VEGETATIVE PROPAGATION IN *DALBERGIA SERICEA*: INFLUENCE OF GROWTH HORMONES ON ROOTING BEHAVIOUR OF STEM CUTTINGS

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Received March 1992

UNIYAL, R. C., PRASAD, P. & NAUTIYAL, A. R. 1993. Vegetative propagation in *Dalbergia sericea*: influence of growth hormones on rooting behaviour of stem cuttings. Vegetative propagation by stem cuttings in *Dalbergia sericea* was studied. Exogenous applications of growth hormones (IAA, IBA, GA_3) influenced rooting behaviour in stem cuttings differently. Sprouting appeared on all cuttings irrespective of treatment. However, sprouting in control and GA_3 treated cuttings dried very early. IBA (100 *ppm*) seemed to be more effective in inducing rooting (per cent cuttings rooted, number of roots per cutting and average length of roots) in *D. sericea* followed by IAA (100 *ppm*), although callus formation was seen on cuttings of all the treatments. Rooting was completely absent from cuttings in the control as well as with GA_3. The possible role of these hormones in rooting of stem cuttings of this species is discussed.

Key words: Vegetative propagation - *Dalbergia sericea* - auxins - rooting

UNIYAL, R.C., PRASAD, P. & NAUTIYAL, A.R. 1993. Pembiakan tampang *Dalbergia sericea* : kesan hormon pertumbuhan keatas sifat pengakaran keratan batang. Pembiakan tampang keratan batang *Dalbergia sericea* telah dikaji. Hormon-hormon pertumbuhan (IAA, IBA dan GA_3) mempengaruhi sifat pengakaran. Pucuk-pucuk kelihatan pada semua keratan-keratan batang. Namun demikian pucuk pada keratan batang kawalan dan GA_3 mengering dengan cepat berbanding perlakukan hormon lain. IBA (100 *ppm*) secara bandingan memberikan kesan yang lebih di dalam pengaruh pertumbuhan akar (peratus pengakaran, bilangan akar per keratan dan panjang purata akar) dan di ikuti oleh IAA (100 *ppm*), walaupun pembentukkan kalus kelihatan pada semua keratan. Tiada akar yang dicerap dari keratan-keratan batang kawalan dan yang diperlakukan dengan hormon GA_3. Peranan yang mungkin yang dimainkan oleh hormon-hormon ini dalam pengakaran keratan spesies ini di bincangkan dalam artikel ini.

Introduction

Rooting of stem cuttings is one of the important means of vegetative propagation which helps in mass multiplication of a species having desired genetic constitution and also to bring out the flowering and fruiting much earlier than from the seedlings. It is a well established fact that growth regulators play an important role in controlling the rooting ability of stem segments (Srivastava & Manggil 1981, Puri & Shamet 1988). Although studies are available on vegetative propagation of species having social forestry/agroforestry importance in the mountains (Nagpal & Singh 1986, Puri & Shamet 1988, Bhatt & Todaria 1990), such studies in *Dalbergia* *sericea*, which is a potential species for biomass production as well as soil amelioration, has not been attempted so far. The present study was an attempt to determine the rooting ability of the stem cuttings of *D. sericea*.

Materials and methods

Stem cuttings were collected from a natural mature tree stand of *D. sericea* at Khanda (760 *m*) near Srinagar in the month of July. Uniform stem cuttings of 27 *cm* length and 0.6 *cm* diameter were selected and divided into seven groups each consisting of 30 cuttings. While the first group served as control, groups 2 to 7 were treated with 100 and 500 *ppm* of indole-3-acetic acid (IAA), indole-3-butyric acid (IBA) and gibberellic acid (GA_3) respectively. For treatment, about 7 *cm* of the basal cut ends were dipped in the respective solutions for 24*h*. Distilled water was used for the control. After treatment the cuttings were planted in non-transparent polythene bags containing equal proportions of garden soil, sand and farmyard manure. The bags were kept in a glasshouse with no artificial illumination and watered regularly. The observations with the naked eye on number of cuttings sprouted, rooted, callus formation, average root length, number of roots and buds per cutting *et cetera*, were recorded at monthly intervals up to two months by uprooting 10 cuttings of each treatment. The average soil temperature at 10*cm* (4 *in*) depth during this period ranged from 30.90°*C* in July to 34.83°*C* in September with a sharp decline to 23.79°*C* in the month of October.

Results and discussion

The results obtained on vegetative propagation of *D. sericea* stem cuttings are shown in Table 1. Gibberellic acid was included in the study as it has been reported to induce rooting by other workers (Nanda *et al.* 1967, 1968b). Concentrations of auxins up to 500 *ppm* were used since even higher concentrations have been used in the successful rooting of some tree species (Radwan *et al.* 1989, Bhatt & Todaria 1990), and in other *Dalbergia* species (Rana *et al.* 1987, Negi 1982). As indicated by the data, within the first month of planting, sprouting was observed in all the treatments except IBA (500 *ppm*) treated cuttings but the percentage varied. Maximum number of cuttings sprouted in IBA (100 *ppm*) treated set followed by IAA (100 *ppm*). The average number of sprouts per cutting was maximum in the control but 100 *ppm* of IBA, IAA as well as GA_3 treated cuttings also had a considerably good number of buds per cutting. The 500 *ppm* of IAA and GA_3 had very poor sprouting not only in terms of per cent cuttings sprouted but also in the number of sprouts per cutting. A decline in the sprouting was recorded in almost all sets with progress of time and at the end of 90 days only IAA (100 *ppm*) and IBA (100 *ppm*) treated cuttings exhibited sprouting, the maximum being in the latter. This decline was gradual as even in the 2nd month of observation, sprouting was recorded in almost all sets except GA_3 (500 *ppm*) although the percentage of sprouted cuttings had declined considerably.

Table 1. Observations on vegetative propagation in *Dalbergia sericea* at different intervals after planting

Treatments	Number of cuttings				Average		
	Observed	Sprouted	Rooted	Callused	Buds/ cutting	Roots/ cutting	Length of root (*cm*)
1st month							
Control	10	4	0	3	5.25	0.00	0.00
IAA 100	10	7	1	4	3.43	3.00	1.00
500	10	1	0	2	1.00	0.00	0.00
IBA 100	10	9	9	1	4.33	18.78	7.00
500	10	0	0	4	0.00	0.00	0.00
GA_3 100	10	3	0	2	4.00	0.00	0.00
500	10	1	0	1	1.00	0.00	0.00
2nd month							
Control	10	2	0	0	2.50	0.00	0.00
IAA 100	10	2	1	0	3.00	10.00	6.67
500	10	1	1	0	1.00	12.00	11.75
IBA 100	10	4	4	0	2.75	35.00	12.00
500	10	1	1	0	1.00	25.00	10.00
GA_3 100	10	1	0	0	10.00	0.00	0.00
500	10	0	0	0	0.00	0.00	0.00
3rd month							
Control	10	0	0	0	0.00	0.00	0.00
IAA 100	10	2	2	0	1.00	11.00	13.00
500	10	1	1	0	1.00	3.00	4.50
IBA 100	10	3	3	0	1.00	11.00	20.00
500	10	0	0	0	0.00	0.00	0.00
GA_3 100	10	0	0	0	0.00	0.00	0.00
500	10	0	0	0	0.00	0.00	0.00
Total							
Control	30	6	0	3	7.75	0.00	0.00
IAA 100	30	11	4	4	7.43	24.00	20.67
500	30	3	2	2	3.00	15.00	16.25
IBA 100	30	16	16	1	8.08	64.78	39.00
500	30	1	1	4	1.00	25.00	10.00
GA_3 100	30	4	0	2	14.00	0.00	0.00
500	30	1	0	1	1.00	0.00	0.00

The rooting did not have an identical pattern to the sprouting. Cuttings in all treatment sets formed callus in the first month which varied from 10% in IBA (100 *ppm*) and GA_3 (500 *ppm*) to 40% in IAA (100 *ppm*) and IBA (500 *ppm*) (Table 1). Callus also formed in 30% cuttings in the control set. Earliest rooting was recorded in the cuttings treated with 100 *ppm* of IBA and IAA where 90% and 10% cuttings rooted respectively within the first month. It seems that the callus failed to differentiate into roots in the control and both the concentrations of GA_3 as none of the cuttings rooted in these treatments even after 60 and 90 days, and also in IBA (100 *ppm*) where the per cent rooting decreased subsequently. In contrast, rooting was observed in IAA (500 *ppm*) cuttings in the second month, though in 10%

cuttings only, which survived even after the 3rd month. Similarly, in IAA (100 *ppm*) treated cuttings rooting was recorded in only 10% cuttings in the first month but later it reached 20% in the third month. Although 10% cuttings of IBA (500 *ppm*) treated set also rooted in the second month of planting, these could not survive by the third month (Table 1). Thus after 90 days of planting, cuttings of only IBA (100 *ppm*) and both the concentrations of IAA treated sets exhibited rooting while rooting did not succeed in other treatments. Irrespective of the growth regulator used, *i.e.*, IAA, IBA or GA_3, the higher concentration exhibited poor rooting, sprouting as well as number of sprouts, roots and root length.

Rooting of cuttings is a complex process involving ecophysiological, biochemical as well as anatomical factors controlling root initiation and development on stem cuttings. Results of the present investigation indicate that application of auxin can bring about rooting in *D. sericea* as auxins have shown promising results at various concentrations for rooting cuttings of several other plant species (Nanda *et al.* 1968a, Brown & Sommer 1985, Puri & Shamet 1988). In the present study IBA (100 *ppm*) was more effective which caused higher rooting as compared to other treatments. It seems that application of IAA and IBA elevated the level of endogenous auxins resulting in the full expression of rooting ability. The auxin induced effect on rooting of cuttings in *D. sericea* is presumed to be mediated through its effect in mobilizing the food reserves by enhancing the activity of hydrolytic enzymes (Nanda *et al.* 1968a). However, rooting of stem cuttings in a species is also dependent on endogenous growth regulators, particular enzyme inactivity (Veeraragavathatham *et al.* 1983), and seasonal variation (Rana *et al.* 1987, Bhatt & Todaria 1990).

Although callus formation was seen on cuttings of all treatments, further differentiation into roots was achieved only in auxin treated cuttings. Girouard (1967) and Bonga and Durzan (1982) have attributed the nondifferentiation of callus into roots either to (i) lack of sufficient food reserve, (ii) some internal factors and/or (iii) age of the cuttings. Such limitation could also exist in *D. sericea* cuttings as even in the control set callus was formed but roots failed to initiate. During vegetative propagation, early growth of sprouting depends on food reserves available in the cuttings (Wright 1975). This is followed by root initiation, which enables the sprouting segment to absorb mineral nutrients from the soil. It seems to be exemplified here by the results obtained on the number of sprouted and rooted cuttings at different intervals after planting; for example, sprouting only in 20% cuttings in IAA (100 *ppm*), 10% in IAA (500 *ppm*) and 30% in IBA (100 *ppm*) was recorded after 90 days as the same cuttings were also rooted. Although 30% cuttings sprouted in the GA_3 (100 *ppm*) treated set in the first month, it decreased to 10% in the second month and ultimately to 0% in the third month because root initiation did not occur. Similarly, the sprouts failed to survive in the control set probably for the same reason. So in the present study sprouting along with simultaneous root initiation on cuttings treated with auxins might lead to their further survival in contrast to wilted and dried cuttings found in the control and GA_3 treatments where rooting failed to occur. This type of observation was also found in some dipterocarps by Srivastava *et al.* (1986) where the majority of shoots wilted as roots were not formed simultaneously. In the present case, successful establishment of the rooted cuttings in IAA and IBA (100 *ppm*) treated sets seemed to be supported by a progressive increase in the average root length with progress of time which was recorded maximum in the 3rd month observation. The most interesting point of the IBA induction of rooting was the development of nodules in the roots where an average of nine nodules per cutting were observed.

Acknowledgements

Financial assistance from the Department of Non-Conventional Energy Sources, Government of India, is gratefully acknowledged.

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