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Effect of Plant Growth Regulators on Rooting of Barbados Cherry (*Malpighia puncifolia*) Cuttings in Mist Chamber

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Abstract

The experiment was carried out in mist chamber to study the effect of IBA and GA_3 alone and in combination on rooting and shooting parameters of Barbados cherry (*Malpighia puncifolia*) cuttings. The treatment combination I_3G_1 (IBA 2000 ppm + GA_3 100 ppm) recorded maximum number of roots/cutting, leaves/cutting, secondary branches/cutting, leaves/secondary branch, length of root, girth of the root, percentage of rooting and survival percentage of rooted cuttings and the minimum was with I_0G_0 (control). With the increase in concentration of GA_3 it consistently inhibited adventitious root formation.
Key words : Barbados cherry, IBA, GA_3.

The Barbados cherry (*Malpighia puncifolia*), a member of Malpighiaceae is one of the important minor fruit and also called as West Indian cherry, Garden cherry and French cherry. According to the analysis of Massachusetts Institute of Technology of fruits grown in Barbados contains 4,500 mg (green), 3,300 mg (medium ripe), 2,000 mg (very ripe) of ascorbic acid. Ripe Barbados cherries bruise and are highly perishable. Barbados cherries are made delicious sweetened with sugar to modify the acidity of a particular type available. The fruits are considered beneficial to patients with liver ailments and dysentery and those with cough and cold. The bark of the tree contains 20—25% tannins and has been used in leather industry. The most common method of propagation of Barbados cherry is by stem cuttings. The purpose of treating cuttings with auxin type growth regulators is to increase the percentage of rooting or to hasten root initiation to increase the number and quantity of roots produced per cuttings and to produce uniformity of rooting.

Methods

The experiment was conducted in the mist chamber of Horticulture Department of Allahabad Agricultural Institute—Deemed University, Allahabad in the rainy season during 2003-2004. The cuttings were made on August 12, 2003 and were treated with IBA and GA_3 concentration alone and in combination based on different treatments by quick dip method. There were four different concentrations of IBA (I_0–Distilled water, I_1–500 ppm, I_2–1,000 ppm, I_3–2,000 ppm) and three different concentrations of GA_3 (G_0–Distilled water, G_1-100 ppm, G_2-200 ppm). Fifteen cuttings were taken under each treatment in three replications, so there were five cuttings in each replication under each treatment. About six months old mature branches were selected and cuttings were made about 15—20 cm in length possessing 4—6 dormant buds with 2—3 leaves. While making cutting the lower basal cut was made horizontally at right angle to the axis and the upper cut was given just above the opposite side of the bud. The cuttings were dipped in respective growth regulators for 30 seconds. To see the combined effect of IBA and GA_3 the cuttings were treated first with GA_3 solution and then in IBA solution. After dipping the cuttings, they were removed and planted closely in rooting media sand. The cuttings were examined after 15 days of interval. The average number of roots/cuttings, number of leaves/cutting, number of secondary branches/cutting, number of leaves/secondary branch, length of the longest root, girth of the thickest root, percentage of rooting/cutting and survival percentage of the rooted cuttings were recorded. The data were analyzed statistically following method of analysis of variance (1).

Table 1. Effect of plant growth regulators on rooting parameters of Barbados cuttings.

Treatments	Average no. of roots/ cutting	Average length of the longest root (cm)	Average girth of the root (cm)	Percentage of rooting
I_0	1.99	3.66	0.61	20.66
I_1	3.88	4.74	1.00	40.19
I_2	4.88	5.66	1.33	50.58
I_3	6.22	5.98	1.47	64.38
CD at 5%	0.95	0.51	0.25	9.97
G_0	4.08	4.95	1.14	42.33
G_1	5.74	5.66	1.43	59.47
G_2	3.41	4.05	0.74	30.17
CD at 5%	0.82	0.44	0.22	8.63
I_0G_0	1.66	2.50	0.57	17.18
I_0G_1	2.33	3.67	0.65	24.12
I_0G_2	2.00	3.33	0.61	20.70
I_1G_0	3.66	5.00	1.10	37.88
I_1G_1	4.66	5.33	1.20	48.24
I_1G_2	3.33	3.90	0.70	34.47
I_2G_0	5.00	6.00	1.37	51.75
I_2G_1	6.33	6.67	1.87	65.52
I_2G_2	3.33	4.33	0.75	34.47
I_3G_0	6.00	6.30	1.53	62.11
I_3G_1	9.66	7.00	2.00	100.00
I_3G_2	3.00	4.66	0.90	31.05
CD at 5%	1.65	0.89	0.44	17.2

Table 2. Effect of plant growth regulators on vegetative parameters of Barbados cuttings.

Treatments	Average no. of branches/ cutting	Average no. of leaves/ branch	Average no. of leaves/sec branch	Survival percentage
I_0	1.27	1.23	0.53	32.21
I_1	1.63	1.90	1.20	46.44
I_2	1.93	2.36	1.55	58.88
I_3	2.18	2.70	1.72	63.66
CD at 5%	0.31	0.33	0.20	5.65
G_0	1.70	2.07	1.31	49.83
G_1	2.01	2.53	1.60	62.33
G_2	1.54	1.55	0.83	38.74
CD at 5%	0.26	0.28	0.22	4.89
I_0G_0	1.00	1.10	0.43	26.26
I_0G_1	1.28	1.40	0.67	36.66
I_0G_2	1.53	1.20	0.50	33.33
I_1G_0	1.63	2.00	1.33	46.00
I_1G_1	1.78	2.22	1.43	53.33
I_1G_2	1.48	1.50	0.84	40.00
I_2G_0	1.93	2.40	1.67	60.00
I_2G_1	2.33	3.00	2.00	73.33
I_2G_2	1.53	1.70	1.00	43.33
I_3G_0	2.26	2.80	1.83	66.66
I_3G_1	2.67	3.50	2.33	86.00
I_3G_2	1.63	1.80	1.00	38.33
CD at 5%	0.53	0.57	0.46	9.79

Results and Discussion

The maximum number of roots/cutting (6.22), length of the longest root (5.98 cm), girth of the thickest root (1.47 mm) and percentage of rooting/cutting (64.38%) were recorded in the I_3 level of IBA, whereas significantly minimum number of roots/cutting (1.99), length of longest root (3.66 cm), girth of the thickest root (0.61 mm) and percentage of rooting/cutting (20.66) were recorded in the I_0 level of IBA (Table 1). This might be due to that auxin is required for initiation of adventitious roots on stems and indeed it has been considered that divisions of the first root initial cells are dependent upon either applied or endogenous auxin. This finding is in conformity with those of Hasssig (2). The auxins play an important role in the metabolic activities and cell division which results in an increase in the size of roots in terms of length and diameter (3—5).

Similarly GA_3 application at G_1 level recoded significantly the highest number of roots/cutting (5.74), length of the longest root (5.66 cm), girth of the thickest root (1.43 mm) and percentage of rooting/cutting (59.47%) and lowest due to G_0 level of GA_3 (Table 1). GA_3 also increased number of roots/cutting from higher level to lower level, may be due to cell elongation by synthesizing enzymes and the effect of inhibitors (6). The proportional decrease in number of roots/cutting and percentage of rooting/cutting were recorded with the increase in the levels of GA_3. The present finding is in the agreement with the findings of Withan and Gentile (7), who showed that GA_3 partially inhibit auxin oxidase activity in an enzyme extract from crown gall tissue culture of *Parthenocissus tricuspidata.* Similar findings have also been reported by Kato (8).

Among various combinations I_3G_1 proved to be the best combination, producing maximum number of roots/cutting (9.66), length of the longest root (7.00 cm), girth of the thickest root (2.00 mm) and percentage of rooting/cutting (100%), whereas lowest values were recorded in I_0G_0 combination (Table 1). It may be due to the reason that both auxin and gibberellin play an important role in cell elongation and cell division which results in maximum length and girth of roots. The same finding have been confirmed by Abidin and Baker (9) and Choudary and Singh (10). The proportional decrease in number, length and girth of roots/cutting have been recorded with the increase in the levels of GA_3. The present findings is in confirmity with the Withan and Gentile (7). The maximum survival percentage of rooted cuttings (63.66) was recorded with I_3 level of IBA and minimum survival percentage of rooted cuttings (32.11). Similarly G_1 level of GA_3 recorded maximum survival percentage (62.33) than other levels of GA_3 and among various combinations, I_3G_1 had the highest survival percentage (86.00) and minimum percentage with I_0G_0 (control).

Similarly both IBA and GA_3 significantly influenced the shoot parameters also (Table 2). The maximum number of leaves/cutting (2.70), number of secondary branches/cutting (2.18) and number of leaves/secondary branch (1.72) were recorded with I_3 (2000 ppm IBA), whereas minimum number of leaves/cutting (1.23), number of secondary branches/cutting (1.27) and number of leaves/secondary branch (0.53) were recorded with I_0 level of IBA. The finding suggested that number of leaves increased in the same trend as the number of roots increased with the same treatment. This may be attributed to its effect of shifting of assimilate partitioning from roots to leaves or leaves to roots and increased levels of chlorophyll and carbohydrates in leaves, stems and roots besides increased mineral content, hormonal balance and soluble protein in leaves. This result is in agreement with findings of Debnath and Gowda (11), Purohit and Shekkarapa (12) in *Punica granatum*, Sandhu et al. (13) in sweet lime and Singh et al. (14) in *Citrus jambhiri*, Similarly G_1 (1,000 ppm GA_3) recorded the maximum number of leaves/cutting (2.53), number of secondary branches/cutting (2.01) and number of leaves/secondary branch (1.60) and minimum with G_0 level of GA_3 (Table 2).

However, the combination of GA_3 and IBA also showed significant on all shoot parameters. I_3G_1 (IBA 2,000 ppm + GA_3 100 ppm) produced maximum number of leaves/cutting (3.50), number of secondary branches/cutting (2.67) and number of leaves/secondary branch (2.33) than other treatment combinations and minimum was with control (Table 2). The better vegetative growth with IBA and GA_3 may be due to maximum number and length of roots which probably drive more nutrients and water from the soil and produces more photosynthates due to more number of leaves. The present finding is in accordance with the observations made by Manan et al. (15).

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