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The Effect of Indole Butyric Acid and the Time of Stem Cutting Preparation on Propagation of Damask Rose Ornamental Shrub

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Abstract

In order to investigate the morphological reactions of cutting of damask rose to IBA (indole butyric acid) in different times, an experiment was done in a factorial experiment based on RCD and three times with three replications and 10 observations per each replication. In this experiment, the simple effects of IBA, time and their interaction effects were measured against morphological properties of damask rose rooting. Important measured factors were the root length, the percentage of rooting, the percentage of callus and the dry root weight. After immersing the cutting in IBA quickly for 5 seconds, the cutting were placed in the medium in a research greenhouse under mist system. According to the findings of the present research, in the simple effect of IBA, their time and interaction, the maximum increase in the average root length was obtained in 4000 mg/L^{-1} IBA and in cutting taken in winter. Similarly, the maximum rooting percentage was achieved in cutting treated with 2000 and 4000 mg/L IBA in March. The highest root dry weight was gained in March and in a concentration of 4000 mg/L of IBA.

Keywords: Indole butyric acid, Morphological characteristics, *Rosa damascena*.

INTRODUCTION

Regarding the necessity to reduce the dependence on oil revenue in the country, paying attention to the role of agriculture and natural resources in establishing a proper setting for export development becomes highlighted in order to develop nonoil exports. The damask rose (*Rosa damascena* Mill.) belongs to the Rosaceae family. It is cultivated in many parts of the world thanks to enjoying an extraordinary aroma and an immense diversity. This family consists of 2000 cultivars and about 100 genera and the chromosome basis of most of them is 2n=14. Iran is among the oldest countries producing flower and rose water in the world, with a 2500-year background.

Damask rose is a deciduous shrub and evergreen samples can hardly be found among them (Rout *et al*., 1999; Nybom *et al.*, 2005). The propagation of this plant is usually asexual and is done through cutting. This method of propagation is not fast, but is the easiest and best method to producing new plants and its greatest advantage is the production of plants similar to the parent (Ruchala *et al.*, 2002). Cutting is the best method for propagation of deciduous ornamental shrubs and evergreen broad-leaved and conifer trees (Khosh-khui, 1997). Research showed that the soft wood cutting of the maple tree is rooted from the terminal parts of young shoots in late spring under mist system and treating them with IBA enhanced rooting precentage. The results obtained from the study on the effect of cutting length and different concentrations of IBA (3000, 4000, and 5000 mg/L) on rooting of the cuttings of ornamental camellia revealed that, 5000 mg L^{-1} IBA, had the highest rooting precentage (Hashemabadi and Sedaghathoor, 2005).

The aim of this study is determination of best IBA concentration and time of cutting on rooting of damask rose.

MATERIALS AND METHODS

In order to investigate on different IBA concentrations and time of cutting on rooting of damask rose, an experiment was conducted in the greenhouse of Agricultural Research and Natural Resources Center of Semnan province under a intermittent mist system. The cuttings carried out during March, June, and October after application of IBA through the quick immersion method and planting in a light soil bed. The study was replicated three times in a factorial experiment based on RCD with 10 cutting in each plot. The best time of cutting is when the first cold results in abscission of leaves. In cold climates, cutting is sometimes done in late winter or early spring, while in warm climates it is from February to mid April (Khosh-khui *et al.*, 2007). If enhanced vegetative growth of plants is required, soft wood cuttings should not be used, however, usage of hard wood cuttings harvested in late fall and early winter is recommended (Hajiyan, 1996). Mist system provided relative humidity above the cultivation bed. In the current research, a hydrometer measured the relative humidity of the greenhouse, where it was variable between 60 to 80 percent in all of the three times. This system has been very effective in enhancing rooting of difficult rooting, soft wood cutting of large-leaved cultivars and broad-leaved evergreen ones unlike conifers.

Cuttings were planted in the rooting bed after 5″ immersing in the iprodione + carbendazim fungicide solution (2/1000) and IBA (0, 500, 1000, 2000, and 4000 mg/L). After 60 days, the cuttings were taken out of the bed and the results were recorded.

In this research, the simple effects of IBA and the time of cutting and their interaction on the mean length of the root, rooting percentage, the percentage of callus and the dry weight of the root were measured. Ruler was used in order to measurement the mean length of the root. After transferred to laboratory, the root was separated completely from the cutting and washed to remove any external materials, then exposed 70 °C for 48 hours. After taking out the dried roots related to each sample from the oven, every sample was weighed separately on a digital balance ($P<0.01$).

Table 1. ANOVA table of effect of IBA and time on morphological characteristics of *Rosa damascene* Mill.

S. O. V	df	MS			
		Average root length	Rooting percentage	Callus percentage	Root dry weight
IBA (H)	4	7.079*	1147.778*	1214.444*	8.314*
Time of cutting (T)	2	23.214*	5446.667*	3795.556*	30.132*
H*T	8	1.790*	182.778^{ns}	167.778^{ns}	2.426^{ns}
Error	30	0.102	157.778	126.667	2.023
Total	45				
CV		16.63	19.15	16.08	71.84

*, n,s : Significant at 5% probability level and not significant, respectively.

Statistical analysis was done by SPSS software and the means were compared using the Tukey test at a 5% probability.

RESULTS

In the results of this research, according to ANOVA (Table 1) and F-test, it can be stated that the simple effects of IBA and the time of cutting length of the root, rooting percentage, callusing percentage, and dry weight of the root were significant at 5% level, interaction effect of IBA and time was not significant at the 5% probability level in these traits except average root longth (Table 1).

Fig. 1 and 2 showed that the highest mean length of the root was seen in 4000 mg L^{-1} IBA, while the lowest one was obtained in the control treatment (Fig.1). Furthermore, the highest root mean length was obtained in cuttings obtained in March, (Fig. 2).

According to results, in all three times, March, June and October, the cutting prepared in March were better in all properties than those obtained in June and October. 4000 mgL^{-1} IBA in cutting obtained in March, had the highest root length among all treatments (Fig. 3).

Rooting percentage

The IBA at 4000 mg L^{-1} enhanced rooting percentage in cuttings with a significant differ-

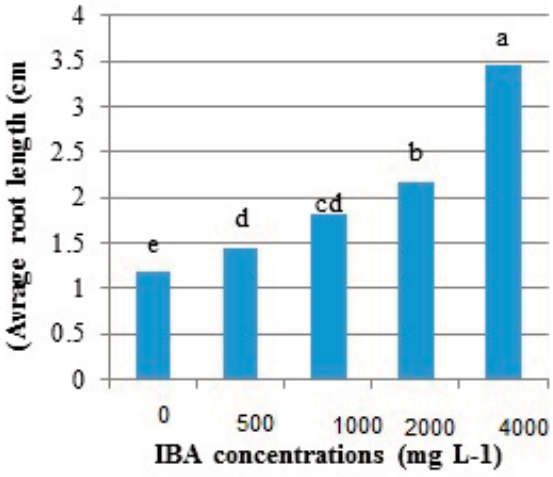

Fig. 1. The effect of IBA on average root length of *Rosa damascena* Mill.

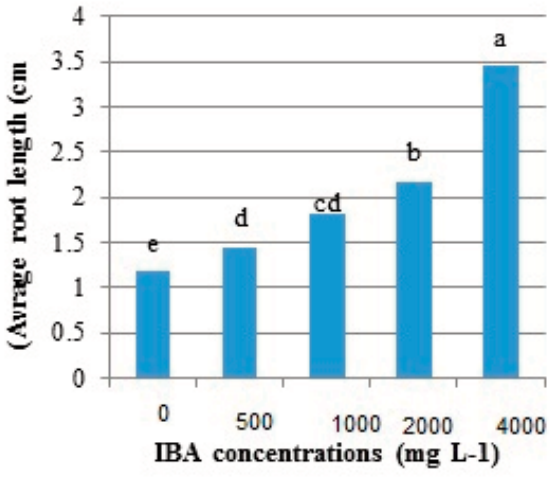

Fig. 2. Times of cutting on average root length of *Rosa damascena* Mill.

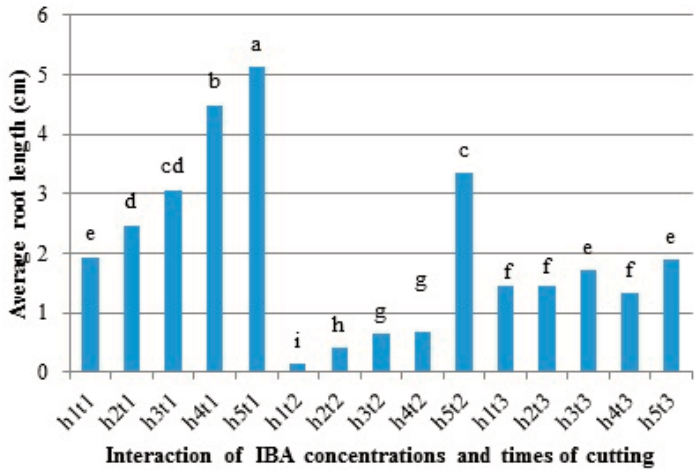

Fig. 3. Interaction of IBA concentrations and times of cutting on average root length of *Rosa damascena* Mill.

ence of 5% compared to 0 and 500 mgL^{-1} (Table 1, Fig. 4). Similarly, the maximum percentage of rooting was obtained in cuttings obtained in March (Fig. 5).

Callus percentage

The comparison of March, June, and October revealed that callus percentage were the best in March than other times (Fig. 8). The 4000 mg L^{-1} IBA showed a positive impact in terms of callus percentage compared to other treatments and increased callus percentage at 5% probability (Fig. 7). Interaction effect of IBA and time of cutting had not significant effect on callus percentage (Table 1).

Root dry weight

Based on the ANOVA (Table 1), it can be observed that the difference among different levels of IBA and various times of cutting are significant at 5% probability level, their interaction effect on root dry weight was not significant (Table 1). The maximum root dry weight was obtained in 4000 mg L^{-1} IBA and the minimum one to the control treatment (Fig. 9).

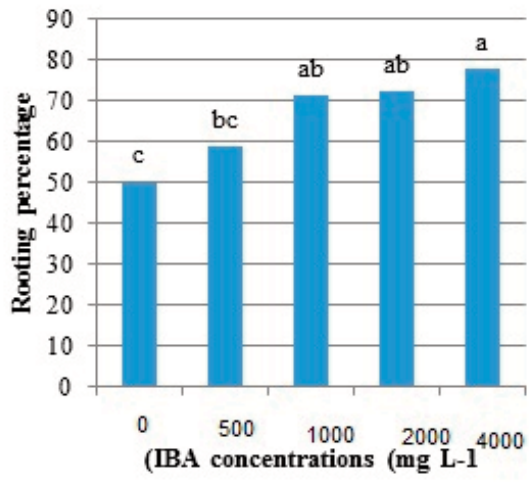

Fig. 4. The effect of IBA concentrations on rooting percentage of *Rosa damascena* Mill.

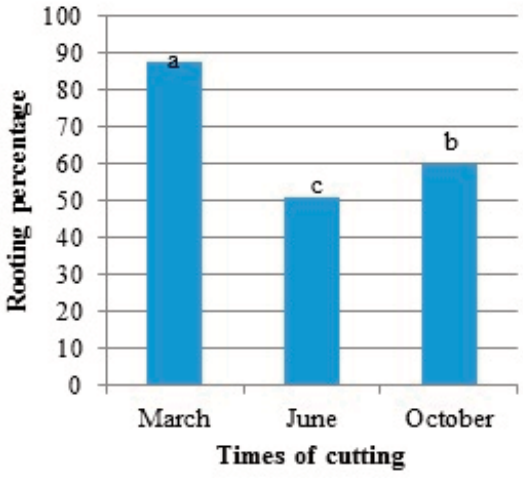

Fig. 5. The effect of imes of cutting on rooting percentage of *Rosa damascena* Mill.

Fig. 6. The comparison of average root length in control treatment (a) and 4000 mg L^{-1}(b).

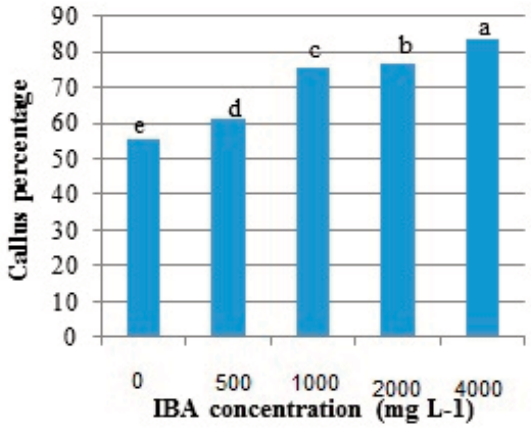

Fig. 7. The effect of IBA concentrations on callus percentage of *Rosa damascena* Mill.

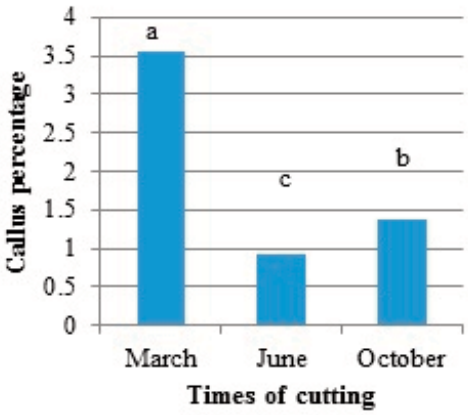

Fig. 8. Times of cutting on callus percentage of *Rosa damascena* Mill.

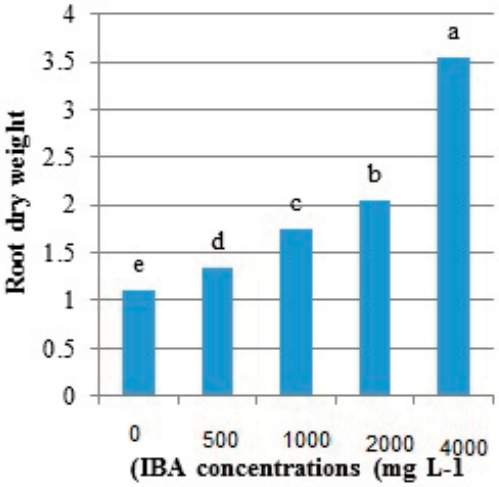

Fig. 9. The effect of IBA concentrations on root dry weight of *Rosa damascena* Mill.

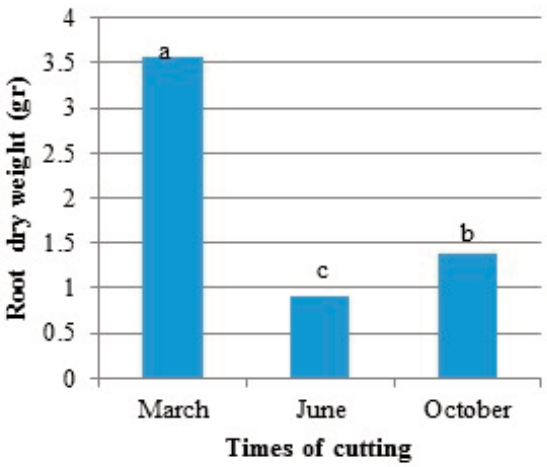

Fig. 10. Times of cutting on root dry weight of *Rosa damascena* Mill.

DISCUSSION

According to the results of this study and evaluation of measured traits in the cuttings of ornamental shrub of damask rose in the greenhouse at different concentrations of IBA and various times of cutting preparation, it can be said that the March improvied all of the traits including the

root mean length, rooting percentage, callus percentage, and root dry weight. Regarding the IBA concentrations, it should be noted that application IBA showed a clear impact on rooting in damask rose. Overall, effect of March with 4000 mg L^{-1} IBA are the best treatment to improve rooting in cutting of damask rose flower.

The results obtained from the effect of different levels of IBA on the diameter of stalks obtained from apple cutting showed that there is no significant difference between various treatments and the control. This can imply that IBA, the applied growth regulator, affects most of the properties related to the root (Delargy and Wright, 2006).

The results of the investigation of two methods of quick immersion end of cutting and spraying IBA and NAA on cutting showed that method of hormone application had significant influence in some species. For example, *Aglaonema, Gardenia*, and ivy cuttings with quick immersion of end cuttings in high concentrations of IBA has been known to be effective compared with spraying on Chrysanthemum, Begonia, and Dieffenbachia (Blythe *et al.*, 2004).

In another study, it has been shown that semi-hardwood cutting prepared during the first week of February, immersed quickly in 4000 mg L^{-1} IBA, had the highest callus, rooting percentages and root dry weight as much as 91.8% compared with the first week of November (Zarin Ball *et al*., 2005). In addition, rooting percentage of cuttings in quick immersion was better tha other methods (Eftekhari and Moalemi, 2003; Zarin Ball *et al.,* 2005).

IBA resulted in significant increase of rooting percentage of *Conocarpus* compared *Dombeya natalensis, Polygonella polygamy,* and *Thunbergia grandiflora* (Gupta and Kher, 1989; Edward and Watson, 2001; Heather *et al.*, 2010).

With regard to the effect of treatments on cutting callus percentages, the results manigfest that application of IBA is more effective than NAA, in *Bougainvillea spectabillis, Hibiscus rosa-sinensis, Thunbergia grandiflora*, and *Polygonella polygama* (Widiastoety and Soebijanto, 1988; Moalemi and Chehrazi, 2003; Gupta and Kher, 1989; Heather *et al.*, 2010), However, it is not consistent with the results obtained by other researchers on *Callistemon citrinus* and *Nerium oleander* L. This incompatibility might be due to the difference of plant types.

According to literatures, external usage of IBA increased IBA mechanism is developing IAA (indole acetic acid) and prepared amino acids required for proteins that are involved in the formation of root primordia (Ryugo and Breen, 2003).

The research on *Callistemon citrinus* demonstrated that the root length and the number of roots are directly correlated with increased root weight. It was also reported that the highest percentage of rooting, maximum number and length of roots, the highest root dry weight, and the maximum leaf number were obtained in cuttings treated with IBA at 4000 mg L^{-1} concentration that obtained in February (Zarin Ball *et al*., 2005).

By stimulating rooting, auxin makes carbohydrates and nitrogenous substances transfer from the leaves to the root, and increased dry and fresh weight of roots (Hashemabadi and Sedaghathoor, 2005).

Hussein (2008) reported that in his study on *Thunbergia grandiflora* maximum rooting percentage and the longest root were obtained in 4000 mg L^{-1} and the highest number of roots was achieved in 6000 mg L^{-1}.

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