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STUDIES ON FOLIAR APPLICATION OF GROWTH REGULATORS AND CHEMICALS ON SEEDLING GROWTH OF MANGO VARIETIES

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ABSTRACT

A field experiment was carried out to study the effect of foliar application of growth regulators and chemicals on seedling growth of mango varieties. Among the varieties used Bappakkai recorded the maximum seedling height (30.4 cm), girth (0.83 cm), number of leaves (15.0), leaf area (460.4 cm^2), fresh weight (36.55 g), dry weight (14.38 g), internode elongation (4.49 cm) and per cent of graftable seedlings (86.6 %) and minimum was in variety Olour (22.3 cm, 0.62 cm, and 13.9, 196.2 cm^2, 15.86 g, 5.62 g, 4.49 cm and 39.1 % respectively). Among the treatments, the maximum plant height (32.1 cm), intermodal length (9.26 cm) and dry weight (11.57 g) was recorded in GA_3 300 ppm while the other treatment nitrophoska 0.2 per cent noticed maximum leaf area (408.5 cm^2) and fresh weight (30.25 g). The number of leaves (16.4), stem girth (0.78 cm) and per cent of graftable seedlings (73.3 %) was maximum in benzyl adenine 50 ppm, GA_3 200 ppm and benzyl adenine 75 ppm respectively and minimum was noticed in control. In interaction the variety Bappakkai seedlings sprayed with GA_3 300 ppm recorded maximum plant height (35.9 cm), girth (0.93 cm) and per cent of graftable seedlings (100 %) whereas Bappakkai seedlings sprayed with GA_3 200 ppm noticed maximum fresh (48.7 g) and dry weight (18.2 g) and the Olour seedlings sprayed with benzyl adenine 50 ppm and GA_3 300 ppm recorded the maximum number of leaves (18.0) and intermodal length (9.46 cm) respectively. The GA_3 200 and 300 ppm spray helps to obtain more graftable seedlings in the varieties Olour and Bappakai respectively.

INTRODUCTION

Mango (*Mangifera indica. L*) is the most important commercially grown fruit crop of India and is considered as national fruit. It belongs to the botanical family Anacardiaceae and is native of Indo-Burma region (Mukherjee, 1958). The polyembryonic varieties are weak and takes more time to attain the graftable size due to nucellar embryony but they helps to obtain true to type and uniform seedlings. Since, the present day nursery practices involve much cost and risks with respect to rising of seedling rootstocks and their subsequent maintenance until they attain the graftable size. Healthy growth of rootstock is most important in attaining the higher rate of grafting success resulting in higher productivity. Some scientists (Hazrat *et al.*, 2006 and Marler and Mickelbart, 1992) studied the effect of different growth regulators on seedlings. However, the information in mango was meager especially in polyembryonic mango varieties. Hence, the present study was under taken to examine the effect of different growth regulators and chemicals on the growth and vigor of mango seedlings.

MATERIALS AND METHODS

The present investigation was carried out at Indian Institute of Horticultural Research, Bangalore during 2011-12. Healthy, disease free vigoursly growing and uniform seedlings of 45 days age plants raised in the nursery bed for this experiment were transplanted to polybags of 25X15 cm size of 200 gauge thickness which were filled with potting mixture. The growth regulators are sprayed two times for seedlings. First spray was given one month after transplanting and second spray was given one month after first spray. It was sprayed by using sprayer (Hazart *et al.,* 2006).

Factorial Complete Randomized Design was adopted for this experiment. Eight different treatments were imposed (GA_3 100 ppm, GA_3 200 ppm, GA_3 300 ppm, Benzyl Adenine 25 ppm, Benzyl Adenine 50 ppm, Benzyl Adenine 75 ppm, Nitrophoska spray 0.2% and Water spray (control)) on two varieties (Olour, Bappakkai) of mango. Twenty five seedlings used for each treatment, which was replicated thrice (Venkat rao and Reddy, 2005).

RESULTS AND DISCUSSION

Vegetative growth characters

The significant differences were observed (Table 1) among different varieties and treatments in seedling height, number of leaves, stem girth and leaf area. At 150 days after spraying, the maximum seedling height (30.4 cm), seedling girth (0.83 cm), number of leaves (15.0) and leaf area (460.4 cm^2) was recorded in variety Bappakkai and minimum was in Olour (22.3 cm, 0.62 cm, 13.9 and 196.2 cm^2 respectively). Among the treatments, the maximum seedling height (32.1 cm) and girth (0.78 cm), number of leaves (16.4) and leaf area (408.7 cm^2) was recorded in T_3, T_2, T_5 and T_7 respectively and minimum was in T_8 (20.4 cm, 0.61 cm, 11.1 and 184.1 cm^2 respectively). There were no significant differences among interactions with respect to plant height, girth and number of leaves, With respect to leaf area, the highest leaf area (583.5 cm^2) was recorded in treatment Nitrophoska 0.2% in variety Bappakkai and minimum was in water spray with variety Olour (57.8 cm^2).

The regulation of growth by gibberellins and benzyl adenine relates almost extensively to its stem elongation properties. Influence of gibberellic acid and benzyle adenine on stem elongation is by two ways. (1) They have direct effect on stem elongation by inducing cell wall loosening, by increasing cell wall extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall and by increasing cell division leading to more growth. (2) The indirect effect of these chemicals on stem elongation was by increasing the synthesis of IAA (Leopold and Kriedemann, 1983). The increase in seedling height and girth by application of gibberllic acid and benzyl adenine was also reported by earlier workers VenkataRao and Reddy (2005), Padma and Reddy (1998) and Shalini *et al*. (1999) in mango.

The application of GA_3 and benzyl adenine increases the plant height and seedling girth in mango is mainly due to cell elongation, increase in size and rapid cell division. Due to this the elongation of internode will takes place, hence the seedling height will increases. Similar results were observed by Marler and Mickelbert (1992) in Carambola, Kawthalkar and Kunte (1974) in Rangpur lime and Hazart*et al*. (2006) in *Araucaria heterophylla*.

Table 1: Effect of foliar spray on seedling characters in different varieties of polyembryonic mango seedlings

Treatments	Plant height Varieties			No. of leaves Varieties			Stem girth Varieties			Leaf area (cm^2) Varieties		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	23.4	29.2	26.3	12.1	17	14.5	0.62	0.76	0.69	200.8	391.1	295.9
T_2	31.2	32.4	31.8	13.6	16.3	15	0.69	0.88	0.78	80.4	534.6	307.5
T_3	28.4	35.9	32.1	12.5	14	13.3	0.58	0.93	0.75	167.8	466.2	317
T_4	21	28.5	24.7	16	15	15.5	0.66	0.84	0.75	242	557.7	349.8
T_5	24	32.2	28.1	18	14.8	16.4	0.65	0.84	0.74	311.3	504.2	407.7
T_6	21.3	27.5	24.4	16.2	13.7	15	0.68	0.81	0.74	276.4	435.5	355.9
T_7	15.2	31	23.1	12.5	17.4	15	0.62	0.84	0.73	233.4	583.5	408.5
T_8	14.3	26.4	20.4	10.7	11.6	11.1	0.5	0.72	0.61	57.8	310.4	184.1
Mean	22.3	30.4		13.9	15		0.62	0.83		196.2	460.4	
	T	V	T× V	T	V	T× V	T	V	T× V	T	V	T× V
F.test	*	*	NS	*	*	NS	*	*	NS	*	*	*
SEm±	1.69	0.84	2.39	1.05	0.52	1.49	0.02	0.01	0.04	27.75	13.87	39.24
CD at 5%	4.89	2.44	-	3.05	1.52	-	0.08	0.04	-	80.14	40.07	113.34

* Significant at 5%; NS - Non significant ; DAS – Days after spraying; Varieties:V_1 – Olour ; V_2 – Bappakai ; TreatmentsT_1 – GA_3 100ppm ;T_2 – GA_3 200ppm ; T_3 – GA_3 300ppm ;T_4– Benzyl Adenine 25ppm; T_5– Benzyl Adenine 50ppm;T_6 – Benzyl Adenine 75ppm;T_7 – Nitrophoska spray 0.2%;T_8 - Water spray

Table 2: Effect of foliar spray on per cent of graftable seedlings, internodes elongation, fresh and dry weight in different varieties of mango seedlings

Treatments	Graftable seedlings at 150 DAS (%) Varieties			Internodes elongation (cm) at 15 DAS Varieties			Fresh weight (g) Varieties			Dry weight (g) Varieties		
	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	40	80	60	5.93	4.6	5.26	16.46	32.85	24.65	5.66	12.73	9.19
T_2	53.3	73.3	63.3	9.2	6.86	8.03	11.78	48.7	30.24	3.87	18.28	11.07
T_3	20	100	60	9.46	9.06	9.26	15.26	43.36	29.31	5.09	18.06	11.57
T_4	53.3	93.3	73.3	2.03	2.93	2.48	14.37	34.86	24.61	5.54	14.51	10.02
T_5	40	100	70	2.51	4.53	3.52	22.26	36.83	29.55	8.09	14.6	11.34
T_6	53.3	93.3	73.3	1.73	2.66	2.2	20.53	29.1	24.81	7.12	11.47	9.29
T_7	26.6	86.6	56.6	1.33	2.93	2.13	18.3	42.2	30.25	6.57	15.63	11.1
T_8	26.6	66.6	46.6	0.96	2.33	1.65	7.9	24.5	16.2	3.03	9.78	6.4
Mean	39.1	86.6		4.14	4.49		15.86	36.55		5.62	14.38	
	T	V	T× V	T	V	T×V	T	V	T× V	T	V	T× V
F.test	*	*	*	*	NS	*	*	*	*	*	*	*
SEm±	3.2	1.6	4.53	0.47	0.23	0.66	1.88	0.94	2.67	0.72	0.36	1.01
CD at 5%	9.25	4.62	13	1.36	-	1.92	5.45	2.72	7.71	2.08	1.04	2.94

* Significant at 5%;NS - Non significant ;DAS – Days after spraying; Varieties:V_1 – Olour;V_2 – Bappakai ;TreatmentsT_1 – GA_3 100ppm ;T_2 – GA_3 200ppm ;T_3 – GA_3 300ppm ;T_4– Benzyl Adenine 25ppm;T_5– Benzyl Adenine 50ppm;T_6 – Benzyl Adenine 75ppm;T_7 – Nitrophoska spray 0.2%;T_8- Water spray

The production of more number of leaves in varieties and treatments may be due to the vigorous growth induced by the GA_3 and benzyl adenine treatments, more number of branches which in turn facilitates better harvest of sunshine by the plants to produce more number of leaves. These results obtained on this aspect were in agreement with Marler and Mickelbert (1992) in carambola, Kawthalkar and Kunte (1974) in Rangpur lime and Hazart *et al*. (2006) in *Araucaria heterophylla*.

The leaf area was increased by the application of 2 per cent nitrophoska was mainly due the presence of nitrogen, phosphorus and potassium nutrients in equal proportion and also immediate absorption of these nutrients through foliar application helps to increase more vegetative growth in turn leaf area. Variation in leaf area could be expected among the varieties, as the attribute is generally genetic character. Variation in leaf area due to the treatments with hormones and chemicals was also reported by Agarwal (1986) in citrus and Khobragode *et al*. (1999) in mango who reported that, greater leaf area was associated with vigorous rootstocks.

Per cent of graftable seedlings, internode elongation, fresh and dry weight of seedling

Significant differences were observed (Table 2) among different varieties and treatments. The per cent of graftable seedlings, internode elongation, fresh and dry weight of seedling was maximum in variety Bappakkai (86.6%, 4.49 cm, 36.5 and 14.38 g respectively) whereas minimum was in Olour (39.1 %, 4.49 cm, 15.86 and 5.62 g respectively). Among the treatments the maximum graftable seedlings (73.3 %), internode elongation (9.26 cm), fresh (30.4 g) and dry weight of seedling (11.5 g) was recorded in T4, T3, T7 and T3 respectively. whereas water spray noticed minimum of graftable seedlings, internode elongation,fresh and dry weight of seedling (46.6 %, 1.65 cm, 16.2 and 6.40 g respectively).

Significant differences were observed (Table 2) among interactions with respect to all the characters. The maximum graftable seedlings (100 %), internode elongation (9.46 cm), fresh (48.7 g) and dry weight (18.0 g) were recorded in T3V2, T3V1 and T2V2 respectively and minimum was recorded in T8V1 (20.0 %, 0.96 cm, 7.9 and 3.03 g).

The more per cent of graftable seedlings are achieved in GA_3 and benzyl adenine application it is mainly due to rapid cell division which mainly helps to increase the thickness of seedling girth. Similar results were observed by Marler and Mickelbart (1992) in carambola, Hazrat *et al*. (2006) in *Araucaria heterophylla*, Kawthalakar and Kunte (1974) in Rangpur lime and Hoda *et al*. (2010) in citrus.

The role of GA_3 in cell elongation is still obscure, but several theories have been advanced, gibberellins may cause elongation by the induction of enzymes that weaken the cell walls. Treatment with gibberellins induces formation of proteolytic enzyme that would be expected to release tryptophan, a precursor of IAA. Gibberellins frequently increase auxin content. Gibberellins may also transport auxins to their site of action (Macleod and Millar, 1962).

Another mechanism by which GA might stimulate cell elongation is that the hydrolysis of starch resulting from the production of gibberellins induced á- amylase might increase the concentration of sugar, thus raising the osmotic pressure in cell sap so that water enters the cell and stretch it. Similar results were obtained by Singh and Singh (1974) in mango, Marler and Mickelbert (1992) in carambola, Kawthalkar and Kunte (1974) in Rangpur lime and Hazart *et al*. (2006) in *Araucaria heterophylla*.

The application GA_3 resulted in increased fresh and dry weight of seedlings was mainly due to application of GA_3 is translocated to the expanding internodes and beyond into apical region and young leaves. The increase in length was accompanied by increased dry weight and during expansion there was direct relation between dry weight and volume of water on the internode. The crude cell wall fraction of the dry weight also increases greatly and there was a direct relation between internode volume and amount of wall. Similar results were observed by Monselise and Halevy (1962) in citrus.

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