

## Research Article

# Influence of Growth Hormones on Hardwood Cutting of Bougainvillea cv. Dr H. B. Singh

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**Abstract**

An experiment on stimulation of rooting of *Bougainvillea glabra* cv. Dr. H.B. Singh using two different rooting hormones (IBA and NAA) was conducted at Bougainvillea Repository, Division of Floriculture and Landscaping, IARI, New Delhi between the months of February to April, 2017. The experiment was laid out in Completely Randomized Design (CRD) with three replicates. Data were collected on Days to first Sprout, no of vegetative buds/plan, rooting percentage, length of longest shoot, shoot fresh wt./plant, shoot dry wt./plant, length of longest root/plant, fresh wt. of root/plants and Dry wt. of root/plant. The results showed that the treatment of cuttings with NAA (6000 ppm) was significantly better than the control and all the other treatments with respect to rooting of cuttings like Days to first Sprout (14.667 Days), no of vegetative buds/plant (5.333), rooting percentage (100.00%), length of longest shoot (37.667cm), shoot fresh wt./plant (12.0 g), shoot dry wt./plant (0.96g), length of longest root/plant (12.567cm), fresh wt. of root/plant (1.557 g) and dry wt. of root/plant (0.367g) followed by NAA (5000) ppm and IBA (2500ppm) + NAA (2500 ppm) compared to control and other treatments, irrespective of the use of plant growth regulators.

**Keywords:** Bougainvillea, IBA, NAA, Growth regulators, ppm, Rooting hormone

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**Introduction**

Bougainvillea is an important ornamental plant of tropical and subtropical North Indian conditions commonly used as a shrub, hedge and climber in the garden. It bears varied coloured bracts with profuse flowering in dry and hot weather conditions. The modernization and urbanization have enhanced the use of bougainvillea, because landscape horticulture is getting lot of attention and also high in demand due to large scale plantation in urban areas, drought and pollution tolerant, low maintenance requirement in comparison to other plants and various uses. The difficult to root cultivars which are difficult to propagate and whose market demand is increasing day by day application of exogenous rooting hormone on hard wood cutting or on air layering propagation is applicable alternative. Certain nursery men who work at small scale and cannot afford to choose the tissue culture techniques, in such areas work on suitable productive method is very successful and important.

Bougainvillea var 'Dr H.B. Singh'. A hybrid of 'Trinidad' x 'Formosa'. Leaves dark-green, glabrous, elliptic, with acute tip; bracts violet purple, medium to big, cordate released in 1977. In difficult-to-root bougainvillea cultivars [1] like *B. glabra* cv. Dr. H.B. Singh (light purple flower), the rooting success through conventional method of rooting of hardwood cuttings is very low. Various auxins such as Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), Naphthalene Acetic Acid (NAA) and 2,4- Dichloropheoxy Acetic Acid (2,4-D) have been reported to promote rooting in cuttings of the most of the plant species. Each auxin's concentration varies from plant to plant and type of the cuttings used. IBA or NAA or combination of both is mostly recommended for rooting of cuttings. These are available in liquid, talc, tablet, and gel formulations. Liquid formulations are generally sold as solvent based concentrates that may be diluted to the desired concentration for treating cuttings of specific crops [2]. The treatment of cuttings with auxins (NAA or IBA) has been reported to improve rooting in many woody species including *Bougainvillea alba* [3]. The present study was, therefore, undertaken to standardize the growth regulator treatment and method of plantation for improving the rooting of cuttings and establishment of plants.

**Materials and Methods**

The experiment was carried out in Bougainvillea repository of the Division of Floriculture and Landscaping, Indian

Agricultural Research Institute, New Delhi during the year 2016-2017. The hardwood cuttings (20cm, pencil thickness) of *B. glabra* cv. Dr. H. B. Singh, prepared in February, and quick dip treatment were given (10 sec.) with different concentrations of IBA (Indole-3 butyric acid), NAA (Naphthalene acetic acid) and combinations of both. The stock solution of ppm was prepared by dissolving NAA or IBA 1mg/liter distilled water. IBA and NAA directly not dissolve in distilled water so using ethyl alcohol. The required concentrations were prepared by diluting the stock solution with distilled water. The pH was adjusted to 5.8-6.0 by using the 1N HCl or NaOH. The hard wood cuttings were treated with growth regulator with different concentrations as given below:

- T<sub>1</sub> : Control (Without Hormones)
- T<sub>2</sub> : IBA 1000ppm
- T<sub>3</sub> : IBA 2000ppm
- T<sub>4</sub> : IBA 3000ppm
- T<sub>5</sub> : IBA 4000ppm
- T<sub>6</sub> : IBA 5000ppm
- T<sub>7</sub> : IBA 6000ppm
- T<sub>8</sub> : NAA 1000ppm
- T<sub>9</sub> : NAA 2000ppm
- T<sub>10</sub> : NAA 3000ppm
- T<sub>11</sub> : NAA 4000ppm
- T<sub>12</sub> : NAA 5000ppm
- T<sub>13</sub> : NAA 6000ppm
- T<sub>14</sub> : IBA 1000 + NAA 1000 ppm
- T<sub>15</sub> : IBA 1000 + NAA 1500 ppm
- T<sub>16</sub> : IBA 1500 + NAA 1000 ppm
- T<sub>17</sub> : IBA 1500 + NAA 1500 ppm
- T<sub>18</sub> : IBA 2000 + NAA 2000 ppm
- T<sub>19</sub> : IBA 2500 + NAA 2500 ppm

The cuttings were planted in polybag with mixture of cocopeat, vermiculite, vermin compost and sand (2:1:1:1) in month of February and kept in shade net conditions. The experiment was laid out in completely randomized design with three replications to determine the statistical significance of treatment effects. Differences were considered significant at 5% level of significance.

## Results and Discussion

The hardwood cuttings treated with growth regulators (quick dip) were significantly better than the control with respect to rooting of cuttings. (*i.e.* days to first Sprout, no of vegetative bud/plant, rooting percentage, length of longest shoot, shoot wt./plant, shoot dry t wt./plant, length of longest root/plants, fresh wt. of root/plants and dry wt. of root/plants.)

### *Effect of rooting hormones on Survival percentage*

The survival percentage and number of sprout per cutting observed after 75 days of cutting planting. The results show in **Table 1** that the survival percentage of bougainvillea varies from 0 to 100 %. The maximum survival percentage (100%) observed in NAA 6000ppm followed by NAA 5000ppm, IBA 6000ppm and IBA 2500ppm + NAA 2500ppm (90%). The maximum number of sprout per cutting (5.333) observed in NAA 6000 ppm followed by NAA 5000 ppm and both minimum recorded in control. Its due to the auxin application has been found to enhance the histological features like formation of callus tissue and differentiation of vascular tissues [4]. The maximum percentage of sprouting was observed from the treatments where NAA was applied at higher concentration (6000 mg L<sup>-1</sup>) [5]. It was found that in 15-20 cm long cuttings of Bougainvillea with 3-5 leaves of cv. Usha survival (100%) were best with NAA at 4000 ppm or IBA at 4000 and 6000 ppm [6]. Better sprouting from the semi hard wood cuttings of guava when treated with NAA @ 2000 ppm [7]. They also reported that sprouting is mainly attributed to the stored carbohydrates in the cuttings used for sprouting. Some researchers reported that IBA at 6000 ppm was found significantly superior for increasing sprouting percentage, number of shoots of *Bougainvillea buttiana* cv. Mahara in case of *Glycyrrhiza glabra* Linn, while comparing the effectiveness of various concentrations of IBA and NAA on sprouting in cuttings [8, 9].

**Table 1** Effect of exogenous rooting hormone on survival percentage, growth and rooting characters of bougainvillea cv. Dr. H. B. Singh

Treatments	Days to first sprout	No. of Vegetative buds/plant	Survival %	Length of the longest shoot(cm)	Shoot fresh wt./plant(g)	Shoot dry wt./plant (g)	Length of the longest root (cm)	Root fresh wt./plant (g)	Root dry wt./plant (g)
T1	35.333	1.333	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2	30.667	1.333	10.00	3.333	1.00	0.113	2.167	0.013	0.001
T3	27.333	1.333	20.00	10.667	1.173	0.05	2.40	0.017	0.002
T4	23.00	2.667	40.00	16.50	3.333	0.29	5.00	0.30	0.06
T5	21.00	3.00	50.00	20.167	3.667	0.307	5.70	0.467	0.087
T6	19.333	3.00	60.00	21.833	4.00	0.417	5.733	0.487	0.087
T7	16.00	3.667	90.00	24.667	6.333	0.69	7.40	1.12	0.20
T8	27.333	1.667	20.00	11.167	1.233	0.127	2.467	0.087	0.003
T9	25.667	2.333	30.00	12.50	2.833	0.257	4.30	0.29	0.037
T10	16.667	3.00	60.00	24.167	5.333	0.47	6.40	0.68	0.157
T11	16.00	3.333	70.00	24.333	6.333	0.63	7.267	0.927	0.197
T12	15.333	4.333	90.00	27.333	8.667	0.89	9.633	1.30	0.32
T13	14.667	5.333	100.00	37.667	12.00	0.96	12.567	1.557	0.367
T14	26.667	2.00	30.00	12.333	2.367	0.137	3.467	0.13	0.023
T15	22.00	2.667	50.00	17.833	3.333	0.30	5.40	0.373	0.063
T16	25.333	2.333	40.00	13.667	3.00	0.27	4.333	0.233	0.057
T17	17.00	3.00	50.00	23.167	4.333	0.447	6.067	0.503	0.123
T18	16.333	3.333	60.00	24.333	5.90	0.61	6.467	0.693	0.184
T19	15.667	3.667	90.00	25.00	6.667	0.827	7.867	1.19	0.283
Mean	21.64	2.80	50.52	18.45	4.28	0.41	5.50	0.54	0.11
C.D.	9.932	1.452	14.684	13.400	4.353	0.503	3.181	0.827	0.208

### Effect of rooting hormones on Shoot growth

Among the shoot character Table 1 shows that minimum days to first sprout (14.667 days), length of longest shoot/plant (37.667 cm), Maximum shoot wt./plant (12.00 g) and shoot dry wt./plants (0.96g) was recorded in NAA 6000ppm Followed by NAA 5000ppm and IBA2500+NAA 2500ppm and the minimum was recorded in control (**Figure 1**). This might be due to its high concentration which would have stimulated emergence of sprouts in cuttings. Similar information was also reported [10] 4000 mg/l IBA proved the best for number of days taken for sprouting in obtaining, number of shoots/cutting, length of shoot and survival per cent of rooted cuttings in *Bougainvillea peruviana* cv. Touch Glory and in case of *Glycyrrhiza glabra* Linn [9]. Some researchers reported that IBA at 6000 ppm was found significantly superior for increasing sprouting percentage, number of shoots, length of shoot, fresh and dry weight of shoots of *Bougainvillea buttiana* cv. Mahara [8].



**Figure 1** Effect of rooting hormone (NAA) on root and shoot growth of Bougainvillea cv. Dr. H. B. Singh

### ***Effect of rooting hormones on Root growth***

The quick dip treatment of hardwood cuttings with NAA 6000 ppm resulted in maximum percentage of rooted cutting (100.00%), length of longest root/plants (12.567cm), fresh wt. of root/plant (1.557g) and dry wt. of root/plants (0.367g), followed by NAA 5000 ppm and IBA 2500 + NAA 2500ppm irrespective to the use of plant growth regulators (Table 1 and Figure 1). The minimum percentage of rooted/cutting (0 %), length of longest root/plants (0 cm), fresh wt. of root/plants (0 g) and dry wt. of root/plants (0.0 g) was recorded in control. It was reported by the maximum number of roots with the increasing concentration of NAA up to 6000 mg/l [5]. The length of roots also increased with the increasing concentration of NAA. The increase in length of roots in cuttings treated with growth regulators may be due to the accumulation of metabolites at the site of application of auxins, cell enlargement, enhanced hydrolysis of carbohydrates, synthesis of new proteins, and cell division induced by the auxins [11]. It was reported that highest percentage of rooting, number of roots per cutting and root length from the hard wood cuttings of *Bougainvillea* variety Mary Palmer in response to the auxin [12]. Similar information was also reported in 4000 mg/l IBA proved the best for obtaining higher percentage of rooted cuttings, number of roots/cutting, length of root and survival per cent of rooted cuttings in *Bougainvillea peruviana* cv. Tourch Glory [10] and the highest length of root in *Bougainvillea* cuttings with 4000 ppm IBA [13]. The results are in conformity with the earlier findings of beneficial effect of IBA on rooting with quick dip treatment in *Bougainvillea* [1, 14-19] also reported significantly higher per cent of rooting in *Bougainvillea* var. Alok with IBA 2000ppm with quick dip method.

### **Conclusion**

Among the all concentration of Plant growth regulators (IBA, NAA and IBA + NAA) NAA 6000ppm give the Better Results. It is appropriate to increase percentage of rooting for *Bougainvillea* cuttings. This might be due to its high concentration which would have stimulated emergence of sprouts in cuttings. Similar information was also reported [5] and observed the maximum number of roots with the increasing concentration of NAA up to 6000 mg L<sup>-1</sup> and 4000 mg/l IBA proved the best for number of days taken for sprouting in in obtaining higher percentage of rooted cuttings, number of roots/cutting, length of root, number of shoots/cutting, length of shoot and survival per cent of rooted cuttings in *Bougainvillea peruviana* cv. Tourch Glory [10].

The results of the present investigation get support from the findings of above said workers and also suggest that the variation of bract colour is the main reason of attraction of *bougainvillea*. Considering its huge demand and short supply application of rooting hormones on hard wood cuttings would be inevitable practice in the years to come for commercial production of beautiful *bougainvillea* on small scale for nurserymen.

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