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Effect of IBA, NAA and their Combination on Rooting and Biochemical Parameters of Stem Cuttings in Barbados Cherry

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ABSTRACT

An investigation was to assess the influence of growth regulators IBA, NAA and their combination on rooting and biochemical parameters of stem cuttings in Barbados cherry. It was observed that, the least number of days (21.33) taken for root initiation, maximum percentage of rooting (80.00) was observed in cutting treated with IBA 5000 ppm followed by IBA 4500 ppm over other treatments. Significantly highest Chlorophyll-a (1.26), Chlorophyll –b (0.55) and total chlorophyll content (1.82 mg/g of fresh weight) of leaves and C : N ratio (8.74) was observed in cuttings treated with IBA 5000 ppm followed by IBA 4500 ppm over all other treatments.

Keywords- Barbados cherry, rooting, biochemical parameters, stem cutting, plant growth regulators.

I. INTRODUCTION

The Barbados cherry is belong to the family of Malpighiaceae and originated from South Mexico, Central and South America, but currently it is grown in many regions of tropical and sub-tropical areas of Asia. Barbados cherry contains main constituents in 100 g of fresh fruit such as vitamin C (1.500 mg), vitamin A (77-215 mg), carotenoids (1.44 mg), vitamin B1 (0.02 mg), vitamin B2 (0.07 mg), anthocyanins (16 mg), proteins (0.21 to 0.80 g), fat (0.23 to 0.80 g), carbohydrates (3.6 to 7.8 g), and minerals especially iron (0.24 mg), calcium (11.7 mg) and phosphorus (17.1 mg). Due to its constitution, this fruit also has many medicinal properties: it is a vitamin-rich source and plays as an antioxidant and anti-anemic, appetite stimulant, healer, anti-inflammatory and mineraliser (5). Nowadays, Barbados cherry got more importance and particularly preferred in dry land horticulture. Barbados cherry commercially propagated through cutting using growth regulators. Even though, it was propagated by cuttings, but rooting reactions and growth characters of the cuttings are very significant. It is naturally adapted to both medium and low rainfall regions. Barbados cherry vegetative propagation is greatest desirable in order to propagate true-to-type plants. Therefore, vegetative methods of propagation viz., cleft or modified crown grafting, air layering, budding and cuttings were followed. Among these different methods of vegetative propagation, stem cutting is preferred which is economical, quick, easy and does not require the particular techniques as in case of other methods (17). The information on an investigation on the propagation of Barbados cherry from cuttings and use of plant growth regulators for better root growth are insufficient. Therefore, the research was undertaken on the propagation of Barbados cherry using different plant growth regulators for rapid multiplication.

II. MATERIAL & METHOD

The experiment was conducted in 2017-2018, in a low-cost polyhouse of the department of Fruit Science, College of Horticulture, Mudigere. The experiment was conducted in a complete randomized design with 12 treatments consisting of plant growth regulators IBA, NAA and their different combinations. The cuttings were collected from mature one-year-old shoots made into small pieces having 4-6 nodes, uniform length (15 cm) and diameter (0.8 to 0.9 cm).

The cuttings were treated with plant growth regulators by quick dip method and for this a required amount of growth regulator was weighed and dissolved in suitable solvent and then the volume was made up to 1 liter using distilled water. The cuttings were dipped in different as per treatment solution for 30 seconds, shade dried and planted in optimum size polybags. Chlorophyll content of leaf was analyzed by collecting the healthy, fully matured leaves collected from the fifth node from the tip of the stem at peak growth stage. Fresh and fully matured leaves from the plant covered with plastic bag and brought to the libratory from the field to avoid desiccation and were cut into small pieces. A known weight of the sample (100 mg) from leaf tissue cut into small pieces and was incubated in 7.0 ml of DMSO at 65°C for 30 minutes. After the incubation period, the supernatant was collected by decanting and leaf tissue was discarded. Then the volume of the supernatant was made up to 10 ml using DMSO. The absorbance of the

extract was measured at 645 nm and 663 nm using DMSO as blank in a spectrophotometer (Visiscan 167). The total nitrogen content in the sample was estimated with the help of Kelplus equipment through Micro-Kjeldahl method (11). The total carbohydrates were estimated by Anthrone method (7) and C: N ratio is calculated as the ratio of carbohydrates (%) to that of nitrogen (%) obtained by dry weight basis and the following observation was recorded on days taken for root initiation, per cent of cuttings rooted, Chlorophyll (a and b), total chlorophyll, total carbohydrates and C: N ratio.

III. RESULTS & DISCUSSION

Significant variation was observed among different treatments with respective parameters of Barbados cherry hard wood cuttings. Earliest rooting initiation (21.33 days) was observed in cutting treated with IBA 5000 ppm while, control recorded maximum days (36.00) for root initiation. This might be due to efficient utilization of stored resources in cuttings treated with plant growth regulators may initiate early rooting. Similar results are reported by Akshay (2012) in *Piper nigrum* and Shivaji *et al*. (2014) in fig. The maximum percentage (80.00) of rooted cuttings was significantly highest when the cuttings were treated with IBA 5000 ppm and lowest rooting percentage (30.00) was recorded in control. This might also be due to the fact that optimum concentration of IBA leads to mobilization and utilization stored of carbohydrates and nitrogen fraction with the presence of co-factor at the wound site, which may have helped in better root initiation. Parallel result was reported by Singh *et al.* (2014) in mulberry, and Singh (2017 in pomegranate.

Significantly highest Chlorophyll-a (1.26), Chlorophyll–b (0.55) and total chlorophyll content (1.82 mg/g of fresh weight) of leaves was recorded in cuttings treated with IBA 5000 ppm and minimum Chlorophyll-a (0.33), Chlorophyll –b (0.14) and total chlorophyll content (0.48mg/g of fresh weight) of leaves was recorded in control. This might be due to increased leaf area with increased concentrations of auxins might have enhanced more nutrient uptake activated more photosynthates resulting in more chlorophyll content of leaves. Similar results were reported by Kaur *et al.* (2002) in grape and Abdulqader *et al.* (2017) in olive. Significantly decline was observed in total carbohydrates (4.37%) when cuttings treated with IBA 5000 ppm. While, the untreated cuttings recorded maximum carbohydrates (5.80) percentage. However, initial carbohydrate percentage was (6.13). The steady decline during the initiation and growth of roots indicated a breakdown and utilization of carbohydrates during root development. This might also increased activity of catalyzes and peroxidase which accompanied the breakdown of carbohydrates in Barbados cherry cuttings. Similar result was reported by (Prasad *et al*. 1980 and Ghatnatti, 1997).

The lowest nitrogen content (0.50%) was observed in cuttings treated with IBA 5000 pppm while, the highest nitrogen content (0.90%) was observed in control. However, the initial nitrogen content in Barbados cherry cutting was (1.15%). This might be due to degradation as the process during rooting. Basu and Ghosh (1974) revealed that low nitrogen brings about an increase in the activity of rooting co-factors, thus causing better rooting in *Justica grandusa* cuttings. Similar results were obtained by Rao *et al.* (1988) in cashew and Chandramouli (2001) in bersera.

The highest carbohydrate/nitrogen ratio (8.74) was recorded in cuttings treated with IBA 5000 ppm and lowest C: N ratio (6.4) was recorded in control. greater would be the activity of rooting co-factors and there by better rooting as reported by earlier workers Mokashi, 1978 in 'Thompson seedless' grapes; Kaundal and Singh (1989) in *Pyrus communis* and Chandramouli (2001) in bersera.

Treatments details:

T_1	**Control**	**T_7**	**IBA 4500 ppm**
T_2	**IBA 2000 ppm**	**T_8**	**IBA 5000 ppm**
T_3	**IBA 2500 pmm**	**T_9**	**IBA2000ppm+NAA 2000 ppm**
T_4	**NAA 3000ppm**	**T_{10}**	**IBA2000 ppm +NAA 2500ppm**
T_5	**NAA 3500 ppm**	**T_{11}**	**IBA2000 ppm +NAA 3000**
T_6	**-NAA 4000 ppm**	**T_{12}**	**IBA2000 ppm +NAA 3500 ppm**

Table 1: Effect of IBA, NAA and their combination on root parameters

Tr. No	Days for root initiation	Per cent rooted cutting
T_1	**36.00**	**30.00**
T_2	**30.33**	**36.67**
T_3	**29.33**	**41.67**
T_4	**27.33**	**60.00**

T_5	**28.67**	**51.67**
T_6	**28.67**	**50.00**
T_7	**26.00**	**63.33**
T_8	**21.33**	**80.00**
T_9	**28.67**	**48.33**
T_{10}	**29.00**	**48.33**
T_{11}	**29.00**	**48.33**
T_{12}	**29.00**	**45.00**
S. Em ±	**1.10**	**4.74**
C.D @ 5 %	**3.20**	**13.83**

Table 2: Effect of IBA, NAA and their combination on Carbohydrates, Nitrogen and C: N ratio

Tr. No	Carbohydrates (%)	Nitrogen (%)	C: N ratio
T_1	**5.80**	**0.90**	**6.4**
T_2	**5.17**	**0.79**	**6.5**
T_3	**5.30**	**0.80**	**6.6**
T_4	**5.17**	**0.72**	**7.18**
T_5	**5.30**	**0.74**	**7.10**
T_6	**5.53**	**0.77**	**7.10**
T_7	**4.90**	**0.68**	**7.2**
T_8	**4.37**	**0.50**	**8.74**
T_9	**5.47**	**0.79**	**6.92**
T_{10}	**4.43**	**0.78**	**6.90**
T_{11}	**5.10**	**0.76**	**6.7**
T_{12}	**5.43**	**0.82**	**6.62**
S. Em ±	**0.11**	**0.05**	**-**
C.D @ 5 %	**0.33**	**0.13**	**-**

Table 3: Effect of IBA, NAA and their combination on Chlorophyll content of leaves

Treatment details	Chlorophyll content of leaves (mg/g. fr. wt.)		
	Chlorophyll "a"	Chlorophyll "b"	Total chlorophyll
T_1	0.33	0.14	0.48
T_2	0.98	0.40	1.29
T_3	0.91	0.34	1.29
T_4	1.16	0.40	1.56
T_5	1.09	0.48	1.55
T_6	1.07	0.38	1.53
T_7	1.15	0.52	1.69
T_8	1.26	0.55	1.82
T_9	1.09	0.44	1.50
T_{10}	1.09	0.44	1.50
T_{11}	1.06	0.37	1.43
T_{12}	0.90	0.44	1.34
S. Em ±	0.12	0.05	0.17
C.D @ 5 %	0.36	0.17	0.49

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IV. CONCLUSION

On the basis of results obtained in the present investigation, it can be concluded that among the 12 treatments, IBA 5000 ppm shown comparatively good results with respect to days taken for initiation, per cent of rooting and biochemical parameters followed by the IBA 4500 ppm. Based on the findings of the current investigation, it is recommended that vegetative method of propagation through cuttings in Barbados cherry is reliable for nursery plants production as it is a quick and easy method of vegetative propagation.

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