

## GROWTH INCREMENTS OF INDIGENOUS SPECIES PLANTED IN SECONDARY FOREST AREA

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### ABSTRACT

Studies on the growth performance on five (5) selected indigenous trees species of *Azadirachta excelsa*, *Cinnamomum iners*, *Hopea pubescens*, *Intsia palembanica* and *Shorea leprosula* under open area planting technique on secondary forest area were carried out in Pasoh Forest Reserve Area, Negeri Sembilan. Evaluation on the growth of these species was performed nine years after planting. An experimental design of Randomized Complete Block Design was adapted. The results showed that the growth increments of species planted for diameter at breast height (DBH) ranged from 0.97cm/year to 1.06cm/year with *A. excelsa* attaining the highest survival rate followed by *S.leprosula* and the lowest was recorded by *I. palembanica*. *A. excelsa* exhibited the highest growth increment in terms of height, followed by *S. leprosula* and the lowest was recorded for *C. iners*. Result indicates that some indigenous species can be adapted to rehabilitate secondary forest area.

**Keywords:** growth increments, indigenous species, secondary forest, survival rate and rehabilitation, generating degraded land forest

### INTRODUCTION

Logging has a major impact on the structural and compositional development of forests. Although the selective logging that has been widely employed in the Asian tropics where fewer trees per unit area are removed as compared to clear cutting, the extraction of large trees usually damages neighboring trees and influences the development of the under storey vegetation (Okuda et al. 2003). Forest rehabilitation by introduction of enrichment plants is commonly practiced in Malaysia in regenerating degraded land forest.

However, the selection of the right species played a very important means in determining the successful rehabilitate of the degraded forest land (Kobayashi & Ueda 2003; Zaki et al. 1998; Lamb & Tomlinson 1994). Rehabilitation using indigenous timber species on a larger scale usually encountered the following obstacles: irregular supply and recalcitrance of seeds, and high variability in growth



of seedlings with unknown genetic potential, as seedlings are raised from stumps or wildings (Appanah & Weinland 1993). The current studies also focus on the enrichment planting but on a different site at different soil characteristics. It aims at identifying the best species for plantation and rehabilitation among selected woof species.

## MATERIALS AND METHOD

Five indigenous species were selected for the study comprising of *Azadirachta excelsa*, *Cinnamomum iners*, *Intsia palembanica*, *Hopea pubescens* and *Shorea leprosula*. The study area was located in Pasoh Forest Reserve Area, Negeri Sembilan (about 120 km from Kuala Lumpur). The experimental plot chosen (42 ha) was a degraded logged-over forest established in August, 1995. Randomized Complete Block Design (RCBD) was used to analyze the data obtained from three replications of 30 m x 150 m block. Each block had 30 subplots measured at 5 m x 10 m each. In each subplot, a total of 15 seedlings were line-planted at a spacing of 2 m x 2 m. The total number of potted-seedlings planted was 1,350. Open planting technique had been used. The growth criteria measured were the diameters at breast height (DBH) and the total height of the planted species. Data was subjected to the analysis of Variance and Duncan's Multiple Range Test. An Analysis of variance was used to evaluate the growth performance of the species.

## RESULTS AND DISCUSSION

The results of the study are tabulated in Tables 1 and 2. Results show the mean diameter at breast height (DBH), mean total height, mean diameter and mean height increment of the trees evaluated.

### Growth diameter of trees

From Table 1, the highest mean increment in diameter at breast height (DBH) for two years periods (2002-2004) recorded when the trees were at ages 7 to 9 years was 2.11 cm for *Azadirachta excelsa* followed by *Shorea leprosula*, *Hopea pubescens*, *Cinnamomum iners* and *Intsia palembanica* which were 2.05 cm, 2.02 cm, 1.96 cm, and 1.93 cm, respectively. However, statistical analysis conducted showed no significant difference ( $p \leq 0.05$ ) between the increments of DBH among the plant species. The same results were obtained by Appanah and Weinland (1993) who noted that *I. palembanica* was a slow growing species.

### Growth height of trees

The highest mean increment (Table 2) from the two years periods (2002-2004) recorded when the trees were at ages 7 to 9 years was recorded by *Azadirachta excelsa* at 2.75 m and followed by *Shorea leprosula*, *Hopea pubescens*, *Intsia palembanica*, and *Cinnamomum iners* at 2.32 m, 2.07 m, 1.61 m, and 1.54 m respectively. Statistical analysis showed a significant difference ( $p \leq 0.05$ ) in the



increments of height among species except for *C. iners* and *I. palembanica*. Species *A. excelsa* also had the highest mean annual increment of 1.38 m/year. Meanwhile, *S. leprosula*, *H. pubescens*, *I. palembanica*, and *C. iners* have gained mean annual increment of 1.16 m/year, 1.04 m/year, 0.81 m/year, and 0.77 m/year, respectively. According to previous data studied by Sainih (2002), mean annual increments of height were 1.34 m/year, 1.83 m/year, 0.98 m/year, 0.74 m/year, and 0.65 m/year for *A. excelsa*, *S. leprosula*, *H. pubescens*, *I. palembanica*, and *C. iners*, respectively. In the present work, general decrease in mean annual increment in height of similar plant species was observed against the previous study. However, mean annual increment in height can fluctuate from year to year as observed by Appanah and Weinland (1993) on *S. leprosula* and *I. palembanica*, which recorded the mean annual increment in height as 0.8 m/year and 1.0 m/year, respectively.

Table 1. Mean for total diameter at breast height (DBH) and increment of DBH of five tree species after two years of recording at 7 to 9 years old.

Species	Block	No. of trees	Total DBH	Mean total DBH	Mean increment (2002-2004)	Mean increment diameter (cm/yr)
<i>A. excelsa</i> (*74.1%)	1	37	9.71	12.67 <sup>a</sup>	2.11 <sup>a</sup>	1.06
	2	32	13.69			
	3	31	15.16			
<i>C. iners</i> (*76.3%)	1	37	9.03	9.36 <sup>c</sup>	1.96 <sup>a</sup>	0.98
	2	33	10.41			
	3	33	8.68			
<i>H. pubescens</i> (*44.4%)	1	21	7.97	7.28 <sup>d</sup>	2.02 <sup>a</sup>	1.01
	2	29	7.42			
	3	16	5.42			
<i>I. palembanica</i> (*48.2%)	1	20	5.79	5.91 <sup>d</sup>	1.93 <sup>a</sup>	0.97
	2	26	6.07			
	3	19	5.83			
<i>S. leprosula</i> (*20.7%)	1	11	9.28	11.15 <sup>b</sup>	2.05 <sup>a</sup>	1.03
	2	9	10.95			
	3	8	13.92			

Mean for total DBH and increment in DBH (by column) are significantly different ( $p \leq 0.05$ ) by Duncan's New Multiple Range Test.

Note: \* Percentage of survival trees



Table 2. Mean for total height and increment in height of five tree species after two years of recording at 7 to 9 years old.

Species	Block	No. of trees	Total height	Mean total height	Mean increment (2002-2004)	Mean increment height (m/yr)
<i>A. excelsa</i> (*74.1%)	1	37	11.28	12.98 <sup>a</sup>	2.75 <sup>a</sup>	1.38
	2	32	13.85			
	3	31	14.12			
<i>C. iners</i> (*76.3%)	1	37	6.04	6.00 <sup>d</sup>	1.54 <sup>d</sup>	0.77
	2	33	6.47			
	3	33	5.47			
<i>H. pubescens</i> (*44.4%)	1	21	7.01	7.43 <sup>c</sup>	2.07 <sup>c</sup>	1.04
	2	29	8.07			
	3	16	6.46			
<i>I. palembanica</i> (*48.2%)	1	20	5.42	5.82 <sup>d</sup>	1.61 <sup>d</sup>	0.81
	2	26	6.07			
	3	19	5.90			
<i>S. leprosula</i> (*20.7%)	1	11	11.46	11.18 <sup>b</sup>	2.32 <sup>b</sup>	1.16
	2	9	10.15			
	3	8	11.95			

Mean for total height and increment in height (by column) are significantly different ( $p \leq 0.05$ ) by Duncan's New Multiple Range Test.

Note: \* Percentage of survival trees

## CONCLUSIONS

*Azadirachta excelsa* has the highest mean increment of diameter at DBH at 2.11 cm, followed by *Shorea leprosula*, *Hopea pubescens*, *Cinnamomum iners* and *Intsia palembanica*, which are 2.05 cm, 2.02 cm, 1.96 cm, and 1.93 cm, respectively. In terms of highest increment in height, *Azadirachta excelsa* recorded 2.75 m followed by *Shorea leprosula*, *Hopea pubescens*, *Intsia palembanica*, and *Cinnamomum iners* at 2.32 m, 2.07 m, 1.61 m, and 1.54 m, respectively. Overall results indicate that *Azadirachta excelsa* and *Cinnamomum iners* have good performance both in survival rate and growth in the open planting technique.



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