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ENHANCING ROOTING PERFORMANCE OF STEM CUTTING OF GARDENIA (*Gardenia jasminoides*) USING ROOT PROMOTING TREATMENTS

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ABSTRACT

The experiment was conducted with *Gardenia jasminoides* to find out the suitable root promoting treatments of stem cutting both in the winter and summer season. The treatments of the experiment were T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators. The experiment was laid out in Randomized Complete Block Design with three replications. Among the treatments, T_3 was found superior in terms of days required for shooting, number of roots per cutting, number of shoots per cutting, percentage of rooting, percentage of survival, etc, both in the winter and summer season. The results of T_3 were closely followed by T_1 and T_2. On the other hand, the results from T_0 treatment were found lowest in all parameters. However, 78.33% rooting in the summer and 67.93% rooting in the winter were recorded from T_3, whereas it was only 43.66% in the summer and 37.66% in the winter for T_0 treatment.

Key words: Gardenia, plant growth regulators, wounding, propagation, season

INTRODUCTION

Gardenia (*Gardenia jasminoides*) belongs to the family Rubiaceae, native to the tropical and subtropical regions of Africa, Asia, Madagascar and Pacific Islands, is a flower plant. It is evergreen bushy shrub and widely grown in subtropical regions as an ornamental plant for their flowers are heavily perfumed at night. Propagation by cutting is commonly used in the commercial production of ornamental flowers. Cuttings of some species root readily without an auxin treatment, while cuttings of other species benefit from auxin treatment through enhanced promotion of rooting; benefits may be dependent upon the species and cultivar, condition of the cutting wood, time of year, and other factors (Hartmann *et al.,* 2002).

Gardenia is generally propagated by stem cutting. Cutting is easy but some problems arise when cuttings are planted in soil. Some cuttings become dried, wilted and some become rotten. As a result, propagation percentage is reduced. Rooting hormones are very necessary for easy to root and improve the quality of root system developed, decrease rooting time and improve the percentage of cutting rooted (Salman, 1988). There are now several commercial synthetic forms of rooting hormones available for nursery industry, such as IBA or NAA or a mixture of both (Blazich, 1988). Wounding to cuttings base is a common practice in commercial production of rooted cuttings. Wells (1962) stated that wounding was used for first, to speed up the rooting processes, second, to increase the number and quality of roots, and third, to improve attachment points between roots and the cuttings. Al-Noaimy (1999) found by wounding the terminal cuttings of *Cotoneaster prostrate* taken at November to March (except those taken at December) treated with a mixture of IBA and NAA at concentration 1000 mg/L for both by quick-dip method gave the best result for rooting percentage. Many investigators emphasized that the time of the year have a dramatic influence on rooting performance of stem cuttings.

Root-promoting chemicals for plant propagation commonly contain indole-3-butyric acid (IBA), 1-naphthaleneacetic acid (NAA), or a combination of the two, and are available in liquid, talc, tablet, and gel formulations. Root initiation with the use of growth regulators occupies a significant position in the

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field of propagation. All the growth regulators are not equally suitable for rooting performances. Among the growth regulators IBA is the most commonly and widely used rooting hormone to achieve high percentage of rooting success for the ornamental species (Kundu *et al.*, 1987). Other exogenous hormones which regulate plant growth arc IAA, NAA, 2, 4-Dichloro phenoxy acetic acid (2, 4-D), Indole Propionic Acid etc. Activity of growth regulators depends upon the amount of hormone applied and a particular concentration of growth regulator may be more effective for root initiation. In our country, rooting in the winter season is little bit harder than summer season. The performance can be improved with the application of some root promoting treatments. Root promoting chemicals can enhance rooting performance of plants in the winter season as well. In the present study, some plant growth regulators applied individually, and also in combination with wounding treatment to cutting base to improve the rooting performance of gardenia both in the summer and winter season.

MATERIALS AND METHODS

A field experiment was carried out at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka. The experiment was conducted in two season, in winter from December 2020 to March 2021 and in summer from mid March 2021 to mid June 2021. There were four treatments namely, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators. The experimental area was divided into three equal blocks containing 8 plots in a block. There were 24 plots in total. The experiment was laid out in Randomized Complete Block Design with three replications. To provide wounded treatment, Basal parts i.e. proximal end of the cuttings were wounded with surgical blade. These cuttings were collected from mature branches of one year old stem, about 15 cm long having 2-3 nodes depending on the species. All the leaves were cut off and 20 cuttings were used in each treatment. 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 treatment solution for 24 hours, immerging 2.5 to 5 cm of their basal portion before planting in the field.
Cuttings were planted in the beds on the 1st December, 2020 in winter and on the 15th March, 2021 in summer at a spacing of 10 cm x 10 cm. The recorded data on different parameters of the crop were statistically analyzed using Statistix 10 software program and levels of significance of the treatment means were evaluated by LSD test at 5% probability. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F- test.

RESULTS AND DISCUSSION

Days to shoot initiation
Significant variation among the treatments had been observed in days to shoot initiation of stem cutting of gardenia (Table 1). The maximum days to shoot initiation in winter (35.66) was found from the

Table 1. Effect of different root promoting treatments on days to shoot initiation, number of shoot per cutting and length of shoot per cutting

Treatment	Days to shoot initiation		Number of shoot per cutting		Length of shoot(cm) per cutting	
	Winter	Winter	Summer	Summer	Winter	Summer
T_0	35.66 a	34.33 a	2.08 c	2.75 c	0.69 c	1.32 c
T_1	34.00 bc	33.33 b	3.01 b	3.33 b	1.20 ab	1.68 b
T_2	34.33 b	33.00 b	3.08 ab	3.25 b	1.05 b	1.51 bc
T_3	33.00 c	31.00 c	3.33 a	3.58 a	1.30 a	2.61 a
$CV_{(\%)}$	1.68	1.08	5.29	3.92	8.37	8.11
$LSD_{(0.05)}$	1.0843	0.6685	0.2867	0.2385	0.1672	0.2717

(In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators)

control which was similar to that of T_2 and T_1 treatments while the minimum days to shoot initiation (33.00) was recorded from T_3. The maximum days to shoot initiation in summer (34.33) was found from T_0 (control) treatment which was identical to T_1 and T_2 treatments while the minimum days to shoot initiation (31.00) was recorded from T_3 treatment. That means T_3 enhanced the shooting of gardenia in the both season. NAA, IBA and wounding application resulted in earlier completion of physiological processes in rooting and sprouting of cuttings both in the winter and summer

Number of shoot per cutting

Growth regulators exhibited a significant influence on number of shoot per cutting in both winter and summer (Table 1). The maximum shoot per cutting in winter (3.33) was measured from T_3 which was statistically similar to that of T_2 and T_1 while the minimum shoot per cutting in winter (2.08) was recorded from the control. Similarly, the maximum shoot per cutting in summer (3.92) was also measured from T_3 which was statistically similar to that of T_1 and T_2 while the minimum shoot per cutting in summer (2.75) was recorded from the control. The best result was found from NAA, IBA or wounding treated cutting due to the increased mobilization and utilization of the stored carbohydrates in the cutting.

Length of shoot per cutting

Shoot length of stem cutting of gardenia showed statistically significant differences for different growth in winter and summer. In winter, the maximum length of shoot (1.30cm) per cutting was recorded from T_3 treatment which was statistically identical with T_2, while the minimum length of shoot (0.69 cm) was obtained from T_0 (control) treatment. In summer, the maximum length of shoot (2.61 cm) per cutting was recorded from T_3 treatment which was statistically similar with T_1 and T_2, while the minimum length of shoot (1.32 cm) was obtained from T_0 (control) treatment (Table 1). Increased shoot length might be due to the increased mobilization and utilization of the stored carbohydrates in the cutting.

Percentage of shooting

Considering the percentage of shooting of stem cutting of gardenia, significant variation was found in different root promoting treatments in winter and summer (Fig. 1). In winter, the maximum percentages of shooting (33.33 %) was observed in T_3 which was statistically similar to that of T_2 and T_1, whereas the minimum percentage of shooting was obtained in T_0 (20.83 %) treatment. In summer, the maximum percentages of shooting (33.83 %) was observed in T_3 which was statistically identical to T_1 and T_2 treatment whereas minimum percentage of shooting was obtained in T_0 (27.50 %) treatment.

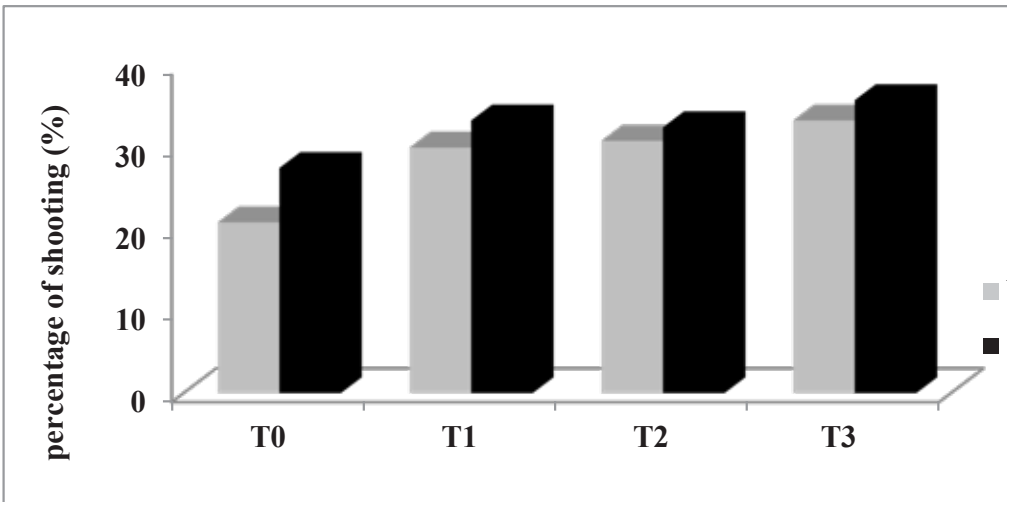

Fig. 1. Effect of different root promoting treatments on percentage of shooting

(Here, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators)

Number of roots per cutting

Root enhancers exhibited a significant influence on number of root per cutting both in winter and summer (Table 2). In winter, the maximum number of root per cutting (6.79) was measured from T_3 treatment which was statistically identical to that of T_2 treatment while the minimum number of root per cutting (4.16) was recorded from T_0 (control) treatment. Considering summer season, the maximum number of root per cutting (7.83) was also obtained from T_3 treatment while the minimum number of root per cutting (4.51) was recorded from T_0 (control) treatment. Root promoting treatments enhance rooting performances both in winter and summer season. It might be due to the effect of PGR and wounding to cutting base. Similar result was also observed by Singh *et al.* (2013) in citrus.

Table 2. Effect of different root promoting treatments on number of roots per cutting, length of root per cutting and number of new shoot at 30 DAT in polybag

Treatment	Number of roots per cutting		Length of root per cutting (cm)		Number of new shoot at 30 DAT in polybag	
	Winter	Summer	Winter	Summer	Winter	Summer
T_0	4.16 c	4.51 c	2.77 c	3.24 c	2.50 c	2.91 c
T_1	6.16 b	6.47 b	3.80 b	5.36 b	3.25 b	3.50 ab
T_2	6.38 ab	6.58 b	3.85 b	5.34 b	3.25 b	3.41 b
T_3	6.79 a	7.83 a	4.81 a	6.25 a	3.58 a	3.83 a
CV $_{(\%)}$	5.18	8.26	7.81	6.37	5.74	6.34
LSD $_{(0.05)}$	0.5731	0.9875	0.5608	0.6055	0.3332	0.4076

(In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators)

Percentage of Rooting

Significant variation among the rooting treatments had been observed in percentage of rooting of stem cutting of gardenia in winter and summer season (Fig. 2). The maximum percentage of rooting in winter (67.93 %) was found from T_3 which was similar to T_2 and T_1 whereas the minimum percentage of rooting (37.66 %) was recorded from T_0 treatment. Similar result was also noticed in the summer season where the maximum percentage of rooting (78.33 %) was recorded in T_3 treatment. On the other hand the minimum percentage of rooting (43.66 %) was recorded from T_0 (control) treatment. That means, by the application of rooting treatments the nursery man can propagate gardenia in winter as well.

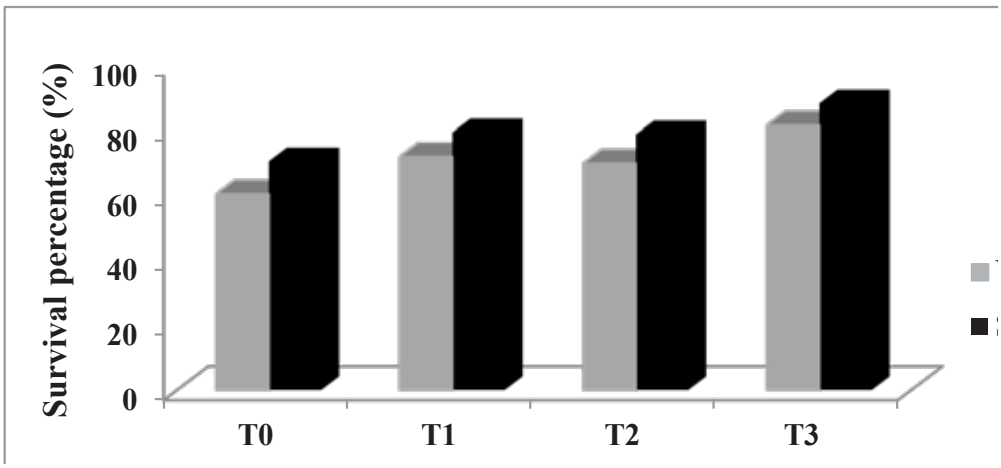

Fig. 2. Effect of different root promoting treatments on percentage of rooting

(Here, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators)

Length of root

Rooting treatments exhibited a significant influence on length of root per cutting both in the winter and summer season (Table 2). The maximum length of root per cutting in winter (4.81 cm) was found in T_3 treatment which was statistically similar to that of T_2 and T_1 while the minimum length of root per cutting (2.77 cm) was recorded from the control. Similarly, in the summer, the maximum length of root per cutting (6.25 cm) was also noted on T_3 treatment which was statistically identical to that of T_1 and T_2 treatments while the minimum length of root per cutting (3.24 cm) was recorded from the control. Increased length of root was might be due to the effect of NAA, IBA and wounding to cutting base of gardenia. Similar result was also noted by Lal *et al.* (2007) in guava.

Number of new shoot at 30 days after transplanting in polybag

Number of new shoot at 30 days after transplanting in polybag is an important parameter for crop plant because of its physiological role in photosynthetic activities. Number of new shoot at 30 days after transplanting in polybag varied significantly due to different root promoting treatments (Table 2). At winter, the maximum number of new shoot at 30 days (3.58) was recorded from T_3, which was statistically similar with T_1 and T_2 treatments, while the minimum number of new shoot at 30 days (2.50) was obtained from T_0 (control). In the summer season, the maximum number of new shoot at 30 days (3.83) was recorded from T_3 which was statistically identical with T_1 and T_2 treatments, while the minimum number of new shoot at 30 days (2.91) was obtained from T_0 (control).

Survival percentage

Considering the survival percentage of stem cutting of gardenia, significant variation was found in different root promoting treatments (Fig. 3). In winter, the maximum percentage of survival (81.61%) was observed in T_3 which was statistically identical to T_1 and T_2 treatment whereas the minimum percentage of survival was obtained in T_0 (60.50 %) treatment. In summer, the maximum percentage of survival (88.42 %) was also observed in T_3 which was statistically identical to T_1 and T_2 treatments whereas minimum percentage of survival was obtained in T_0 (70.69 %) treatment.

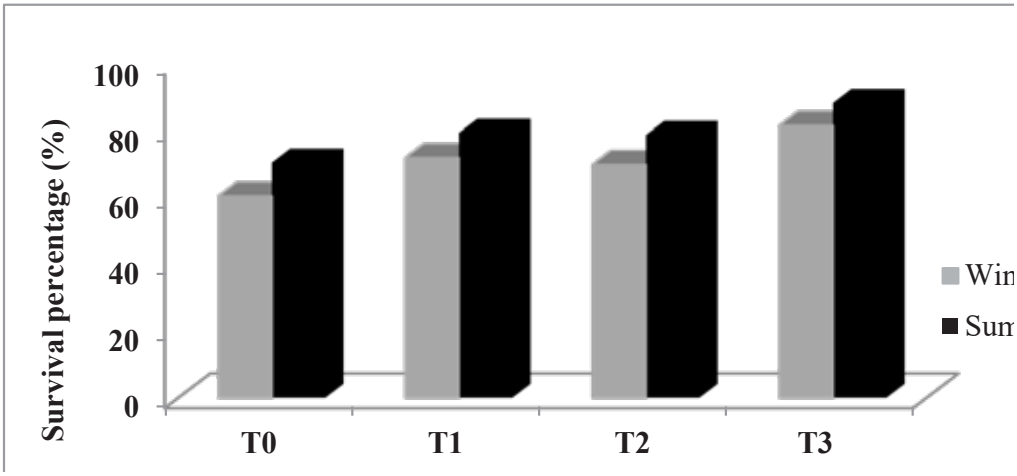

Fig. 3. Effect of different growth regulators on survival percentage

(Here, T_0 = Control, T_1 = Mixed plant growth regulators (1000 ppm IBA + 1000 ppm NAA), T_2 = Wounding to cutting base and T_3 = Wounding to cutting base + Mixed plant growth regulators)

CONCLUTION

On the basis of results of the present investigation, it can be concluded that performance of root promoting treatments was found significant than control treatment. Among the treatments, treatment T_3

(Wounding to cutting base + Mixed plant growth regulators) gave the best results both in winter and summer season for gardenia propagation through stem cutting.

REFERENCES

Al-Noaimy, G.Y.Q. 1999. Study on propagation of Cotoneaster prostrate shrubs by terminal cuttings. M.Sc. Thesis. College of Agric. and Forestry, Mosul University (In Arabic).

Blazich, F.A. 1988. Chemicals and formulations used to promote adventitious rooting. Advances in plant sciences series (USA).

Gupta, V.N., Banarji, B.K and Datta, S.K. 2002. Effect of auxin on the rooting and sprouting behavior of stem cuttings of bougainvillea cv. Los banosvarigata,, Silver Margin‟ under mist. *Haryana J. Hort. Sci.* 31(1-2): 42-44.

Hartmann, H.T., Kester, D.E., Davies J., F.T. and Geneve, R.L. 2002. Hartmann and Kester's Plant Propagation: Principles and Practices, 7th edn. Prentice-Hall, Upper Saddle River, NJ.

Kundu, U.K, Farooque, A.M., Aditya, D.K. and Mondal, M.F. 1987. Effect of IBA on propagation of *Ixora coccinia* by stem cutting. *Bangladesh Hort.,* 15(2): 7-10.

Lal, S., Tiwari, J.P., Aswathi, P. and Singh, G. 2007. Effect of IBA and NAA on rooting potencial of stooled shoots of guava (*Psidium guajava* L.) cv. Sardar. *Acta Hort*., 7(35): 193-196

Salman, M.A. 1988. Propagation of Horticulture Plants.Dar Alkotob Publishing Pressing, Mosul, Univ. Iraq. (In Arabic).

Singh, K.K., Choudhary, T. and Kumar, P. 2013. Effect of IBA concentrations on growth and rooting of *Citrus limon* cv. Pant lemon cuttings. *Hort. Flora. Res. Spectrum*, 2 (3): 268 - 270

Wells, J.S. 1962. Wounding cuttings as a commercial practice. Comb. Proc. *Int. Plant Prop. Soc*., 12: 47-54.