

Effects of Plant Materials, Cutting Positions, Rooting Media and IBA on Rooting of *Shorea leprosula* (Dipterocarpaceae) cuttings

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ABSTRAK

Kajian ini menguji kemungkinan menghasilkan stok tanaman bagi *S. leprosula* Miq. dari bahan yang bertlainan (anak benih dan tunas), bahagian keratan (pucuk, tengah dan pangkal) dengan menggunakan kepekatan IBA (kawalan, 50 µg dan 150 µg dan Seradix 3) dan media pengakaran (pasir, sabut kelapa dan sekam padi). Penanaman keratan bahagian tunas bawah menghasilkan peratus pengakaran sebanyak 100% setelah ianya dirawat dengan 100 µg IBA dan ditanam di pasir sebagai media pengakaran. Berdasarkan kepada peratus kemandirian dan pengakaran, analisa varian menunjukkan perbezaan yang sangat bererti ($p < 0.001$) di antara rawatan. Keratan tunas menghasilkan pertumbuhan akar yang lebih baik daripada keratan anak benih.

ABSTRACT

Vegetative propagation by cuttings of seedlings of *Shorea leprosula* can be an effective, easy and economical means for raising quality planting stock. This study examined the possibility of raising planting stocks of *S. leprosula* from different plant materials (coppice and seedlings), cutting positions (upper tip, middle and basal), using concentrations of IBA (control, 50 µg, 100 µg, 150 µg and Seradix 3) and in rooting media (sand, paddy husk and coconut fibre). Basal cuttings of coppice gave the highest rooting percentage, 100% when treated with 100 µg IBA and grown in sand rooting medium. Analysis of variance based on survival and rooting percentages showed high significant differences ($p < 0.001$) among and between the treatments. Coppice cuttings produced better root growth than seedling cuttings.

INTRODUCTION

Vegetative propagation using stem cuttings is an effective alternative means of raising planting stock for species with irregular seed supply or for clonal propagation. In tropical countries, seed supply and variability among trees are two major problems in tree planting programmes. The long and irregular periodicity of flowering and fruiting season (Ng, 1976), and short seed viability period (Lo, 1985), further prevent the production of a large planting stock. Other problems associated with seed production include poor seed tree selection and accessibility of seed source. Hence, most of the seedlings raised from such seeds would have phenotypic variation making uniformity of growth and form difficult to attain. Thus clonal propagation using cuttings can be one of the ways of overcoming the problems outlined.

Shorea leprosula Miq. is one of the main commercial species within the red meranti group in Malaysia. It has been reported that *S. leprosula* is probably one of the merantis that can be easily regenerated silviculturally (Wyatt Smith, 1966). However, the regeneration after logging is problematic because of its unpredictable seed supply due to irregular flowering and fruiting (Smits, 1983; Annuar, 1989). Successful propagation by cuttings would help to provide a regular supply of planting stock. Limited studies have been conducted on the rooting ability of cuttings of indigenous species particularly on how rooting could be influenced by factors such as hormonal treatment, cutting materials, cutting positions and rooting media. This study examined how cutting positions, rooting media and growth hormones affect the rootability of *S. leprosula* using cuttings.

MATERIALS AND METHODS

Cuttings were obtained from uniform and healthy 2 month-old coppice shoots and 9 month-old seedlings raised in the nursery. Four weeks prior to the cutting experiment, the seedlings were fertilized with 1.5 g/liter of NPK 15:15:15 in liquid form to ensure vigorous growth and sufficient food reserves in these cuttings. Coppice shoots were obtained by decapitating the over-aged (7 year-old) seedlings two months prior to the cutting experiment. Uniform single-stem seedlings and coppice shoots were selected and cut into single-node cuttings with a leaf each, trimmed to about 30% of their size. The cuttings were then vertically inserted into rooting media which were misted one minute every half hour. To maintain high humidity, the beds were covered with gunny sacks mounted on a wooden frame.

The experiment involved a 2 x 3 x 3 x 5 factorial combination of two plant materials (coppice and seedlings), three cuttings derived from specific positions (basal, middle and tip respectively), three rooting media (coconut fibre, paddy husk and sand), with three auxin concentrations of Indole butyric acid (IBA of 50 µg, 100 µg, 150 µg) plus Seradix 3 and auxin free as the control. Hormone was applied to the basal tips of cuttings by the droplet method. Cutting positions, viz: basal (B), middle (M) and tip (T) of seedling (S) cuttings were obtained from the main stem at the second, sixth and tenth nodes respectively. For coppice (C), cuttings were taken from the second, third and fourth nodes respectively starting from the apex. Therefore, seventy five cuttings were used for each treatment.

Survival percentage which is the percentage of alive cuttings, rooting percentage, root number, root and dominant shoot length, root and shoot dry weight were assessed after two months of planting. The cuttings were considered alive if the inner bark was still green (Alias, 1984).

The data were analysed for variance among treatments and for interactions between and among treatments. Treatment means were compared using the Duncan Multiple Range Test at $p < 0.05$. SAS, a statistical package, was used for the analyses.

RESULTS

Effects of cutting position

Generally, coppice cuttings showed higher survival and rooting percentages than cuttings obtained from seedlings (Table 1). For coppice cutting, rooting percentage increased significantly from the tip to the base. But for seedlings, cuttings from the middle position produced the highest rooting percentage.

TABLE 1
Effects of cutting position on the survival and rooting percentages of *S. leprosula* cuttings

Cutting Position	Survival %	Rooting %
Coppice:		
basal	100a*	65 a
middle	99 a	45 b
tip	95 b	29 c
Seedling:		
basal	8 e	7 d
middle	51 d	44 b
tip	77 c3	1 C

* Values with the same letters are not significantly different at $P < 0.05$ based on the Duncan Multiple Range Test

Between the two plant materials, coppice cuttings generally tended to have better root development in terms of number, length and dry weight than the seedling cuttings (Fig. 1). However, shoot development of coppice cuttings showed an opposite trend to root development (Fig. 2).

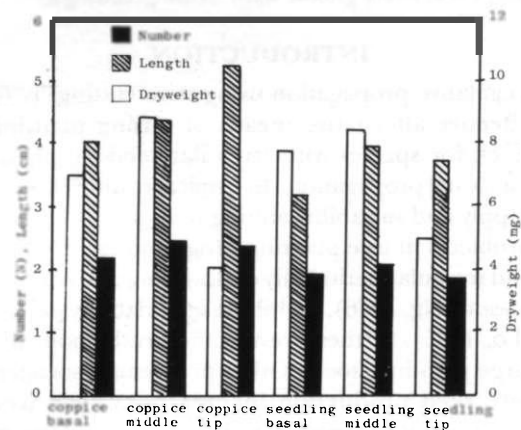


Fig. 1: The effects of cutting positions on the root development of *S. leprosula* cuttings

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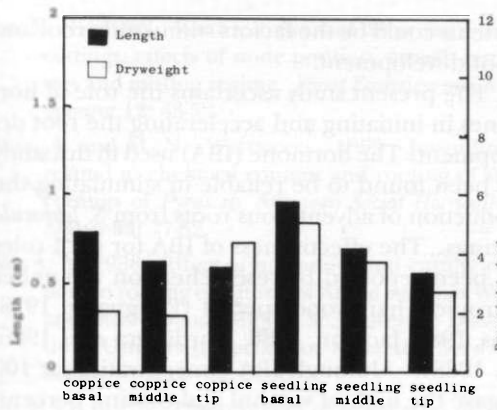


Fig. 2: The effects of cutting positions on the shoot development of *S. leprosula*

Effects of rooting medium

Both, the survival and rooting percentages were significantly different ($P < 0.001$) when grown in different rooting media (Table 2). Cuttings of *S. leprosula* rooted better in sand (41%) than in coconut fibre (37%) and paddy husk (33%). However, root growth and development in cuttings grown in coconut fibre and paddy husk were observed to be better than in those grown in sand (Fig. 3).

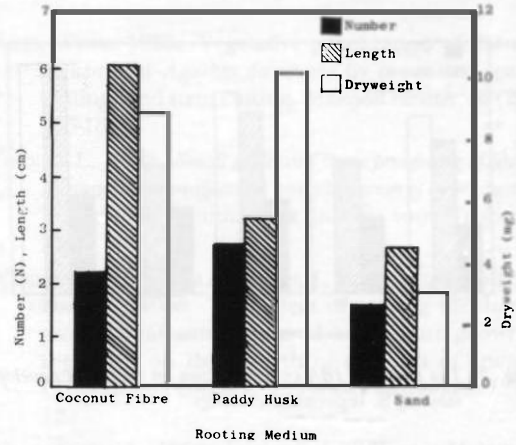


Fig. 3: The effects of rooting media on the root development of *S. leprosula*

Effects of IBA concentration

Both, the survival and rooting percentages were significantly different ($p < 0.001$) when grown in different IBA treatments (Table 2). Generally, hormonal treatments gave better rooting responses than the control (without hormone) in *S. leprosula* cuttings (Fig. 4). The highest survival and rooting percentages recorded were 82% and 64% respectively when treated with 100 µg IBA. The optimum root growth based on the number, length and dry weight was obtained from cuttings treated with Seradix 3 (Fig. 5).

TABLE 2
Analysis of variance (ANOVA) of survival and rooting percentages of *S. leprosula* cuttings.

Sources	Survival %	Rooting %
Cutting Position (POS)	707.38 ***	201.62 ***
Rooting medium (MED)	10.66 ***	19.54 ***
IBA hormone (HOR)	49.95 ***	233.62 ***
POS x MED	6.08 ***	3.66 **
POS x HOR	10.25 ***	12.17 ***
POS x MED x HOR	1.59 N. S.	1.90 N. S.

** - $P < 0.01$
 *** - $P < 0.001$
 N.S - Not Significant

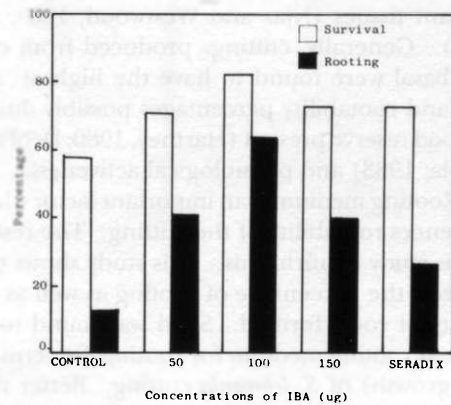


Fig. 4: The effects of IBA on the survival and rooting percentages of *S. leprosula* cuttings

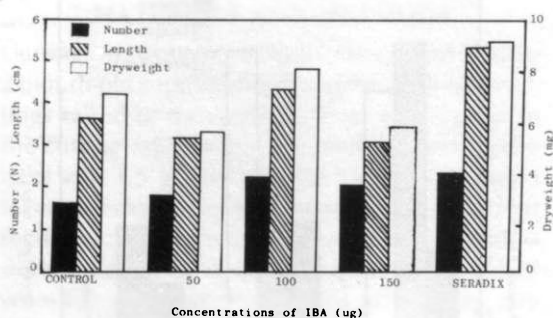


Fig. 5: The effects of IBA concentration on the shoot development of *S. leprosula* cuttings

DISCUSSION

The ability of cutting to form roots is determined by the position where the cutting is obtained. The juvenility of the stock plant can also be an overriding factor in root formation especially for plants which are difficult to root (Hartman and Kester, 1983). The results showed that cuttings taken from young seedlings often form new roots more easily than those taken from older and adult plants. Similar findings were obtained from cutting experiments on *Dryobalanops oblongifolia* (Penguang 1978), *S. acuminata* and *S. parvifolia* (Alias 1984). However, the differences of rooting responses with respect to cutting positions are greatly affected by the extent of lignification, secondary thickening and chemical composition of plant tissues (Niaz and Westwood, 1969; Lo, 1985). Generally, cuttings produced from coppice basal were found to have the highest survival and rootability percentages possibly due to the food reserve present (Hartney, 1980; Deol and Khosla; 1983) and physiological activeness.

Rooting medium is an important factor which influences rootability of the cutting. The results of this study confirm this. This study shows that it affects the percentage of rooting as well as the quality of roots formed. Sand was found to be the best rooting medium for rooting (in terms of root growth) of *S. leprosula* cutting. Better root and shoot development (in terms of morphology and number) were also observed in the other two rooting media. Coconut fibre was reported to consist of 37% of cellulose and crude fibre, 62% of carbohydrates and 56% selected minerals (Thio, 1982). The physical and chemical characteristics of the medium such as pH, porosity, water holding capacity and nutrient

contents could be the factors stimulating root and shoot development.

The present study ascertains the role of hormones in initiating and accelerating the root development. The hormone (IBA) used in this study has been found to be reliable in stimulating the production of adventitious roots from *S. leprosula* cuttings. The effectiveness of IBA for such roles has been reported by researchers on a number of tropical hardwood species (Penguang, 1978; Alias, 1984; Jackson, 1986; Wardipura *et al.*, 1986; Ng, 1988). Although IBA concentration at 100 µg gave the highest survival and rooting percentages, cutting of *S. leprosula* treated with Seradix 3 (a powder form of auxin containing 0.8% IBA) produced the best root growth. This further suggests and confirms that different levels of hormone application can influence the rootability of cuttings.

Seedlings of *S. leprosula* could be raised using cuttings. The basal portion of the coppice material was found to be the best cutting position and sand was the most suitable rooting medium for rooting of *S. leprosula* cuttings. The application of suitable auxin such as IBA could enhance the rootability percentage of this species. Further work is necessary to improve on the technique with the use of materials from mature trees or wildings.

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REFERENCES

- ALIAS, M. S. 1984. The physiology of rooting cuttings *Shorea platyclados* V. sl ex Foxw. and *Shorea acuminata* Dyer and eleven other species of Forest trees. B. Sc. (Forestry) Dissertation, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia. 96pp.
- ANNUAR, M. 1989. Effects of hormones and cutting position on rootability of *Acacia mangium* A. Cunn. Ex Benth. and *Shore curtisii* Dyer Ex King cutting. B. Sc. (Forestry) Dissertation Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia. 87pp.
- HARTMAN, H. T. and D. E. KESTER. 1983. *Plant Propagation: Principles and Practices*. Englewood Cliffs, New Jersey: Prentice-Hall Inc.
- JACKSON, M. B. 1986. *New Root Formation in Plants and Cuttings*. Dordrecht: M. Nijhoff.

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- LO, Y. N. 1985. Root initiation of *Shore macrophylla* cuttings: effects of node position, growth regulators and misting regime. *Forest Ecosystem and Management* 12: 43-52.
- NIAZ, A. and M. N. WESTWOOD. 1969. Juvenility as related to chemical content and rooting of stem cuttings of *Pyrus sp.* *American Social Horticultural Science* 93: 77-82.
- NG, A. B. 1988. Effect of hormones and cutting position on rooting of cutting of *Acacia mangium* Willd. and *Shore leprosula* Miq. B. Sc. (Forestry) Dissertation, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia. 62pp.
- NG, F.S.P. 1976. The problem of forest seed production. In Proceedings of National Seed Symposium. Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia.
- PENGUANG, M. 1978. Trials on vegetative propagations of some forest three species by rooting of cuttings. B. Sc. (Forestry) Dissertation, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia. 84pp.
- SMITS, WTHM. 1983. Vegetative propagation of *Shorea obtusa* and *Agathis dammara* by means of leaf-cuttings and stem cutting. *Malayan Forester* 46 (2): 175-185.
- THIO, G. L. 1982. *Small scale and home processing of fresh coconut (oil manufacture) and utilization of by-products.* Amsterdam: Koinionklijk Institut voov Tropen. 71pp.
- WARDIPURA, R., S. SALAHUDDIN, J. S. BAHARSJAH and S. HARRAN. 1986. The effect of rooting medium, partial leaf area removal and plant growth regulatos on the growth of cuttings of cocoa (*Theobroma cocoa* L.). *Forum-Pascasarjana* 1: 1-12.
- WYATT SMITH, J. 1966. Ecological studies on Malayan forests. I. Malayan Forestry Department Research Pamphlet 52.

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