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Effect of Growth Substances and Sex Type on Rooting of Kakrol Stem Cuttings

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ABSTRACT

The studies on effect of different growth substances on root formation in kakrol vine cuttings revealed that among different growth substances, IBA at 1500 ppm recorded early (13.28 days) and higher percentage of rooting (90.97), number of roots per cutting (32.19), length of the longest root (21.05 cm), length of the shoot (31.95 cm), number of leaves per cutting (21.21) and percentage of establishment (99.23).Between male and female cuttings, male recorded significantly higher percentage of rooting (70.87) and early rooting (15.58 days), number of roots per cutting (21.08), length of the longest root (16.44 cm), length of the shoot (22.42 cm), number of leaves per cutting (11.68) and percentage of establishment (92.42) in the main field compared with female.The interaction between growth substances x chemicals revealed that IBA 1500 ppm + male cuttings recorded significantly early rooting (12.16 days), greater number of roots per cutting (34.46) and the longest root (22.43 cm) over rest of the combinations.

Key words : Cuttings,Growth Substances, Kakrol, Rooting

Kakrol (*Momordica dioica* Roxb.) (2n = 2x = 28) is a cucurbitaceous, dioecious perennial vegetable grown naturally in certain pockets of India but extensively in coastal belts of Andhra Pradesh. In order to meet the internal demand and also to make a significant dent in the export trade, it is necessary to take up cultivation of this crop on a commercial scale. The first pre-requisite for popularizing the crop commercially should be the availability of large quantities of planting material. For easy and quick method of multiplication, and to get uniform plant material of desired genetic constitution on a large scale vegetative propagation is considered to be the most important method of multiplication. The propagation of plant by stem cuttings is an important means of vegetative reproduction. Regeneration of roots and cuttings is basically a problem of growth and differentiation at the cellular level. The process of regeneration is largely controlled by internal factors including hormonal and nutritional status of the cuttings and the external factors like temperature,humidity, light and rooting media. Synthetic growth substances have been shown to stimulate rooting in cuttings of many plant species. The stem cuttings obtained from male and female plants provide good planting material for planting. With this a desired sex ratio can also be maintained. Therefore, attempts were made to find suitable concentration for obtaining rooting in stem cuttings of kakrol.

MATERIAL AND METHODS

The present investigation" was carried out at Agricultural Research Institute, Rajendranagar, Hyderabad from June 2005 to November 2006. The growth substances used in conducting the experiment were : G_1 – IBA 1000 ppm, G_2 – IBA 1500 ppm,G_3 – IBA 2000 ppm,G_4 – NAA 1000 ppm, G_5 – NAA 1500 ppm, G_6 – NAA 2000 ppm,G_7 – Salicylic acid 50 ppm,G_8 – Salicylic acid 75 ppm, G_9 – Salicylic acid 100 ppm, G_{10} – Ethrel 100 ppm, G_{11} – Ethrel 150 ppm, G_{12} – Ethrel 200 ppm and G_{13} – Control. Two types of cuttings viz., male and female were used which are replicated thrice using factorial randomized block design as suggested by Panse and Sukhatme (1967)

Matured vine cuttings with three nodes after treating with different growth substances at different concentrations for 30 seconds were planted on the same day in polythene bags containing the rooting media prepared with equal proportion of sand, red earth and farm yard manure . The cuttings were planted by exposing the two nodes outside the polythene bag, kept under shade and regularly watered. The cuttings were removed from polythene bags 30 days after planting. Observations were recorded on percentage of rooting, number of days taken for 50 per cent rooting, number of roots per cutting, length of the longest root, length of the shoot, number of leaves, percentage of establishment in main field.

RESULTS AND DISCUSSION

The percentage of rooting was significantly higher in stem cuttings taken from male plants (70.87) than female (66.83) (Table). The number of days taken for 50 per cent rooting was early in male (15.58) than in female (18.20) cuttings (Table). Number of roots per cutting (21.08) (Table), length of the longest root (16.44cm) (Table), length of the shoot (22.42cm) (Table), number of leaves (11.68) (Table) were also more in cuttings from male plants than female. This may be due to sex, genotypic variation and more availability of reserved food materials in the male stem cuttings as they do not produce fruits during their growth and development. Hartmann and Kester (1989) also reported that shoots bearing flower buds did not root well in blue berries. It was attributed to some previous physiological or anatomical conditions associated with the presence of flower buds and fruits. Tripathy *et al.* (1994) found that the percentage of rooting was significantly higher in stem cuttings taken from male plants than female plants in pointed gourd. Further they also reported that the number of primary roots and length of primary roots were also more in stem cuttings taken from male plants.

According to Kumar *et al.,* (1985) the genotypic variation in rooting percentage might be due to differences in sugar content of stem cuttings and the low nitrogen content in stem cuttings increases the rooting cofactors activity to promote better rooting. C/N ratio might be increased by lower nitrogen percentage, which was found conducive for better rooting in *Ficus elastica*. The percentage of rooting ranged from 46.89 with control to 90.97 with IBA 1500 ppm. Further IBA 1500 ppm (90.97) recorded higher percentage of rooting in cuttings followed by NAA 2000 ppm (72.85).

Auxins have been found to stimulate rooting in stem cuttings of several plants (Sinha *et al.,* 1960). The superiority of IBA over other auxins may be explained that the chemical is destroyed relatively slowly by auxin destroying enzyme systems. Further it is reported to persist and translocates poorly *i.e.,* retaining near the site of application and one of the best rooting stimulators compared with other compounds of auxins (Weaver, 1972). Sunitha (1991) in grapevine, Singh *et al.,* (1986) in grape cuttings also observed higher percentage of rooting with IBA1500 ppm. Thimann and Went (1934) had discovered that the auxins exert a primary control over root formation. The probable biochemical reasons for the response may be that the auxin action and some of the cell processes like permeability, metabolism, increased enzymatic activity and cell extension lead to intensified up take of Cl, P^{32}, CO_2, stimulation of RNA, growth stimulation and higher cell wall elasticity .

The number of days taken for 50 per cent rooting ranged from 13.28 with IBA 1500 ppm to 24.47 in control. IBA 1500 ppm (13.28) has taken less number of days for formation of root initials over NAA 2000 ppm (14.82) and other growth substances. According to Krishnamoorthy (1981), the root primordia originates by the divisions of cell phloem, parenchyma of the pericycle by auxin treatment and the direction of movement of metabolites is controlled by auxins. Further the uptake of water and expansion of cell wall are the two stages involved in increasing the size of the cell which require auxins and oxygen. Thimann (1969) observed that auxin activates the messenger type of RNA, which induces synthesis of specific enzymes to help in cell wall extension by way of insertion of new materials in to the cell wall.

IBA 1500 ppm (32.19) had significantly increased the mean number of roots per cutting over control (9.52) and others followed by NAA 2000 ppm (27.79). There was a reverse tendency in average number of roots with increasing concentration of IBA beyond 1500 ppm. This may be because of the reason that auxin helps in rooting behaivour only up to certain critical limits. If higher concentrations beyond critical tolerable limits are given, it may result in inferior or unfavourable conditions, leading to toxicity of the exogenously applied substances.In the present experiment, the endogenous auxins reaching the cambial zone may not be adequate for initiation of rooting primordia in kakrol cuttings but with external application of IBA 1500 ppm appears to be optimum in combination with endogenous auxins and resulting in production of greater number of roots.

The length of the longest root was also significantly improved with the application of growth substances over control and it ranged from 8.99cm with control to 21.05cm with IBA 1500 ppm followed by NAA 2000 ppm (18.62cm).

The superiority of IBA may be due to its growth promoting effect (Thimann and Went, 1934). The availability of food materials to the root development by effective translocation of starch and nitrogen to the base of the cuttings might have encouraged the growth of the roots, as also reported by Pervaiz shagoo *et al.,* (2007) in Barbados cherry.

IBA 1500 ppm recorded maximum shoot length over other treatments and it ranged from 11.72cm with control to 31.95cm with IBA 1500 ppm. Auxins are reported to cause increased linear growth

Table. Effect of different growth substances and cuttings on vine cuttings of kakrol

Cuttings/ Growth substances	Per cent of rooting			Number of days for 50% rooting			Number of roots per cutting		
	Male (C_1)	Female (C_2)	Mean	Male (C_1)	Female (C_2)	Mean	Male (C_1)	Female (C_2)	Mean
G_1 IBA 1000 ppm	69.92	65.29	67.61	15.90	18.83	17.36	22.39	21.21	21.80
G_2 IBA 1500 ppm	92.60	89.33	90.97	12.16	14.39	13.28	34.46	29.91	32.19
G_3 IBA 2000 ppm	79.58	74.27	76.93	14.59	18.56	16.58	24.61	21.77	23.19
G_4 NAA 1000 ppm	71.39	68.24	69.82	16.33	18.21	17.27	20.85	18.11	19.48
G_5 NAA 1500 ppm	74.22	71.48	72.85	15.16	17.73	16.45	21.51	19.69	20.60
G_6 NAA 2000 ppm	85.83	82.31	84.07	13.64	15.99	14.82	29.15	26.42	27.79
G_7 Salicylic acid 50 ppm	70.49	68.21	69.35	14.77	17.66	16.22	19.86	18.58	19.22
G_8 Salicylic acid 75 ppm	69.96	67.61	68.79	15.97	18.41	17.19	22.16	20.32	21.24
G_9 Salicylic acid 100 ppm	65.22	56.29	60.76	14.34	17.98	16.16	17.69	15.62	16.66
G_{10} Ethrel 100 ppm	62.29	59.55	60.92	16.98	19.10	18.04	15.38	11.75	13.57
G_{11} Ethrel 150 ppm	67.97	62.29	65.13	16.17	17.24	16.71	19.07	16.58	17.82
G_{12} Ethrel 200 ppm	63.21	58.75	60.98	15.49	18.73	17.11	16.20	15.73	15.97
G_{13} Control	48.66	45.13	46.89	21.10	23.85	22.47	10.72	8.31	9.52
Mean	**70.87**	**66.83**		**15.58**	**18.20**		**21.08**	**18.77**	

	F-test	S.Ed	CD (0.05)	F-test	S.Ed	CD (0.05)	F-test	S.Ed	CD (0.05)
C (Cuttings)	*	0.941	1.845	*	0.119	0.235	*	0.115	0.226
G (Growth substances)	*	2.400	4.700	*	0.306	0.600	*	0.293	0.575
C x G	NS	3.394	6.65	*	0.433	0.849	*	0.415	0.814

*Significant at 5% level of significance NS - Not significant

Length of the longest root (cm)			Length of the Shoot (cm)			Number of leaves / vine			Percentage of establishment		
Male (C_1)	Female (C_2)	Mean	Male (C_1)	Female (C_2)	Mean	Male (C_1)	Female (C_2)	Mean	Male (C_1)	Female (C_2)	Mean
16.06	15.32	15.69	27.39	24.13	25.76	14.39	12.10	13.25	98.70	95.97	97.34
22.43	19.68	21.05	32.98	30.91	31.95	22.05	20.38	21.21	100.0	98.45	99.23
18.98	18.06	18.52	29.51	28.22	28.86	18.36	16.56	17.46	99.26	96.74	97.99
15.93	14.09	15.01	20.69	18.16	19.42	10.81	10.77	10.79	94.92	93.30	94.11
16.86	16.19	16.53	19.77	17.55	18.66	12.16	10.13	11.15	95.74	94.27	95.00
20.74	16.49	18.62	25.68	23.10	24.39	13.44	11.83	12.64	100.0	98.75	99.37
16.28	15.82	16.05	17.42	15.91	16.67	10.83	8.77	9.80	96.08	93.94	95.01
14.17	12.85	13.51	24.03	22.78	23.40	10.39	8.35	9.37	97.99	95.16	96.58
13.55	12.54	13.05	19.15	17.19	18.17	9.83	7.52	8.67	93.30	90.80	92.05
15.59	13.00	14.29	22.87	20.45	21.66	6.39	4.29	5.34	91.79	90.71	91.25
17.81	17.50	17.66	16.42	14.64	15.53	13.57	10.76	12.17	94.39	93.23	93.81
16.36	15.46	15.91	22.85	20.73	21.79	7.79	4.91	6.35	94.95	92.03	93.49
9.06	8.90	8.99	12.64	10.79	11.72	1.76	1.12	1.44	44.34	42.04	43.19
16.44	**15.07**		**22.42**	**20.35**		**11.68**	**9.80**		92.42	90.42	

F-test	S.Ed	CD (0.05)	F-test	S.Ed	CD (0.05)	F-test	S.Ed	CD (0.05)	F-test	S.Ed	CD (0.05)
*	0.255	0.5005	*	0.262	0.515	*	0.213	0.417	*	0.141	0.276
*	0.651	1.2760	*	0.669	0.313	*	0.542	1.064	*	0.359	0.704
*	0.921	1.8045	NS	0.947	1.857	NS	0.767	1.505	NS	0.508	0.996

*Significant at 5% level of significance NS - Not significant

of stem by way of cell elongation. The new cells enlarge and become differentiated into leaf and different tissues constituting the stem which might have resulted in the higher length of the shoot in the cuttings treated with higher concentrations of auxins. The perusal of data reveals that the maximum number of leaves were observed with IBA which was significantly superior to all other treatments. The number of leaves per cutting ranged from 1.44 with control to 21.21 with IBA 1500 ppm. Similar results with IBA were reported by Varinder Kaur (1990) in geranium and Panwar *et al.,* (1994) in bougainvillea.

The percentage of establishment was more pronounced with IBA and NAA treatments over other treatments and it ranged from 43.19 with control to 99.37 with NAA 2000 ppm. The treatment NAA 2000 ppm (99.37) recorded higher percentage of establishment but was on a par with IBA 1500 ppm (99.23). There was a marked decrease in percentage of establishment of rooted cuttings with increase in concentration of IBA beyond 1500 ppm, which might be probably due to imbalance of nutrients and lower absorption capacity of roots at higher concentrations. Similar results were reported by Sunitha (1991) in grapevine.

The superior percentage of rooting, greater number of roots, leaves and better seedling growth might have helped in the better establishment of rooted cuttings with IBA 1500 ppm which appears to be optimum. Further the prevalence of optimum climate from end of June to August coinciding with better physiological conditions of the rooted cuttings might have improved the percentage of establishment with IBA treatment at 1500 ppm and NAA 2000 ppm (Table).

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