	NS	Sig	Sig	NS
C.D. (P=0.05)	4.55	-	-	-	-	-	-	0.90	30.27	-

NS=Non-significant

Sig.-Significant

in conformity with Chakraborty and Choudhary(2008) in garlic.

The mean value in relation to different spacing indicated superiority of 5cm spacing followed by 10cm and 15cm spacing.

It could be observed from the means of interactions that 50ppm GA₃ with 5cm spacing produced maximum root per hectare which were statistically at par with 40ppm with 5cm spacing and 30ppm with 5cm spacing. The mean root yield per hectare was reduced by the control (water soaking) with wider spacing of 15cm.

The data recorded on various parameters *viz.*, number of branches per plant, fresh weight of leaves and root, root length, root diameter, root : shoot ratio and TSS given in Table 1, indicated that individual factor *i.e.* GA₃ levels and spacing had significant effect on various parameter and interaction between two factors found non-significant. From the mean value of various parameters presented in Table 1 shows that GA₃ with higher concentration *i.e.* 50ppm was found statistically significant and superior over lower concentration and control.

In case of spacing, the wider spacing of 15cm was found statistically significant and superior over medium (10cm) and closer (5cm) spacing considering various parameters except root length which was found maximum at medium spacing of 10cm followed by closer (5cm) and wider (15 cm) spacing treatment.

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