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Rooting performance of stem cuttings of three ornamental plants as influenced by growth regulators

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ABSTRACT

An experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka during the period from mid June to mid August, 2005 to find out the effects of different concentrations of growth regulators, Indole Butyric Acid (IBA) and Napthalene Acetic Acid (NAA) on rooting performance of stem cutting of three ornamental plants viz. Nerium, Bougainvillea and Jasminum. The concentrations of growth regulators of both IBA and NAA were control, 200, 300 and 400 ppm. The cuttings were planted on 13 June, 2005 at a spacing of 15 cm x 15 cm. The experiment was laid out in a Randomized Complete Block Design with three replications. The results revealed that both growth regulators IBA and NAA had significant effects on the rooting performance of the ornamental species. Different concentration of growth regulators significantly influenced all the parameters studied. The highest number of root (25.38) was obtained with 400 ppm IBA in Bougainvillea while it was the lowest (8.75) in Nerium at control. The longest root (23.53cm) was produced by 400 ppm IBA in Bougainvillea while Nerium produced the shortest one (6.53 cm) at control. All the different concentrations of IBA and NAA showed higher percentage of success in rooting. Among the species, Bougainvillea showed the maximum percentage of success (95.60) when treated with 400 ppm IBA. On the contrary, Nerium showed the minimum percentage of success (44.33) at control.

INTRODUCTION

In the present world, flowers and ornamentals have become important not only for its aesthetic and social values but also for its economic contribution. Production and trade with these crops are now very much specialized in the developed countries with a significant contribution to their national economy.

Plant propagation is an important aspect of agriculture, particularly in horticulture. Plants can propagate either sexually (by seed) or asexually (by vegetative means). A number of horticultural plants especially ornamental plants are propagated commercially by vegetative means. Many ornamental plants (for example rose, gardenia etc.) do not normally produce any viable seed. On the other hand, this unique characteristic may be deteriorated due to cross pollination when it is propagated through seed.

Recently in certain areas, cultivation of flowers and ornamentals have been found to be more profitable than the production of many field and other horticultural crops by the growers. Production of floricultural crops is now spreading too many parts of the country and its consumers are increasing in number. Although gardening is mostly limited to public institutions and posh areas, peoples of all classes appreciate the aesthetic value of flowers and gardens. Recently, a considerable enterprise is gradually developing in urban areas for flower marketing.

Among the vegetative means, stem cutting is one of the easiest, cheapest and least time consuming methods of plant propagation (Bose and

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Mukharjee, 1977). The rootability of cutting of different plant species is different. There are certain plant species (for example apple, phalsha, etc.) which form roots easily on cutting while some others give root when external manipulating treatment is given.

Bougainvilleas are among the most floriferous shrubby climbing deciduous of the tropics, producing beautiful color effects which can hardly be excelled by any other plant. In recent years, these have become one of the most popular garden plants all over the world. It is a member of the family Nyctaginaceae, with the following three species; *Bougainvillea spectabilis, B. glabra,* and *B. peruviana* which are usually of commercial importance. Flowers are usually inconspicuous and surrounded by brilliantly colored papery bracts that persist on the plants for a long time.

Jasmines are highly prized for their fragrant flowers, which are used for the preparation of perfume. They are grown commercially for the extraction of the essential oil for perfume and for cut flowers which are commonly used for making garlands and bouquet.

Nerium is a tall flowering shrub widely grown in tropical gardens. It bears clusters of showy flowers at the top of the branches mainly during summer and few flushes in the rains. In dry area the plants are shorter in height and the shoots arising after pruning bear flower in the next year, while in humid atmosphere the new shoots require longer period to mature and initiate flowering.

Root initiation with the use of growth regulators occupies a significant position in the field of propagation (Mukherjee et al., 1976). All the growth regulators are not equally suitable for rooting performances. Among the growth regulators Indole Butyric Acid (IBA) is the most commonly and widely used to achieve high percentage of rooting success for the ornamental species (Kundu et al., 1987). Other exogenous hormones which regulate plant growth are Indole Acetic Acid (IAA), Napthalene Acetic Acid (NAA), 2, 4-Dichloro phenoxy acetic acid (2,4-D), Indole Propionic Acid.

When propagation through stem cutting becomes very difficult, treatments with growth regulators are applied in optimum concentration to promote rooting in stem cutting. Activity of growth regulators depends upon the amount of hormone applied and a particular concentration of growth regulator may be more effective for initiation of root in stem cutting. Thus, optimum concentration of growth regulator needs to be determined for different plant species. Therefore the study was conducted to identify suitable growth regulators for better rooting performance in three ornamental plants by using different growth hormones.

METHODS AND MATERIALS

The experiment was carried out at the Horticultural Garden, Sher-e-Bangla Agricultural University, Dhaka, during June to August, 2005.

Climate

The experimental area was under the sub-tropical climate. The total rainfall of the locality was 259 mm in the months of June while the average maximum air temperature was 32.0oC in August. Average maximum relative humidity was 79 percent in June.

Soil

The soil of the experimental area belongs to the Modhupur Tract. The experimental site was a medium high land and pH of the soil was 5.6. The morphological characters of soil of the experimental plots were AEZ No.- 28, soil series- Tejgaon, general soil- on calcarious dark grey (Source: Soil Resources Development Institute, Farmgate, Dhaka).

Preparation of land

The land for the experiment was spaded several times and big and small clods were broken to obtain a good tilth. The weeds and stubbles were removed from the land. The land was divided into 72 plots. The plots were raised to about 6 cm high from the soil surface. No chemical fertilizers were used in the soil.

Nursery bed

Nursery beds having the size of 3m (length) X 1m (breadth) X 15cm (height) were prepared between two adjacent beds, a distance of 30cm width and 15cm depth were kept for ease of movement and proper drainage of rain water.

The experiment

Nerium, Bougainvillea and Jasminum plants were used in this experiment. Two plant growth regulators, viz. Indole Butyric Acid and Napthalene Acetic Acid were used at four concentrations (0 ppm, 200 ppm, 300ppm and 400ppm) to observe their effect on rooting performance of stem cuttings of these plants. The working concentrations were prepared by dissolving required amount of powdered hormone in 10 ml ethanol with using sufficient distilled water. Distilled water and ethanol was used as control. The experiment was laid out in Randomized Complete Block design (RCBD) with three replications.

Preparation of stem cutting

For preparation of stem cutting, about one year old healthy and disease free stems were selected and separated from the mother plant of these three species. Cuttings were prepared 15 cm length having 2-3 nodes. All the leaves were cut off and 25 cuttings were used in each treatment combination. The lower cuts of the stems were made slanting below the nodes and the upper cuts were horizontal above the nodes. The prepared cuttings were then dipped in the plastic bowl for 24 hours, immerging 2.5 to 5 cm of their basal portion before planting in the field. On the contrary, the stems were dipped in distilled water only in case of control treatments.

Planting and caring of cuttings

Cuttings were planted in the beds on 13th June, 2005 at a spacing of 15cm X 15cm. Two thirds of the length of the cuttings was inserted into the soil at an angle of 45º. Immediately after inserting watering was done uniformly by water can. Shading was provided by bamboo made overhead chatai at a height of 2 m to protect the cuttings from excessive rainfall and sunlight. The shading was kept for 2 weeks. Weeding and earthing up was done as and when needed for proper growth and development of the cuttings. Watering was done according to the necessity. There was no incidence of insect and disease in the experimental cuttings. The plots were kept free from weeds by weeding six times.

The cuttings were kept under observation for 60 days. After that 10 cuttings were collected randomly from each of the 72 plots for data collection. Cuttings were uprooted from each plot by digging soils without tearing the roots. Base of each cutting was washed carefully in a bucket of clear water without damaging the roots. Then data were collected for Percent success (survival), number of shoot per cutting, number of root per cuttings, length of shoot per cutting, length of root per cutting, fresh weight of shoot per cutting, fresh weight of root per cutting, dry weight of shoot per cutting and dry weight of root per cutting.

Data analysis

The recorded data on different parameters were statistically analyzed using MSTAT software to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 1% or 5% probability whenever applicable.

RESULTS AND DISCUSSION

Number of shoots per cutting

Combined effects of plants, growth regulators and doses of growth regulators showed a wide range of significant variation. The highest number of shoots per cutting 4.50 was found with 400 ppm concentration of NAA in Bougainvillea and the lowest one (1.65) was found with 0 ppm NAA in Bougainvillea (Table 1).

Length of shoot per cutting

Interaction effect of plants and levels of growth regulators was insignificant. Combined effect of

plants, growth regulators and their doses also showed a wide range of significant differences (Table 1).The longest shoot 25.60 cm was found with 400 ppm concentration of IBA in Nerium. The smallest shoot 10.50 cm was found with the control treatment of IBA in Jasminum.

Table 1
Effect of different concentration of hormones and their concentrations on rooting performance of Bougainvillea.

Treatment combination	Number of shoot/cutting	Length of shoot (cm)	Fresh weight of shoot (mg)	Fresh weigh of root (mg)	Dry weight of shoot (mg)	Dry weight of root (mg)
P1G1C0	1.67	15.93	1461.67	4.43	251.27	1.10
P1G1C1	2.15	20.80	1510.00	6.40	270.35	1.90
P1G1C2	2.30	23.60	1650.00	6.90	290.10	2.00
P1G1C3	2.50	25.60	2350.00	9.00	340.35	2.30
P1G2C0	1.80	15.00	1510.00	4.50	260.70	1.25
P1G2C1	2.23	19.90	1720.00	6.50	285.00	2.17
P1G2C2	2.45	22.80	2250.00	6.90	401.05	2.38
P1G2C3	3.90	22.85	2580.00	9.30	540.85	2.56
P2G1C0	1.90	12.30	890.00	5.40	250.25	1.60
P2G1C1	2.88	14.80	1610.00	15.10	310.33	3.25
P2G1C2	3.87	16.70	1780.00	16.80	405.00	3.40
P2G1C3	4.17	18.20	2390.00	23.47	410.60	5.86
P2G2C0	1.65	11.50	850.00	5.30	230.50	1.33
P2G2C1	2.15	15.60	1590.00	14.90	295.70	2.85
P2G2C2	2.99	18.70	1646.67	16.50	380.88	3.10
P2G2C3	4.50	21.30	2250.00	22.70	355.67	4.17
P3G1C0	1.70	10.50	1070.00	5.20	210.60	1.22
P3G1C1	2.75	13.60	1550.00	9.50	310.10	1.87
P3G1C2	2.88	16.35	1860.00	11.80	330.85	1.55
P3G1C3	3.25	18.05	2270.00	12.39	340.76	1.87
P3G2C0	1.80	13.70	1020.00	8.15	260.23	1.50
P3G2C1	2.50	16.80	1560.00	9.75	325.23	1.77
P3G2C2	2.85	18.70	1820.00	11.80	330.76	2.87
P3G2C3	3.20	20.80	1970.00	12.85	335.67	2.80
LSD 1%	0.38	2.28	179.78	1.29	26.01	0.26
LSD 5%	0.28	1.69	133.17	0.96	19.27	0.19

P1= Nerium, P2= Bougainvillea, P3= Jasminum . G1=IBA, G2=NAA, Co= 0ppm, C1=200 ppm, C2=300 ppm, C3=400 ppm

Fresh weight of shoot per cutting

Interaction effect between plants and doses of growth regulators also showed significant variation. Combined effect of plants, growth regulators and doses of growth regulators showed a wide range of significant variation. The highest fresh weight of shoot per cutting was found 2580.00 mg with 400 ppm of NAA in Nerium, the lowest one 850.00 mg was found with 0 ppm in Bougainvillea (Table 1).

Dry weight of shoot per cutting

Combined effect of ornamental plants, growth regulators and doses of growth regulators were found significant (Table 1).The highest dry weight of shoots per cutting (540.85 mg) was obtained from 400 ppm of NAA in Nerium. The lowest amount of dry weight of shoot per cutting (210.60 mg) was found with 0 ppm of IBA in Jasminum.

Number of roots per cutting

But number of roots per cutting varied widely when cuttings of ornamental plants, growth regulators and their doses were interacted together (Figure 1). The highest number of root (25.38) per cutting was found when cutting of Bougainvillea was treated by 400 ppm of IBA. Hossain (1990) and Akhter (2001) reported similar results. Figure 2 shows abundant of roots that grew from Bougainvillea by using 400 ppm of IBA. Figure 3 presents the effect of NAA on number of roots/cutting in Jasminum and from figure 4 we found the effect of IBA on number of roots/cutting in Nerium at control treatment.

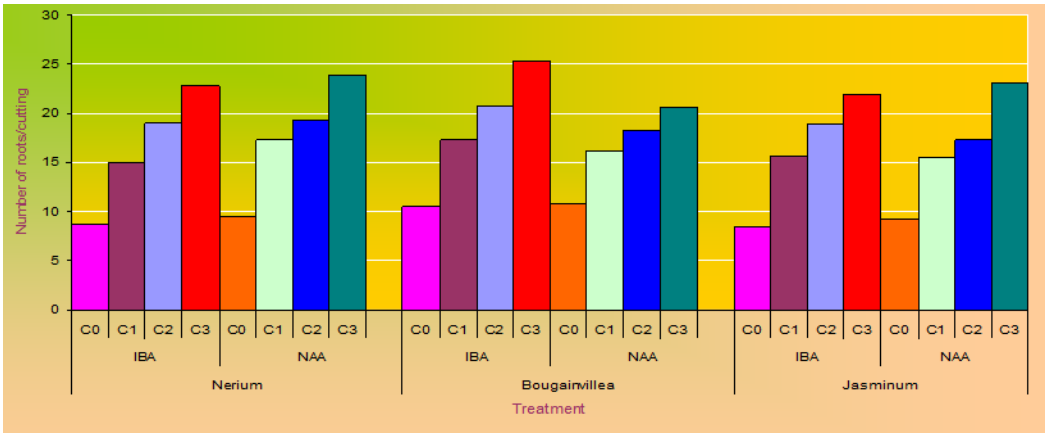

Figure 1
Combined effect of ornamental plants, growth regulators and their different concentrations on number 0f roots/cutting.

Figure 2
Effect of IBA on Number of roots /cutting in Bougainvillea at 400 ppm concentration.

Figure 3
Effect of NAA on number of roots/cutting in Jasminum at 400 ppm concentration.

Figure 4
Effect of IBA on number of roots/cutting in Nerium at control treatment.

Length of root per cutting

Significant variation in respect of root length produced per cutting was observed among the ornamental plants. The longest root produced per stem cutting (14.63 cm) was recorded in Bougainvillea (Figure 5).

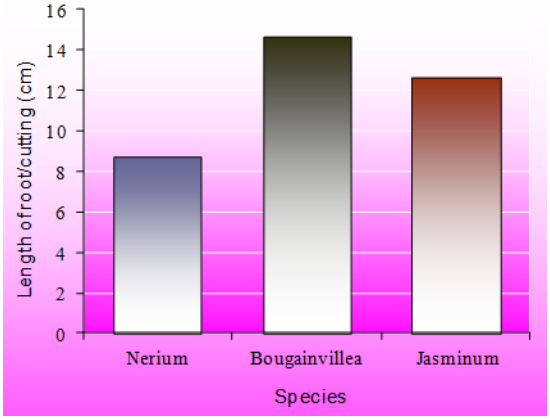

Figure 5
Effect of ornamental plants on length root/cutting of different ornamental plants.

The variation in growth regulator gave significant output, the highest length of root per cutting (12.43) was treated with IBA (Figure 6).

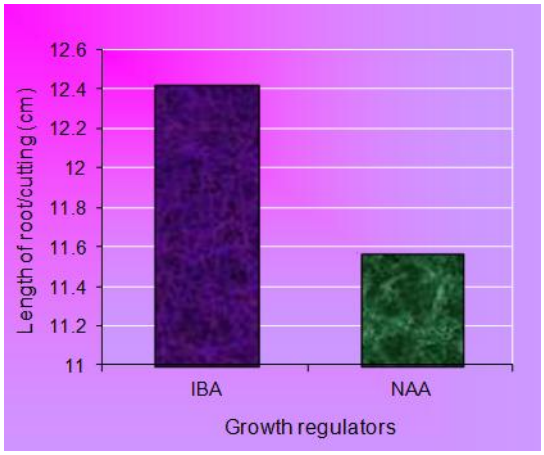

Figure 6
Effect of IBA and NAA on length of root/cutting.

The concentration also showed significant variation. The longest roots 16.64 cm were produced by the treatment 400 ppm concentration (Figure 7).

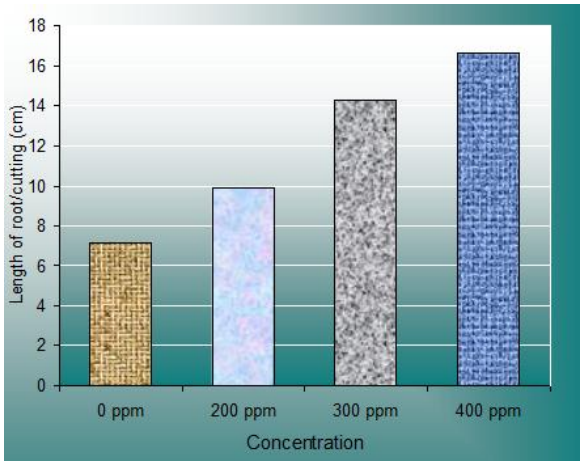

Figure 7
Effect of different concentration of growth regulator on the length of root/cutting.

Interaction effects of ornamental plants with different growth regulators and their concentration were found to be significant (Figure 8). The longest root (23.53 cm) was found when treated with 400 ppm of IBA in Bougainvillea. Kundu et al. (1987) and Hossain (1990) also found similar results in case of Ixora. The lowest root length (6.53 cm) per cutting was produced by o ppm concentration of IBA in Nerium.

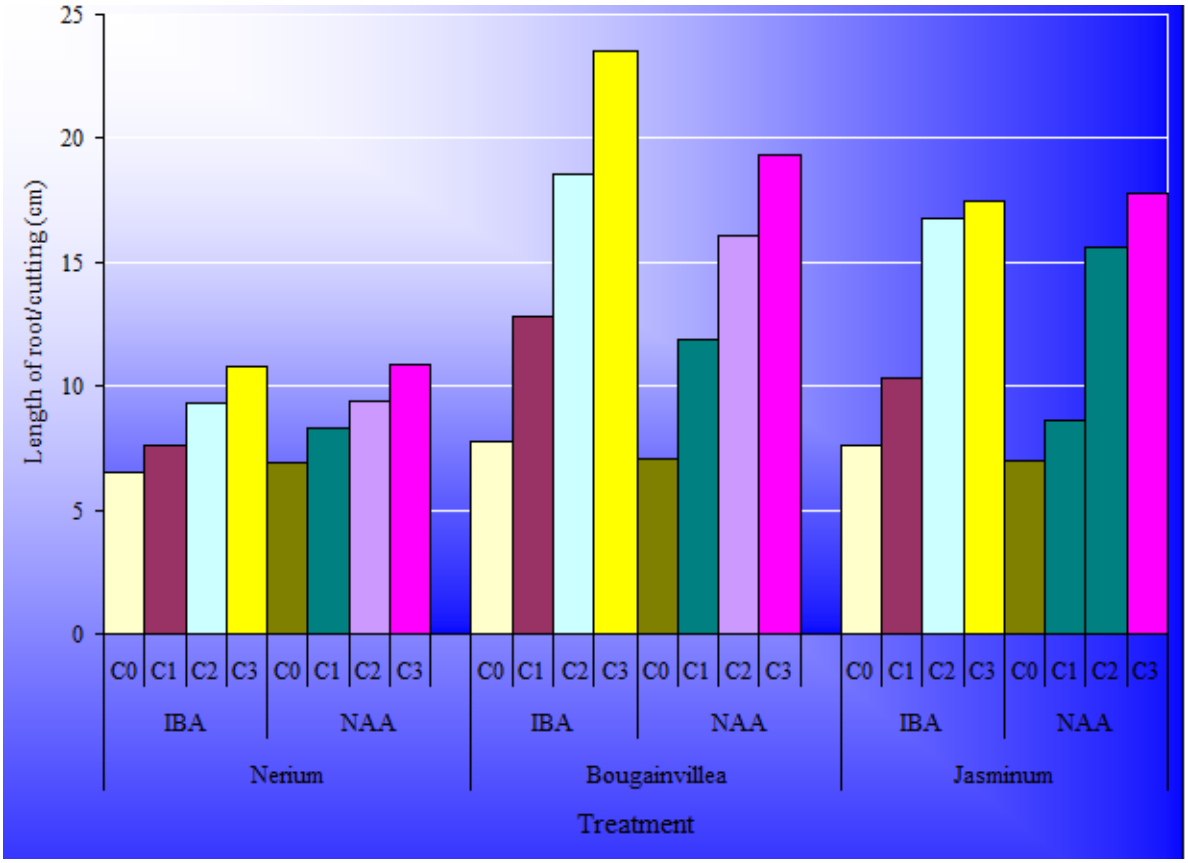

Figure 8
Combined effect of ornamental plants, growth regulators and their different concentrations on number of root/cutting (cm).

Fresh weight of root per cutting

Interaction effect of ornamental plants, growth regulators and their doses of growth regulators showed significant variations. The highest fresh weight of root per cutting (23.47 mg) was found with 400 ppm concentration of IBA in Bougainvillea (Table 1) the lowest fresh weight of root per cutting (4.43 mg) was noted in control treatment of IBA in Nerium.

Dry weight of root

The combined effect among ornamental plants, growth regulators and their doses varied significantly (Table 1).The highest dry weight of root per cutting (5.86 mg) was found in Bougainvillea with 400 ppm concentration of IBA. The lowest dry weight of root per cutting (1.10 mg) was found in Nerium with 0 ppm IBA.

Percent of success

The combined effect among ornamental plants, growth regulators and doses of growth regulators varied significantly (Figure 9). The higher percentage of success 95.60% and 95.10% were found in Bougainvillea and Jasminum with 400 ppm concentration of IBA.

This finding agrees with the results of Singh and Motial (1981). Again the highest value 92.29% was followed by success achieved in Bougainvillea with 400 ppm concentration of NAA. The lowest percentage of success 44.33% was observed in Nerium with 0 ppm concentration of IBA.

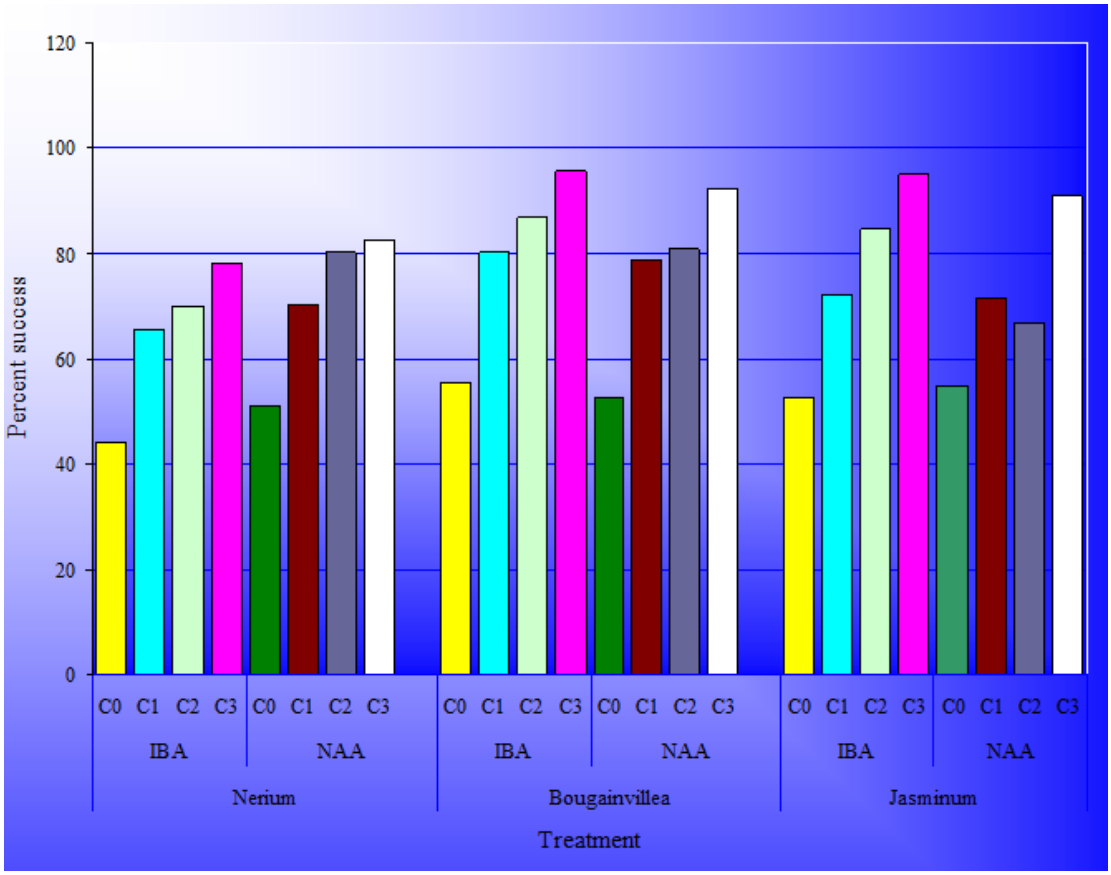

Figure 9
Combined effect of ornamental plants, growth regulator and their different concentrations on percent success of rooting of stem cutting**.**

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