



SEED GERMINATION, SEEDLING GROWTH AND ROOTING OF BRANCH CUTTINGS OF *DALBERGIA SISSOO* ROXB

Md. Abdul Matin*, Md. Sajedul Islam and Md. Salim Azad

Forestry and wood Technology Discipline, Khulna University, Khulna 9208, Bangladesh

Abstract: Seed germination with or without seed coats, their seedlings growth and rooting performance of leafy branch cuttings of *Dalbergia sissoo* Roxb. were studied. In seed germination, seeds with coats showed higher success (68%) but seed coat delayed germination by limiting water absorption in dormant seeds. Higher growth was found in seeds with coat both in terms of height and diameter of seedlings. In case of rooting of branch cuttings, use of 0.8% IBA showed the highest rooting success (90%) with more root number (30) than control where rooting success and root number were 60% and 15, respectively. Difference was not found among the average root length in control and treated cuttings.

Key words: Seed germination, seedling growth, branch, rooting, cuttings and *Dalbergia sissoo*

Introduction

Sissoo (*Dalbergia sissoo* Roxb.) belonging to the family Leguminosae, sub family Papilionidae, is important silviculturally and economically (Troup, 1921). Twenty-seven species of the genus are represented in India, of which 15 are indigenous in Indian Subcontinent (Thothathri, 1987). It is widely recognized as an important multi-purpose tree species. No other timber species, except teak, is so planted in the Indo- Pak-Bangladesh sub - continent. The species is also widely cultivated in urban and roadside areas in the Indian subcontinent. In Bangladesh Sissoo is extensively cultivated by the farmers in the south-western part in small farm forestry or wood lot plantation ranging from 0.5 to few hectares.

Quality seed and seedlings are the important factors to increase yield and to improve the quality of tree products for any land use system related to tree plantings. In Bangladesh, forest department, government agencies and NGOs are mainly associated with nursery raising and planting through the execution of agroforestry, social forestry and homestead forestry programmes (Matin and Rashid, 2000). Seed and seedlings are the main planting materials in most of the tree planting programmes. Quality certified tree seeds are not available in the market other than the seeds collected from locally available trees without considering the genetic potential of seeds (Kamaluddin, 1997). The seed collectors do not always collect seeds at the best time to achieve optimal maturation state. In addition un-predictability of seeding of most species, heavy or gregarious flowering every few years, insects and fungi attacking both flower and seed, formation of poor percentage of flowers into fruits, etc. are very common in tropical natural forests (Ibrahim, 1977). As a result of the above problems, shortage of seed supply, poor germination percentage,

* Corresponding author: Professor Md. Abdul Matin, Forestry and Wood Technology Discipline, Khulna University.

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non-uniformities in timber, slow growth and average low productivity in stands are most common in tropical forests (Matin and Rashid, 1992). Thus, quality seed source and healthy seedlings are prerequisite for raising large-scale quality plantations.

Propagation of vegetative materials from mature plus trees for using them directly as stock plants is an important aspect of clonal silviculture. When a species is amenable to establish, rooting by stem cuttings from mature trees, it is relatively easy to establish stock plant orchards of its plus trees for mass propagation by juvenile stem cuttings (Kamaluddin *et al.*, 1994). Though propagation of *sissoo* by stem cuttings has been known since long (White, 1990), information on mass propagation of stem cuttings for direct field planting is very scarce (White and Thapa, 1990). A propagation method is yet to be developed for the production of planting stock at a low cost. Moreover, establishment of stock plants and their management may allow continuous supply of planting stocks of desired genotypes at an operational scale. Therefore, an attempt has been taken to develop techniques for easy seed germination and healthy seedling growth and their mass propagation through stem cuttings in a non-mist, low-cost propagator by using rooting hormone at different concentrations.

Materials and methods

Seed germination: The fruits of *sissoo* were collected from the plus trees selected in different areas of Chudanga, Meherpur and Khustia districts during 1999-2000. The ages of plus trees were 25-30 years. The pods were dried for 3-4 days in open sun and then stored for germination. The rooting medium was a mixture of soil and cow dung (3:1 ratio). The average ranges of relative humidity, rainfall, air-temperature were 76-80%, 196-200 cm and 28-32 °C respectively, during the course of experiment. Seed germination was done in transparent polybags (15x10 cm) with seed coat and without seed coat conditions. In each treatment 100 seeds were sown in the medium. Watering was done manually during dried days at 9:00 am, 12:00 a.m. and 3:00 pm. The number of seeds germinated was recorded every day in each condition by counting the number of seeds germinated. The starting and finishing dates of germination were recorded and total lengths of period (days) were also calculated. Percentage of germination in both treatments was also calculated.

Seedling growth: To study the growth performances in both the seed coat and without coat conditions, seedlings raised in polybags were used and randomized complete block design was followed with 4 replications (10 seedlings in each replication) for each condition. Height and diameter (at collar zone) were recorded in each month. The height growth was measured by a meter scale and diameter by slide caliper.

Rooting of branch cutting: The scions were collected from the plus trees and packed in gunny bags and moist them by spraying water. The vegetative propagation was done during February-April, 2000. Leafy green stem cuttings, 15-18 cm long with 3-nodes each were used. Two leaves with 2 leaflets trimmed to 50% leaf area retained in each cutting. The basal end of the cuttings was poured in indole- 3yl butyric acid powder (0.4% and 0.8% IBA). The cuttings were set into a non-mist propagator made locally (a modified version of Leakey *et al.*, 1990) immediately after treatment. The control was also set in the same propagator without treatment. The cuttings were placed in randomized complete block design. There were four replications of 10 cuttings having 40 cuttings for each treatment.

The cuttings were placed inside the polybags filled with the rooting media consists of coarse sand at the bottom (5 cm) and fine sand (10 cm) to the top of each polybag. The humidity was 80% inside the propagator. The experiment was done in the nursery of Forestry and Wood Technology

Discipline, Khulna University, Bangladesh and mean maximum air temperature was 30 °C and the mean minimum air temperature was 23 °C during the experiments.

Results

Seed germination: Seed germination percentage (Table 1) of *sissoo* in both seeds with coat and without coat in cow dung mixed soil (3:1) was determined after four weeks.

Table 1. Seed germination percentage (mean of 100 seeds) of *sissoo* in both seeds with coat and without coat in cow dung mixed soil (3:1) after 4 weeks.

Treatment	Germination period (in days)			
	start	cease	total	%
With seed coat	10	25	15	68
Without seed coat	3	8	5	65

Height growth: The effect of season on height growth of *sissoo* seedlings with seed coat and without seed coat was determined in cow-dung mixed soil (Fig. 1).

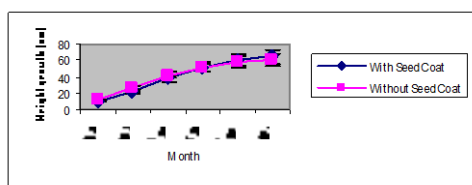


Fig. 1. Effect of season on height growth of *D. sissoo* seedlings with seed coat and without seed coat. Bar shows 95% confidence limit.

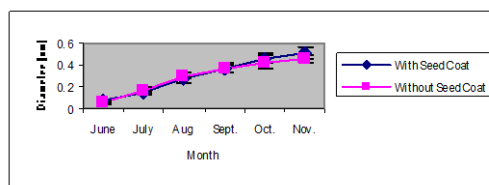


Fig. 2. Effect of season on diameter growth of *Dalbergia sissoo* seedlings with seed coat and without seed coat. Bar shows 95% confidence limit.

Diameter growth: Effect of seed coat and without coat on diameter growth of *sissoo* seedlings was determined in cow-dung mixed soil (Fig. 2).

Rooting of cuttings: Effect of IBA on rooting of cuttings of *Dalbergia sissoo* (Table 2) was determined after 28 days into the propagator. New buds and roots were found earlier in the treated cuttings than the control. Rooting was significantly influenced by IBA concentrations. Cuttings treated with 0.8% IBA showed highest rooting success (90%). The same trend was also found in root number (30) but not in root length.

Table 2. Effect of IBA on rooting of cuttings of *Dalbergia sissoo* after 28 days into the propagator at 5% level of significance.

IBA conc.(%)	Average root no.	Average root length (cm)	Rooting success(%)
0.8	30 ± 7.5	5.0 ± 2.0	90
0.4	25 ± 6.0	5.0 ± 2.5	80
0.0	15 ± 5.0	4.0 ± 2.0	60

Discussion

Seed germination: Higher germination percentage was found in seed with coat than without seed coat. However, seeds with coat required more time to start and finish the process of germination. It was probably due to seed coat impermeability to water or oxygen or both that delayed seed germination (Kozłowski, 1971). Besides, it might be due to the fact that seeds need more time to rot the coat, which reduced germinating energy. Morris *et al.* (2000) found in two species of *Grevillea linearifolia* and *G. wilsonii* seed dormancy were controlled by seed coat or by both seed coat and embryo respectively. The present experiment was also suggested that germination period has no effect on percentage of germination (Table 1) but higher germination capacity is seems to

be controlled by seed viability, seed dormancy and/or injury of seeds by fungi or insects (Matin and Rashid, 1992). The present study also supported the hypothesis that the seed coats slow germination by preventing swelling and limiting water absorption in the dormant seeds (Barnett, 1972).

Height growth: At the end of 6-months, the height growth of seedlings originated from seeds having coat and without coat was showed in 1st and 2nd position respectively. Analysis of variance showed significant differences in height growth between the treatments. Seedlings of without seed coat showed higher height growth during wet season than that of seedlings originated from with seed coat. But in semi dry season, seedlings of without seed coat showed lower height growth than that of seedlings originated from with seed coat. It may be the cause that during wet season (June-August) in without seed coat condition absorption of water was higher whereas in seed coat condition water imbibition was less. On the other hand, in semi-dry period (September-November) seed with coat showed more growth probably due to more storage of water in rotten seed coat, and the reverse mechanism was happened in without seed coat condition. The cause of this tendency of poor height growth in without seed coat condition during semi-dry period might be due to water stress (Matin and Banik, 1993).

Diameter growth: At the end of 6-month, the collar diameter growth of seedlings originated from seeds having no coat was higher in wet season relating to seedlings originated from with coat. But in semi dry season (September- November) the diameter growth of seedlings having seed coat showed higher performance than that of seedlings of without seed coat. Analysis of variance showed that there is significant difference between the treatments. Diameter growth showed the same tendency of seasonal variation like height growth.

Rooting of cuttings: In the control that showed only 60% rooting success and the root number was only 15. The use of IBA enhanced rooting time was reported by Kumer *et al.* (1993) and higher concentration of IBA showed higher rooting success were also reported by not only in *Dalbergia sissoo* (Kamaluddin *et al.*, 1994; Gupta *et al.*, 1993) but also in other tree species (Badola *et al.*, 1993; Matin and Rashid, 1999). In a study of rooting of cuttings in *D. sissoo*, Shamet and Kumer (1988) reported that the use of IBA increased rooting to more than or equal to 40%. But the use of IBA did not affect on root length was also reported by Kamaluddin *et al.* (1994) with *D. sissoo* and also to the tree species (Matin and Rashid, 1999).

Conclusion

In case of *Dalbergia sissoo*, seeds with coat performed better in both seed germination and growth. Moreover, time period for germination did not affect the germination success. Thus, traditional method of germination with seed coat is recommended for future large-scale plantation programme. In case of rooting of cuttings the use of IBA is beneficial to the farmers as the presence of more roots in cuttings help to establish within short time and that can save time and money to the farmers.

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