EFFECT OF DIFFERENT GROWING MEDIA ON THE GROWTH OF *SHOREA ROXBURGHII*

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ABSTRACT

Shorea roxburghii or locally known as meranti temak nipis is from the family of Dipterocarpaceae. Generally, this species is harvested for its timber and resin. Improvement through the selection of plus tree study has been initiated with the main objective is to provide high-quality planting materials. Apart from the project, an initial experiment on the growth performances of the seedlings of S. roxburghii involving growing media treatments has been conducted. This study was conducted to evaluate the effect of different growing media on the growth performances of the seedlings of S. roxburghii. Five different growing media treatments were tested, Treatment 1: Topsoil; Treatment 2: Topsoil (3): Sand (1); Treatment 3: Topsoil (3): Compost (1); Treatment 4: Topsoil (2): Sand (1): Compost (1); and Treatment 5: Topsoil (1): Sand (2): Compost (1). The experiment was laid out in Completely Randomized Design (CRD) and for each treatment, a total of 100 seedlings were tested. The growth data (height) were taken at the initial experiment, after a month, after three months and after six months old. Findings showed that there were significant differences among the five tested treatments with $p < 0.005$. Treatment 3 had the highest height increment after 6 months (16.64 cm) and after 3 months (5.18 cm). This was followed by Treatment 4, also for twice consecutive times after 6 months (15.39 cm) and after 3 months (3.11 cm). The results also indicated that all the top three best seedlings performances were from the growing media treatments that contain compost as the media composition. However, there was no clear indication that the seedlings needed sand in the growing media composition. Therefore, it is concluded that early growth performances of the seedlings of S. roxburghii were positively affected by the combination of topsoil and compost.

Keywords: growing media, growth, seedlings, Shorea roxburghii

INTRODUCTION

Shorea roxburghii is one of the timbers producing species of great importance in Malaysia. It originates from Dipterocarpaceae family which is renowned for its large woody tree attributes. International Union for Conservation of Nature (IUCN) has classified *S. roxburghii* as "Vulnerable" (Pooma et al., 2017). However, in Malaysia Plant Red List, this species is classified as "Near Threatened" (Chua et al., 2010).

The aforementioned species which is known by its vernacular name of "Meranti Temak Nipis" is widely used as plywood. Despite its known use as a timber source, *S. roxburghii* has ample other promising benefits. For example, in Thailand, the decoction of the tree's bark is utilized for treating dysentery, a type of gastroenteritis which results in bloody diarrhoea (Gardner, Sidisunthorn & Anusarnsunthorn, 2000; Labrec et al., 1964). Additionally, *S. roxburghii* dried flowers blended with other various flowers is said able to treat heart conditions and fever.

Besides, this species also has an antioxidant potential based on a study published in 2013 where they have successfully demonstrated that the stem bark extracts of *S. roxburghii* contain a high level of total phenolic compounds (Subramanian, Subbramaniyan & Raj, 2013). Therefore, its stem bark extract can be further explored for its application in the prevention of free radical-related diseases.

The government of Malaysia had launched a new forest plantation strategy which comprising of the six forest plantation models; Very Short Rotation Plantation (VSR), Short Rotation Plantation (SRP), Medium Rotation Plantation (MRP), Long Rotation Plantation (LRP), Mixed Wild Fruit Plantation (MWF) and Agroforestry System (AFS). This model is a part of an effort in the strategic forest plantation establishment in Malaysia. *S. roxburghii* is listed under the MRP model. MRP model is for the high quality timber species. The rotation age is suggested at 45 – 60 years, whereas the thinning should be conducted twice or thrice, starting at the age of 5 to 7 years old (Hashim, Mohd Hazim and Syafinie, 2015).

Recently, improvement through the selection of plus tree study has been initiated with the main objective is to provide high-quality planting materials. Plus tree is defined as the selected tree that has been graded for the sources on production for further breeding study (Hettasch et al., 2002). However, the genetic superiority of the selected plus tree is still needed to be tested. But, the probabilities of the progenies from selected plus tree to have good genotype is high due to reasonable heritability. Seeds collected from the selected plus tree is grown and planted in progeny trial. Conceptually, in progeny trial, the seedlings are planted in the replicated field trial.

During preparation of the planting materials for the establishment of progeny trial plots of *S. roxburghii*, we realized that we have limited information on the best-growing media for the *S. roxburghii* species. From our observation, this species can be germinated easily providing the seeds obtained are of high quality. However, growing media also plays an important role at the early development stage of the seedlings. Growing media is functioned as to physically support the plant, supplying the roots with nutrients, air and moisture. On the other hand, the most ideal growing media should also be light (but heavy enough to support the plant) and must be cost-effective.

Various studies had been done on the effect of different growing media on the growth and development of plant species due to the importance of growing media. For examples; the study of seven different growing media on the growth of Dahlia showed that Dahlia species performed well in growing media containing sand, silt and leaf mold (Kiran et al., 2007). Second, the study of four different growing media on the growth and germination of mango found that the maximum germination recorded by the growing media containing sand, baggas and pine bark in the ratio of (1:1:1) (Binyamin et al., 2017).

Therefore, this study is conducted to evaluate the effect of different growing media treatments on the growth performances of the seedlings of *S. roxburghii*. The media components tested in this study are the most commonly used and can be found easily at the local nursery such as topsoil, sand and compost. Findings in this study will provide the information on the best growing media that would give optimum growth of the seedlings of *S. roxburghii.*

METHODOLOGY

Preparation of the Seedlings and Growing Media

Seeds of *S. roxburghii* were collected from FRIM's Substation in Mata Ayer, Perlis. A total of 500 seedlings were used for the experiment (6 weeks after germination). Five growing media treatments were proposed for this experiment (Table 1). The media composition included topsoil, sand (river sand) and compost (commercial compost by Green Mary). Each media was potted into 6 x 9 inches polybag. For each treatment, a total of 100 seedlings were tested. The experiment was laid out in Completely Randomized Design (CRD). The seedlings were watered using automated water sprinklers which operate twice daily at 8.30 am and 4.30 pm.

Table 1: Treatments of growing media

Treatment	Media component (ratio)
1	Topsoil
2	Topsoil (3): Sand (1)
3	Topsoil (3): Compost (1)
4	Topsoil (2): Sand (1): Compost (1)
5	Topsoil (1): Sand (2): Compost (1)

Data collection

The total height of the seedlings was measured using a centimetre ruler (cm). The data were collected at the initial phase in which after transferring the seedlings into the polybags followed by after one-month interval, after three months interval and after six months interval. The height increment data were measured by subtracting the total height data.

Statistical analysis

Data were analyzed using SPSS Statistics Software ® using Analysis of Variances (ANOVA) and Tukey's HSD post-hoc test was used to compare the mean. The total height (cm) and increment of height (cm) were calculated and taken into the assessment.

RESULTS AND DISCUSSION

Based on the analysis of variances (ANOVA), the growth traits assessed (total height and height increment) showed a significant difference with $p < 0.05$ among the five growing media treatments (Table 2). The initial total height of the seedlings showed that there was slightly significant different with $p = 0.022$, this indicated that there were variations among the seedlings' initial height. Therefore, the height increment data will be used for the evaluations (Figure 1). Nevertheless, the analysis of total height data is still presented in Figure 2.

Table 2: Analysis of Variances (ANOVA)

		Sum of Squares	df	Mean Square	F	Sig.
Initial Total Height	Between Groups	71.139	4	17.785	2.885	.022
	Within Groups	3051.339	495	6.164		
	Total	3122.478	499			
Height after a month	Between Groups	80.278	4	20.069	3.612	.006
	Within Groups	2700.302	486	5.556		
	Total	2780.580	490			
Height after three months	Between Groups	394.372	4	98.593	13.933	.000
	Within Groups	3361.288	475	7.076		
	Total	3755.660	479			
Height after six months	Between Groups	7100.247	4	1775.062	45.078	.000
	Within Groups	18546.737	471	39.377		
	Total	25646.983	475			
Height Increment after a month	Between Groups	9.692	4	2.423	2.930	.022
	Within Groups	196.809	238	.827		
	Total	206.500	242			
Height Increment after three months	Between Groups	581.527	4	145.382	42.217	.000
	Within Groups	1539.321	447	3.444		
	Total	2120.848	451			
Height Increment after six months	Between Groups	4745.767	4	1186.442	50.916	.000
	Within Groups	10951.872	470	23.302		
	Total	15697.639	474			

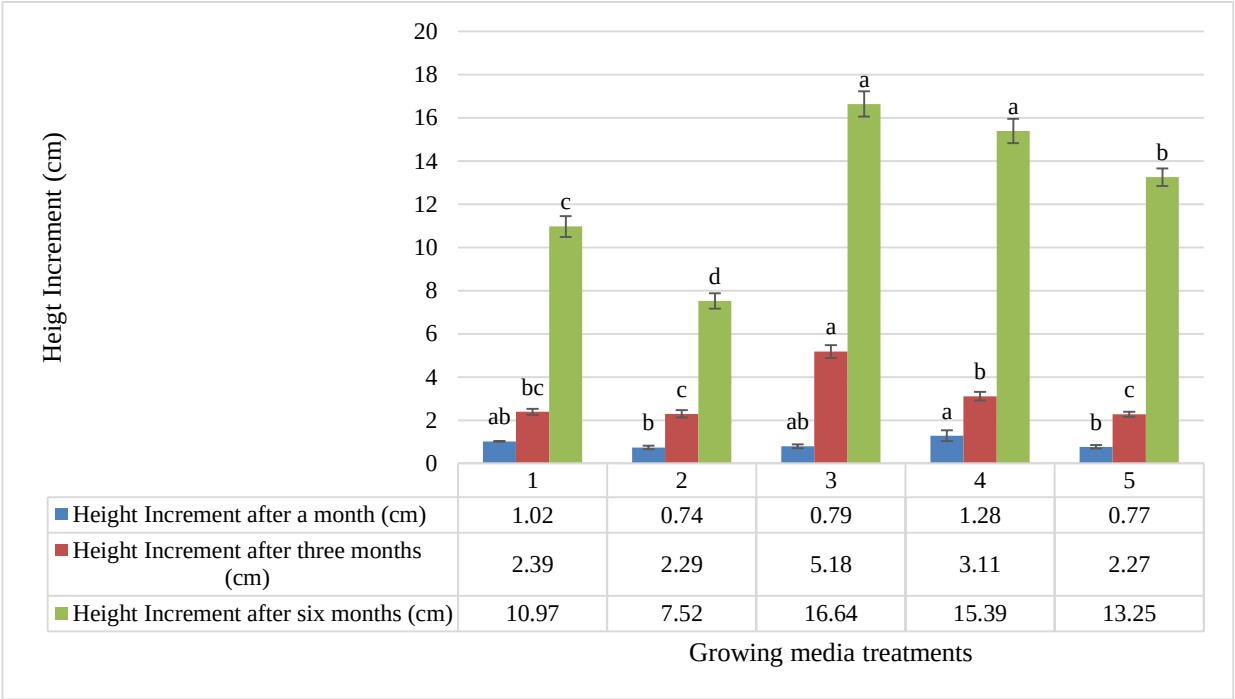
The results indicated that Treatment 3 [Topsoil (3): Compost (1)] had the highest height increment after 6 months (16.64 cm) and after 3 months (5.18 cm). This was followed by Treatment 4 [Topsoil (2): Sand (1): Compost (1)] also for twice consecutive times after 6 months (15.39 cm) and after 3 months (3.11 cm). However, there were variations for the ranking of the

third highest height increment. The third highest height increment was recorded by Treatment 5 [Topsoil (1): Sand (2): Compost (1)], after six months and Treatment 1 (Topsoil), after three months (Figure 1).

Based on the mean comparison by Tukey HSD post-hoc test on the height increment after six months, there was no significant difference between Treatment 3 and Treatment 4. However, there was a significant difference between the treatments on the height increment after three months (Figure 1). From the observation, all the top three best growing media treatments contain compost as the component.

Ideally, growing media should be able to supply the plants' roots with nutrients, air and water. The composition of the growing media should be able to allow optimum root growth and provides good aeration. Growing media should also be light, but heavy enough to physically support the plant. Furthermore, the best growing media must also ensure the best quality of the plant's production on a cost-effective basis (Riaz et al., 2008).

Figure 1: Effect of Growing Media Treatments on the Height Increment (cm) of the Seedlings of *S. roxburghii*.

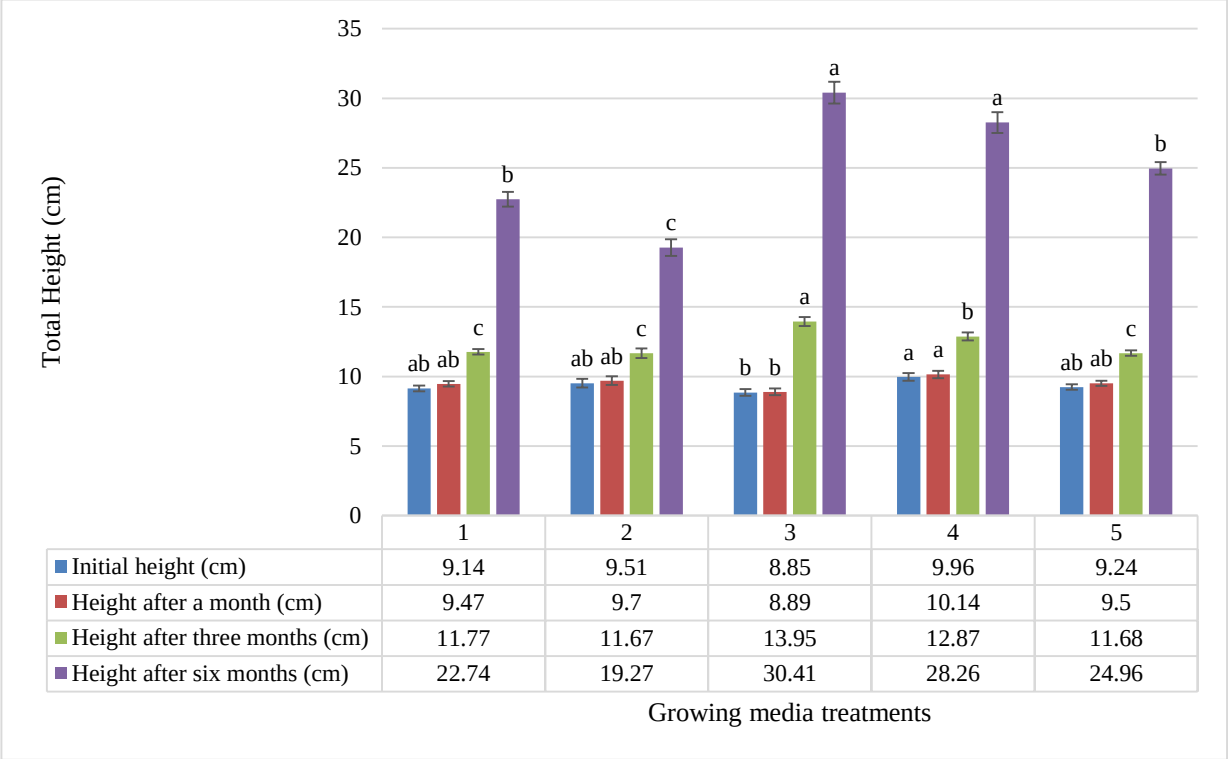


Mean with the same alphabet showed no significant difference at 0.05 and the error bars are showing the Standard Error (SE).

The most used growing media usually contain topsoil, sand and compost as the media's component. However, the ratios usually different depending on the plant's needs. Findings in this study showed that the growth of the seedlings is unfavourable in media containing only topsoil and sand (Treatment 2). This might be due to the lack of nutrients providing by the growing media. Even though sand does not contain any nutrients, it does allow better growth of the roots and provides good aeration. However, when used alone as a growing media, it showed the least response and provided unsatisfactory results. This finding also similar to the study of different growing media on the growth and development of *Dahlia pinnata* (Kiran et al., 2007).

Results obtained from this study showed that the best-growing media for *S. roxburghii* seedlings was from the growing media containing only topsoil and compost (3:1). The compost used in this study is a commercial brand from Green Mary which is commonly used and easily purchased from the local nurseries. The compost contains cocopeat, burnt soil, river sand, burnt husk, rich humus and charcoal powder. However, the ratios of the compost' components are not declared on the bags. Compost naturally functioned as to add the organic material and nutrients to the soil, increasing water holding capacity, biological activity and subsequently improving the plant growth. Furthermore, topsoil on its own, also contained nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg).

Figure 2: Effect of Growing Media Treatments on the Total Height (cm) of the Seedlings of *S. roxburghii.*



Mean with the same alphabet showed no significant difference at 0.05 and the error bars are showing the Standard Error (SE).

CONCLUSION

The *S. roxburghii* seedlings grown in media containing topsoil and compost (3:1) shown the highest height increment. All the top three best seedlings performances were from the growing media treatments that contain compost as the media composition. Therefore, it is recommended that the combination of topsoil and compost (3:1) to be used as the growing media for the optimum growth performances of the seedlings of *S. roxburghii*.

Nevertheless, we have not performed the physical and chemical analysis on the tested growing media. Information on the chemical composition of the topsoil and compost used in the study may have provided significant insight into the findings.

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