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การขยายพันธุ์ไม้ตะเคียนทองอายุ 4 ปี โดยไม่อาศัยเพศ

PRELIMINARY STUDY ON 4 - YEAR OLD *HOPEA ODORATA* VEGETATIVE PROPAGATION

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ทำการทดลองขยายพันธุ์ไม้ตะเคียนทอง (*Hopea odorata* Roxb.) อายุ 4 ปี โดยไม่อาศัยเพศ โดยศึกษาถึงความสามารถในการแตกรากของกิ่งข้างจากตำแหน่งต่าง ๆ กัน ภายในเรือนยอด และอิทธิพลของความสูงในการตัดให้แตกหน่อ เพื่อกระตุ้นให้เกิดกิ่งกระโดง

ผลการทดลองพบว่า ไม่มีความแตกต่างกันในทางสถิติระหว่าง ความสามารถในการแตกรากของกิ่งข้าง จากตำแหน่งต่าง ๆ กัน ของลำต้น แต่จะมีความแตกต่างกันระหว่างต้น และตำแหน่งภายในกิ่ง ค่าเฉลี่ยของการเกิดราก คือ 7.23 % สำหรับต้นที่มีการแตกรากสูงสุด คือ 27.22 % และต้นที่มีการแตกรากน้อยที่สุดคือ ไม่มีการแตกรากเลย ความสูงของการตัดให้แตกหน่อและความโตของแม่ไม้ จะมีผลต่อจำนวนหน่อ, จำนวนกิ่งใน 1 กลุ่มตา และจำนวนกลุ่มตาที่ผลิตกิ่ง การตัดที่ระดับ 20-30 ซม. เป็นระดับที่เหมาะสมในการกระตุ้นให้แตกหน่อ ส่วนระดับของการตัดที่ทำให้เกิดผลผลิตหน่อสูงสุดคือ 20 ซม. โดยมีจำนวนหน่อเฉลี่ยเท่ากับ 8.98 หน่อ/ต้น หน่อที่เกิดขึ้นมาใหม่ทั้งหมดเป็นก่องกระโดงขนาดชั้นความโตของแม่ไม้ที่ทำให้เกิดผลผลิตหน่อสูงสุดคือ 30-40 มม. โดยสามารถผลิตหน่อเฉลี่ย 8.83 หน่อ/ต้น

ABSTRACT

Rooting potential of lateral branch cuttings of 4 year-old-*Hopea odorata*, and effect of hedge height on shoot production of saplings were studied. It was found that rooting potential of branch cuttings differed significantly among ortets and positions on branches, but not among positions on stem. The average rooting percentage was 7.23. The maximum rooting percentage was 27.22, while the minimum was nil. In the hedging experiment, hedge height and diameter at root collar of saplings significantly affected shoot production. Hedge height at 20-30 cm was recommended, whereas hedging at 20 cm height induced the maximum shoots (8.98 shoots/sapling). Hedging at every level induced orthotropic shoots. The average number of shoots produced from saplings in the 30-40 mm diameter class showed the best production (8.83 shoots/sapling).

INTRODUCTION

Hopea odorata is one of the most hygrophilous of all dipterocarps and is found sporadically in the Evergreen and Moist Deciduous Forest. It thrives on deep rich soil commonly found along the banks of streams and in damp areas. Wood texture is suitable for construction timber, furniture, and boat building (FAO, 1985).

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The viability of *Hopea odorata* seeds is very low, usually less than a week. Under controlled temperature (15°C) and moisture, the seeds have been reported to remain viable up to 2 months (FAO, 1985). Since dipterocarp seed supply is very irregular and storing for planting over prolonged periods is impossible, it is important to find the best system for vegetative propagation. (FAO, 1985; Smits, 1987)

Garner *et al* (1976) summarized that plants can be vegetatively propagated in two major ways, by tissue culture and by division or cutting. There are many research findings on vegetative propagation by cutting. It is well known that rooting ability varies depending on species, clone, and position of the propagule on the plant. (Srivastava and Penguang, 1981; Farmer *et al*, 1991; Menzies, 1992; Rodrick and Zsuffa, 1992)

One of the performance differences between seedlings and cuttings is that some species have a pronounced a topophysis effect in cuttings. This difference is less with very young ortets and the risk is likely to increase with ortets of advanced age (Kleinschmit, 1983). This has happened with some dipterocarp species. Smits (1987) reported that a rooted cutting does not always grow into an orthotropic plant. Cutting of plagiotropic branches with the top bud always continues their plagiotropic growth.

In order to produce as many orthotropic plants as possible it is also important to conduct correct pruning of plants in hedge orchards (Smits, 1987). Wise *et al.* (1986) tried to induce orthotropic shoot formation of *Abies fraseri* by decapitation and spraying dikegulac, he found that decapitation treatments which removed the most top growth produced the greatest number of orthotropic shoots in each age-class after one season.

Hedging not only induces orthotropic shoots but also produces rejuvenated shoots that obtain high rooting potential (Davis *et al*, 1987; Macdonald, 1990; and Wise *et al*, 1986). Plants obtained from rooted cuttings of hedged *Pinus radiata* produced growth habits similar to seedlings. (Davies *et al.*, 1987)

Zabala (1992) reported that the Forest Research Institute of Malaysia (FRIM), Malaysia, also used the hedging technique with *Hopea odorata* to produce cuttings.

This experiment was carried out with *Hopea odorata* with 2 objectives : *1)* to determine the suitable hedge height for producing orthotropic shoots *2)* to determine rooting potential of lateral branch cuttings from different clones and different positions on the crown.

MATERIAL AND METHODS

This experiment was carried out at the nursery of the ASEAN-Canada Forest Tree Seed Centre, Muak-lek, Saraburi Province. The mist chambers were concrete blocks and were moistened by watering. The experiment started in March and finished in December 1992. It was divided into sub-experiments as follows:

Rooting potential of lateral branch cuttings

Nine branches from each of 22 4-year-old saplings of *H. odorata* were used as material for this sub-experiment. The lateral branches were collected at the basal, middle and terminal parts of the crown. Branches were cut into 2-node sections for rooting and cuttings were arranged in sequence from the bottom to the tip of the branch. The cutting medium was coconut husk. The cuttings were put in a moist chamber with watering twice a day. After 5 months, the number of cuttings that had rooted were recorded. Data was analyzed by analysis of valance. The model was:

$$X_{ijk} = \mu + P_i + M_j + e_{ijk}$$

Where X_{ijk} = rooting of k^{th} cuttings of the j^{th} sapling at the i^{th} position on the crown (position on the stem and position on the branch).

μ = overall experimental mean

P_i = effect of i^{th} position on stem

M_j = effect of j^{th} sapling
e_{ijk} = random error term

F-tests were used for comparing among treatments.

Hedging experiment

The hedging experiment started in March, by decapitating 240 trees of 4-year-old *H. odorata* saplings at 4 levels : 5 cm, 10 cm, 20 cm, and 30 cm above the root collar. A randomize complete block design was used to select and cut the trees. the diameter at the root collar, number of epicormic shoots, and number of shooting buds (bud that produced shoots) of each hedged sapling were recorded.

Analysis of variance was used to analyze data according to the following model :

$$X_{ijk} = \mu + H_i + B_j + e_{ijk}$$

Where X_{ijk} = number of shoots of the k^{th} seedling in the j^{th} block at the i^{th} height of hedging.
μ = overall experimental mean
H_i = effect of i^{th} hedging height
B_j = effect of j^{th} block
e_{ijk} = random error term

F-tests were used for comparing among treatments.

Multiple Range Test-Scheffe Method-at 95 % confidence level was used for comparing the means.

RESULTS AND DISCUSSION

Rooting potential of lateral branch cutting

Positions on stem of lateral branches had no significant difference in rooting potential, but there were highly significant differences between saplings and positions on branches (Table 1). Average rooting percentage was 7.23, with a variation between saplings of 0 to 27.22 %

The results were the same as reported by Rodrick and Zsuffa (1992) and Farmer *et al* (1991), who found that differences in rooting potential of forest trees existed between ortets. Nautiyol *et al* (1992) found that in young trees of *Tectona grandis*, there was no difference in rooting of branch cuttings taken from different portions of the crown but in the case of mature trees the effect was quite significant.

Table 1. Effect of sapling (ortet), positions on branch and stem on rooting percentage

Main effect	Average (%)	SD	Significant level
Sapling	7.23	22.01	**
(22 sapling)	(0-27.22)		
Position on branch			
- bottom	4.62b	42.10	**
- middle	10.49a		
- tip	6.57ab		
Position on stem			
- bottom	6.01	15.03	ns
- middle	8.00		
- top	7.68		

Note: 1) Means followed by different letters are significantly different at the 0.05 level according to the Scheffe test.
2) ** Significant at $P \leq 0.01$; ns, non significant

Hedge Experiment

The effects of hedge height and diameter on shoot production are shown in Table 2. Hedge height significantly affected number of shoots, number of shooting buds, and number of shoots/bud, while the diameter affected only number of shoots and number of buds. There was no interaction between hedge height and diameter.

The average number of shoots, number of shooting buds, and number of shoots/bud in each treatment are shown in Table 3. Hedging at 20 cm seemed to be the best treatment. It enables the stem to produce the maximum number of shoots and maximum number of shooting buds, while making the stem produce the least number of shoots/bud. However, from comparison of means (Table 4), it was found that there was no significant

Table 2. **Effect of hedge height and diameter on shoot production**

Parameter main effect	No.of shoots	SD	No.of shooting buds	SD	No.of shoots/bud	SD
Hedge height	**	20.56	**	15.87	**	3.59
Diameter	**	9.62	ns	2.49	**	1.74
Interaction	ns	4.01	ns	2.17	ns	0.61

Note : ** Significant at $P \leq 0.01$; ns, non significant; SD, Standard deviation

Table 3. **The average number of shoots, buds, and shoots/bud for various treatments**

Treatment	Average		
(hedge height)	No.of shoots	No.of buds	No.of shoots/bud
5 cm	2.9c	1.1c	2.6a
10 cm	6.3b	2.9b	2.3a
20 cm	9.0a	5.6a	1.6b
30 cm	8.2a	5.4a	1.6b

Note : Means within a column followed by different letters are significantly different at the 0.05 level according to the Scheffee test.

Table 4. **The average number of shoots, buds, and shoots/bud for various diameter classes**

Diameter class	Average		
(mm)	No.of shoots	No.of buds	No.of shoots/bud
0-10	3.4c	2.6	1.2c
10-20	5.6bc	3.7	1.6bc
20-30	7.2ab	4.2	1.9abc
30-40	8.8a	4.2	2.3a
40-50	7.4abc	3.2	2.3ab
50-60	7.5abc	2.5	3.1ab

Note : means within a column followed by different letters are significantly different at the 0.05 level according to the Scheffee test.

difference between the effect of hedging at 20 cm and 30 cm. Hedging at 20 - 30 cm is therefore recommended to be a suitable hedge height. All epicormic shoots were orthotropic.

When the stem was hedged at 30 cm height, the number of shoots did not increase, when compared to 20 cm, because the shoots seemed to emerge mostly from buds close to the top cut only.

The average number of shoots, shooting buds, and shoots/bud for various diameter classes are shown in Table 4. The size class of stems that produced the maximum number of shoots was 30-40 mm diameter at root collar.

By comparing the means, it showed that a diameter above 30 - 40 mm did not increase the number of shoots and/or number of shoots/bud.

It was observed that if the stem diameter was smaller than 20 mm, the epicormic shoots seemed too small to root.

CONCLUSION

Lateral branch cuttings collected from

different positions on the branch and stem had no significant difference in rooting potential, but cuttings taken from different saplings showed highly significant differences. Average rooting percentage was 7.23 and rooting percentage of different saplings varied from 0 to 27.22.

Sapling hedge height and diameter at root collar significantly affected to number of shoots and number of shoots/bud. Hedge height at 20 - 30 cm was recommended, whereas hedging at 20 cm height induced the maximum shoots (8.98 shoots/sapling). All epicormic shoots produced from hedged stems were orthotropic. When stems were cut at 30 cm height, the number of shoots did not increase, because the shoots seemed to emerge close to the top cut only. The greatest average number of shoots was produced from saplings in the 30-40 mm diameter class (8.83 shoots/sapling). Notably, if the stem diameter is smaller than 20 mm, the epicormic shoots seem too small to root.

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