EARLY GROWTH PERFORMANCE OF LARAN (*NEOLAMARCKIA CADAMBA*), BATAI (*FALCATARIA MOLUCCANA*), BINUANG (*OCTOMELES SUMATRANA*) AND TALISAI PAYA (*TERMINALIA COPELANDII*) IN SMALLHOLDER PLOTS

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ABSTRACT

Plots of Laran (*Neolamarckia cadamba*), Batai (*Falcataria moluccana*), Binuang (*Octomeles sumatrana*) and Talisai Paya (*Terminalia copelandii*) were established by smallholders during 2020-2021. The Batai, Binuang, and Laran plot is located at Mile 16, Gum-Gum, while the Talisai Paya plot is situated at Sukau, Kinabatangan. This study aims to examine the growth performance of 4-year-old Batai, Binuang, and Laran, as well as 3-year-old Talisai Paya. The survival rates for these species were 90% for Batai, 76% for Binuang, 74% for Laran, and 100% for Talisai Paya. The mean annual increment (MAI) in diameter at breast height (DBH) ranged from 2.53 to 5.03 cm, while the MAI in height varied from 1.4 to 3.59 m. These results indicate an encouraging growth rate for all species.

Keywords: growth performance, smallholder, mean annual increment, plantation species, diameter class

INTRODUCTION

With decreasing production from natural forest, plantations forest has been established to reduce reliance on natural forests and contribute to forest conservation. Plantation forests are viewed as supplementary sources of timber supply for Malaysia's large wood products industry (Abi & Lim 2005). Based on the Sabah Forest Policy 2018, the Forest Plantation Development Action Plan (2022-2036) has been developed. Forest plantations in Sabah have emerged as a significant component of sustainable forestry practices through strategic and decisive actions. Smallholder forestry faces many challenges, and it is essential to provide them with appropriate government support to maximize their potential. An early growth assessment is conducted on Laran (*Neolamarckia cadamba*), Batai (*Falcataria moluccana*), Binuang (*Octomeles sumatrana*) and Talisai Paya (*Terminalia copelandii*). There has been significant interest in these species due to their economic value, ecological significance, and adaptability to various soil conditions. They are also useful for short-rotation timber production. This study aims to understand the growth rates, survival, and overall performance of these four species, which is crucial for sustainable forest management, economic benefits, and their future role as a timber source. Tree species selection and plantation establishment decisions can be made more efficiently and effectively using this study.

MATERIALS & METHODS

The Binuang, Batai and Laran plots are located at Mile 16, Gum-Gum, Sandakan (5°55'47.5''N, 117°53'33.4''E), whereas Talisai Paya plot is located in Suan Lamba, Sukau (5° 34'49.0''N, 118°06'11.9''E). These plots consist of Rumidi soil Association, primarily made up of mudstone and sandstone. These areas consist of low hills and narrow flats, with an altitude of 15-20 meters and a slope of between 5 to 150 meters on hills (SFD 2024).

In Binuang, Batai, and Laran plots, the spacing is 5 x 5 metres and in Talisai Paya plots, the spacing is 7 x 7 metres. The age of trees at Mile 16, Gum-Gum and Suan Lamba, Sukau are 4 years old and 3 years old, respectively, at the time of assessment. Mortality and growth performance, in terms of height and DBH (diameter at breast height), are assessed. A simple analysis is conducted using Excel, and the MAI (mean annual increment) is calculated to determine DBH and height growth rates.

RESULTS & DISCUSSION

Growth performance of 4-year-ld Binuang, Batai and Laran at Mile 16, Gum-Gum Sandakan

The survival and growth performance of 4-year-old Binuang, Batai, and Laran are summarized in Table 1. The survival rate for these three species ranges from 74% to 94%, with Laran achieving the highest survival rate at 94%. The survival rates for Binuang and Batai are not less than 74%, which is considered good, provided that the final harvesting density of 70 trees per hectare (ha) is maintained. These survival rates fall within the recommended range for plantation species. The mean annual increment (MAI) in diameter at breast height (DBH) ranges from 2.53 cm to 5.03 cm, while the MAI in height varies from 1.4 m to 3.59 m.

Table 1. Mean annual increment (MAI) in height and DBH of Batai, Laran and Binuang at the age of 4 years.

Species	DBH (cm)	Height(m)	Survival (%)
Binuang	2.53	1.40	74
Batai	5.03	3.59	76
Laran	3.27	2.76	94

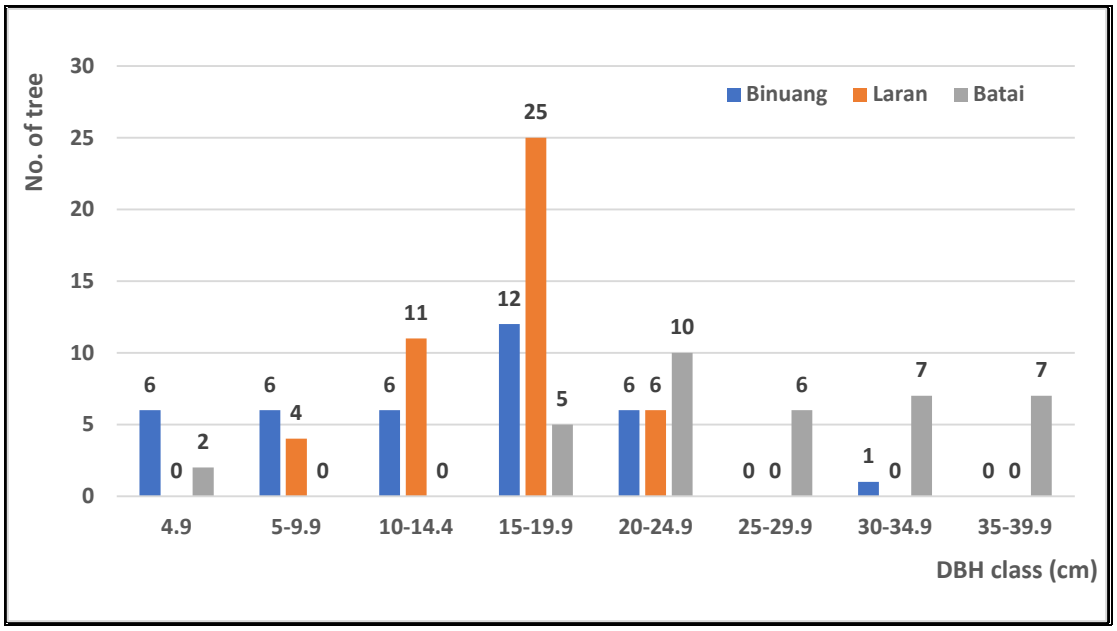

Figure 1. DBH class of 4-year-old Binuang, Batai and Laran.

Binuang

The growth performance of Binuang shows a high density of trees in the lower DBH classes (4.9 to 19.9 cm), indicating a younger population with only a few mature individuals. The significant increase in the 15-19.9 cm DBH class highlights the species' strong potential for growth and survival into larger size classes, demonstrating its promise for future development.

Laran

Laran, on the other hand, exhibits a high density of trees in the 10-14.4 cm and 15-19.9 cm DBH classes, indicating a relatively fast growth rate. However, a decline in the higher DBH classes suggests a limited number of mature trees. This trend, along with the DBH uniformity within the 5-24.9 cm range, may indicate underlying issues.

Batai

Across all DBH classes, Batai exhibits rapid growth, particularly in the higher ranges, exceeding 15 cm. A high number of trees in the larger DBH classes generally indicates the successful establishment of the plantation in a short period. However, two trees were found in the below 5 cm DBH class due to handling mistakes during planting.

A case study on Talisai Paya at Suan Lamba, Sukau

The survival rates and DBH classes of 3-year-old Talisai Paya trees are summarized in Table 2. In the first year, most trees were concentrated in the lower DBH class, with 26 individuals, and the survival rate was 100%, indicating successful early plot establishment. By the second year, 32 trees were in the 5-9.9 cm DBH class, 11 in the 10-11.14 cm class, and 6 in the 4.9 cm class. Despite increasing competition among trees, the survival rate remained at 100%. In the third year, 22 trees were in the 10-14.9 cm class, and 7 in the 15-19.9 cm class, indicating strong growth. However, the number of smaller trees decreased, likely due to increased competition. Overall, Talisai Paya demonstrates a high survival rate and a strong ability to grow into larger size classes.

Table 2. DBH class and survival of Talisai Paya at age of 3-years.

Year	DBH Class (cm)					Survival %
	<4.9	5-9.9	10-14.9	15-19.9	20-24.9	
1st year	26	23	0	0	0	100
2nd year	6	32	11	0	0	100
3rd year	6	13	22	7	1	100

The mean annual increment (MAI) for the first year of Talisai Paya was 4.86 cm, indicating robust early growth (Figure 2). While this reflects strong initial development, the MAI has progressively declined over the three years. It is typical for tree growth dynamics to exhibit rapid early growth, which slows as trees approach maturity. Additionally, faster-growing individuals may suppress the growth of slower-growing trees by limiting sunlight penetration and potentially outcompeting them for nutrients (Ajik 2005).

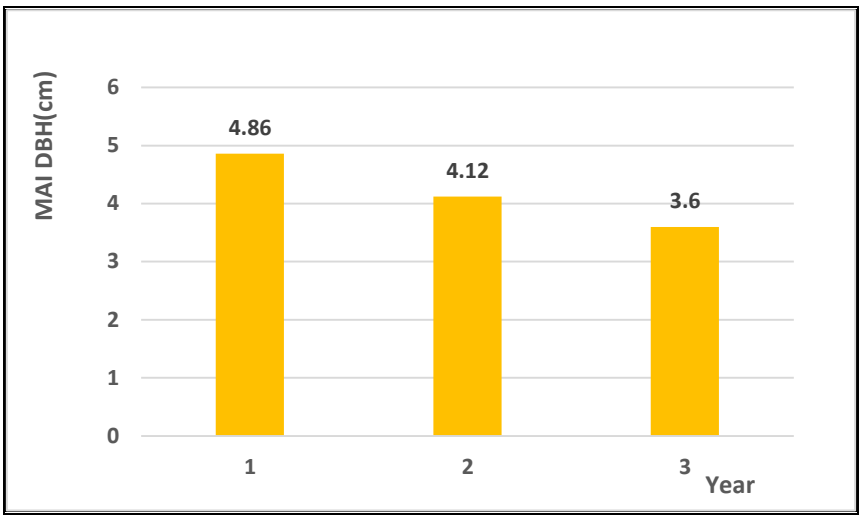

Figure 2. MAI in DBH of Talisai Paya.

The data on the mean annual increment (MAI) in height for Talisai Paya over three years demonstrates a consistent decline in growth rate (Figure 3). In Year 1, the MAI was 2.36 m, indicating strong initial growth likely attributable to effective planting methods. However, by Year 2, the MAI decreased to 1.98 m and further declined to 1.91 m by Year 3. This decline is common among many tree species as they mature and may be influenced by factors such as spatial competition. Understanding these changes is crucial for managing silvicultural treatments, such as thinning (Lapongan 2008).

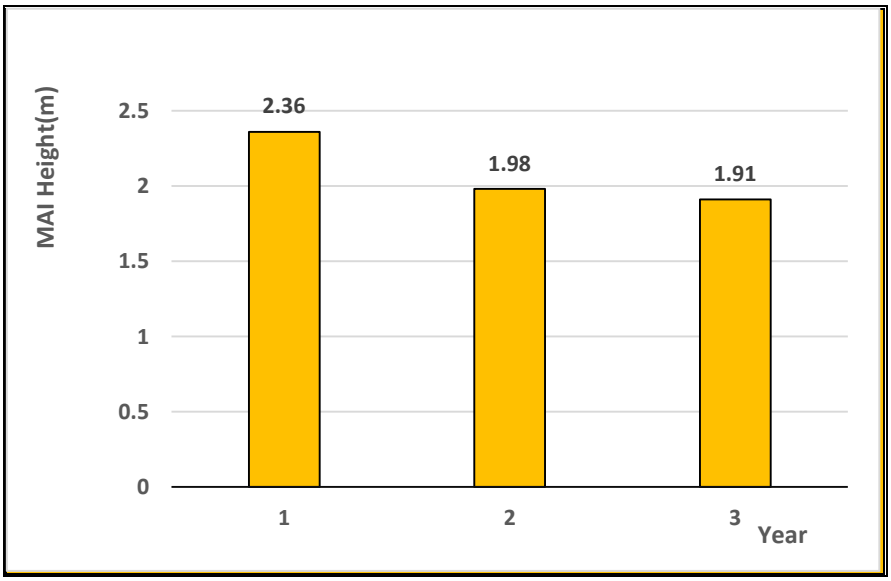

Figure 3. MAI in height of Talisai Paya.

CONCLUSION

In conclusion, the establishment of forest plantations in Sabah represents a crucial strategy to mitigate the decline in timber production from natural forests and to promote sustainable forestry practices. This study assessed the growth performance and survival rates of four important plantation species—Laran (*Neolamarckia cadamba*), Batai (*Falcataria moluccana*), Binuang (*Octomeles sumatrana*), and Talisai Paya (*Terminalia copelandii*)—across different planting sites. The findings reveal that Laran exhibits the highest survival rate at 94%, while Binuang and Batai demonstrate promising growth characteristics, making them viable options for future timber production. Additionally, Talisai Paya shows strong early growth and consistent survival rates over three years, highlighting its potential as a valuable species in plantation forestry.

The data indicate that survival rates and growth increments of these species are generally within recommended ranges, suggesting that with proper management and government support, smallholder forestry can thrive. However, it is important to address potential issues related to competition and growth dynamics to optimize the overall health and productivity of these plantations. Continuous monitoring and effective silvicultural practices, including possible thinning, will be essential to maintain the growth momentum and ecological balance within these plantations. Ultimately, this study underscores the importance of strategic tree species selection and effective plantation establishment in contributing to sustainable forest management and enhancing Malaysia's wood products industry.

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