

# A NOTE ON PROCUREMENT OF PLANTING MATERIALS TO FULFILL THE DEMAND FOR SEEDLINGS IN SMALLHOLDER PLANTATIONS

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## ABSTRACT

As the supply of logs from natural forests continues to dwindle, the downstream timber industry is facing long-term challenges. In response, the Sabah Forestry Department has launched a tree-planting initiative under the RMK-12 project aimed at encouraging smallholders to establish forest plantations by providing planting materials and technical support. The most in-demand species include *Neolamarckia cadamba*, *Terminalia copelandii*, *Falcataria moluccana*, *Eucalyptus pellita*, *Octomeles sumatrana*, *Swietenia macrophylla*, and *Khaya senegalensis*, with *Neolamarckia cadamba* seedlings being the most widely distributed. This project has gained significant traction in the Sandakan area and has also been extended to Keningau, Sukau, and Kota Marudu. The paper addresses seed procurement activities, nursery processes, pest and disease control measures, and the progress of seedling distribution and planting, while also highlighting some issues and challenges.

**Keywords:** smallholder, plantation species, forest plantation, nursery

## INTRODUCTION

The decline in wood production from natural forests will significantly impact downstream industries. To mitigate this, the Sabah government plans to restore forests and secure a future supply of timber by promoting the planting of fast-growing trees in Forest Management Unit (FMU) areas through the Industrial Timber Plantation (ITP) initiative. Additionally, the government encourages cultivating fast-growing forest species on vacant and idle lands in line with the state's forest policy. Under the RMK-12 project, the Sabah Forestry Department supports private landowners and smallholder planters in developing forest plantations. The primary goal of this RMK-12 initiative is to provide free planting materials to smallholder planters, along with free advisory and technical services, which include training on planting techniques, seedling care, and pest and disease control.

The forest plantation tree species promoted under the RMK-12 project have a harvesting cycle of 10 to 15 years. The species currently distributed to smallholders include Laran (*Neolamarckia cadamba*), Talisai Paya (*Terminalia copelandii*), Batai (*Falcataria moluccana*), *Eucalyptus pellita*, Binuang (*Octomeles sumatrana*), Mahogany (*Swietenia macrophylla*), and *Khaya senegalensis*. To ensure that planting materials come from selected and improved sources, individual trees are first identified for their superior traits, such as growth rate, form, and resistance to pests and diseases, and then marked as candidate plus trees (CPT). Before procuring seeds, observations of tree phenology are conducted to determine the flowering and fruiting seasons of each species, ensuring that the collected fruit is fully mature and of high quality. The seeds are then processed, extracted, and treated to promote germination and early seedling growth. Nursery practices follow strict standard operating procedures (SOP), and growth data for these seedlings are collected and recorded annually until the harvesting cycle is complete.

## Tree Phenology

The flowering and fruiting cycles of all targeted species were monitored throughout the year to determine the optimal timing for fruit harvesting. Most fast-growing tree species, such as Mahogany, Laran, talisman paya, and *Khaya senegalensis*, produce fruit once a year. In contrast, other species, like Binuang, *Eucalyptus pellita*, and Batai, produce fruit multiple times a year. Seed collections were conducted during the peak fruiting periods.

## Seed Procurement

The Seed Laboratory at the Sabah Forest Research Centre (FRC) processes and records tree seeds collected from the field. These seeds must be processed and extracted immediately to ensure a high-quality seed stock. Pods from species like Binuang, Mahogany, *Eucalyptus pellita*, and *Khaya senegalensis* need to be sun-dried, and manual extraction of the seeds is required once the pods open. Proper drying of the extracted seeds is essential to prevent fungal attacks, except for Mahogany seeds. Meanwhile, the mesocarp of Talisai Paya fruit needs to be softened or preserved for a month to accelerate seed germination. Laran fruits must be dried until hardened, then placed in a gunny sack or plastic bag and struck with a stick to separate the seeds from debris (Chong 2008). Appendix 1 outlines the necessary steps to ensure proper seed procurement.

## NURSERY PRACTICES

Processed seeds are sown in the nursery, where a mix ratio of 3:2:1 of topsoil, compost and sand, including compound or slow-release fertiliser, is used as the medium for germination. The sowing method depends on the seed size (Kimjus 2020):

- Talisai Paya has large seeds and should be sown directly into polybags.
- Batai, Laran, Binuang, *Khaya senegalensis*, and Mahogany seeds are sown in sowing beds, with cocopeat added for *K. senegalensis* and Mahogany.
- Fine-sized seeds, such as Laran and Binuang, require significant moisture. A pepper shaker is used to distribute the seeds into a seeding tray filled with water (Appendix 2), preventing the seeds from clumping together, which can complicate transplanting.
- *Eucalyptus pellita* seeds should be sown in BX-50 root formation trays (Kimjus 2020) containing cocopeat before being transferred to polybags (Appendix 2).

It is recommended to sow Laran seeds in trays using a coarse river sand medium (Janain pers. comm.), which is highly porous, preventing waterlogging and improving the control of damping-off (Appendix 2). This method also minimises damage during transplanting into polybags. Plants are transplanted into polybags once they reach a height of 4-5 cm (except for Mahogany, which is transplanted at 10-15 cm) and have two to four true leaves (Kimjus 2020). Generally, Laran and Binuang grow in sowing beds or trays for two months before being transferred to polybags. The polybags used are 6" x 9", suitable for seedlings for up to six months in the nursery. Once the seedlings reach two feet, they are ready to be sent to smallholders for field planting (Appendix 3).

## PEST AND DISEASE CONTROL

If early signs of infestation are detected, pest and disease control measures are implemented. These methods include applying chemical pesticides and cleaning the affected areas. When seedlings like Talisai Paya are directly sown into polybags, caterpillar attacks are common, so cypermethrin sprays are used every two weeks. Malathion sprays are also applied every two weeks to control insect attacks on seedlings planted in polybags.

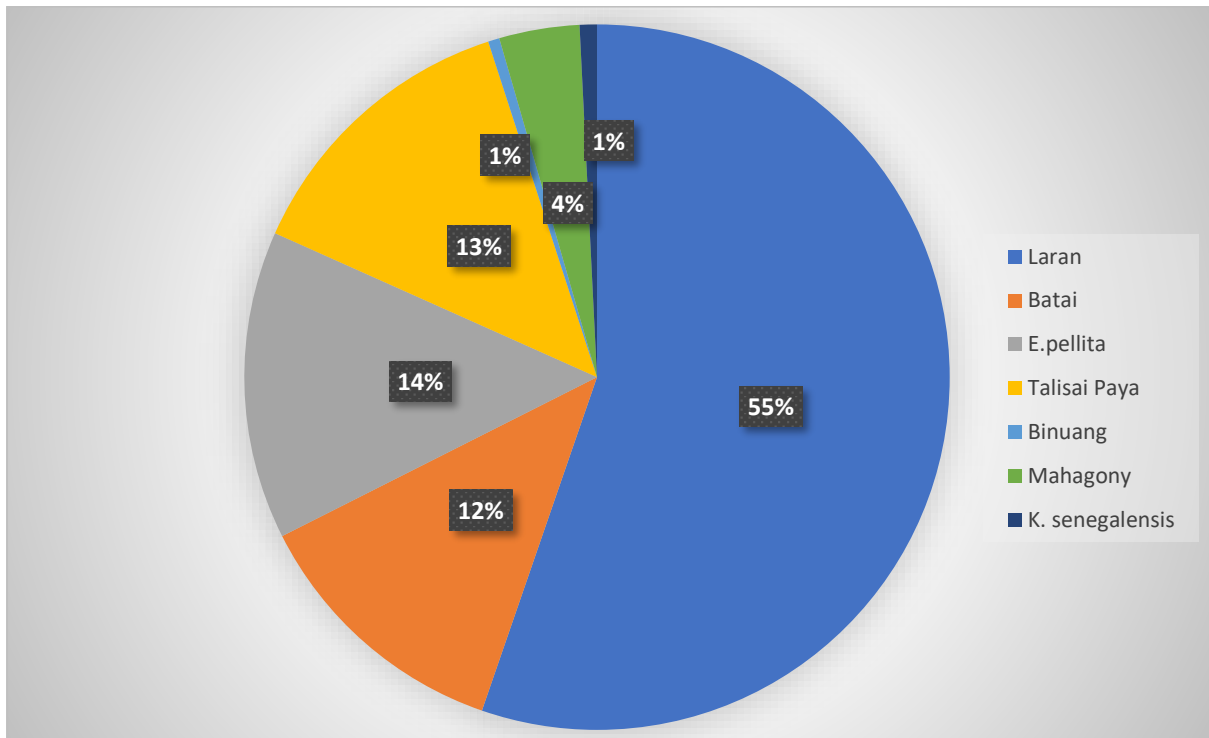
A misting room provides an ideal environment for sowing beds and trays, where caterpillars and insects are not an issue. However, fungal infections, particularly damping-off, can occur due to excessive humidity or high temperatures. A preliminary study on fungal control using a weekly spray of 3% hydrogen peroxide found no fungal infections in Laran germination trays. From 0.5g of seeds sown in the germination tray, 700-750 seedlings were obtained (Guanih *et al.* 2024 in press), compared to 300-350 seedlings from 1g of Binuang seeds without antifungal treatment (Khoo & Kimjus pers. comm.). Fertiliser spraying is also conducted every two weeks to ensure the seedlings remain healthy and recover from stress before being delivered to smallholders.

## SEEDLING DISTRIBUTION

To date, a total of 38,482 seedlings have been distributed, as detailed in Table 1, which outlines seedling distribution by district. The Laran species is the most commonly distributed in Sandakan and is the preferred choice among smallholders (Figure 1). Sandakan is the primary region where Laran is grown, with more than half of the demand coming from smallholders.

**Table 1.** Seedling distribution until September 2024.

Species District	Laran	Batai	<i>E.pellita</i>	Talisai Paya	Binuang	Mahagony	<i>K. senegalensis</i>
Sandakan	10270	2240	4120	1050	0	300	100
Kinabatangan	1190	490	400	120	0	0	0
Lahad Datu	345	160	50	50	0	0	0
Sukau	1408	622	700	1060	0	600	0
Beaufort	230	10	0	420	5	5	0
Tongod	1230	150	100	130	0	0	0
Telupid	980	0	0	170	52	20	0
Kiulu	900	0	0	0	0	0	0
Ranau	330	0	0	0	0	80	0
Kota Marudu	1350	950	0	100	0	0	0
Tawau	350	0	0	0	0	0	0
Keningau	1530	150	0	2000	100	0	0
Kunak	0	0	200	0	0	100	200
Beluran	250	60	0	0	40	300	0
Penampang	150	0	0	0	0	0	0
Kinarut	565	0	0	0	0	0	0
<b>Total</b>	<b>21078</b>	<b>4832</b>	<b>5570</b>	<b>5100</b>	<b>197</b>	<b>1405</b>	<b>300</b>



**Figure 1.** Distribution of seedlings by species.

## PLANTING PROGRESS

Approximately 130 hectares of land have been successfully developed into forest plantations by smallholders over the three and a half years of the program's implementation. Field visits are conducted to monitor the status of the plantings and update the information. After one year, around 49 trees were measured for diameter and height in each area, and this data will continue to be collected and recorded annually.

## ISSUES & CHALLENGES

### Insufficient number of CPTS

The selection of Candidate Plus Trees (CPTs) is still ongoing and may impact the optimal representation of materials for the procurement activity. Additionally, CPTs located in remote areas, such as Laran in Trus Madi Forest Reserve, can pose challenges for seed collection efforts.

### Phenological Variability

The flowering and fruiting cycles of target species may vary by location. This variability affects the timing of seed collection, and if seeds are not collected at the optimal time, they may be immature or of poor quality. Such issues can negatively impact germination rates and reduce seedling vigor.

## **Seed Viability and Processing**

Maintaining seed viability from the time of collection to sowing is critical. Improper handling, processing, and storage can result in poor germination rates. For instance, the seeds of certain species, like Talisai Paya, require special treatment such as softening or preserving the fruit mesocarp for accelerated germination. Other species, like Laran and Binuang, must be carefully dried and processed to prevent fungal infections and ensure high-quality seeds.

## **Logistical Constraints in Distribution**

Once seedlings are ready for distribution, logistical challenges arise, particularly in delivering them to remote or dispersed smallholders. At times, we do not have the capacity to deliver the planting materials, requiring smallholders to collect them themselves. Often, when this occurs, smallholders delay in collecting the materials, which can result in missed opportunities to establish the seedlings in the field during the optimal planting window.

## **Pest and Disease**

Seedlings in nurseries are vulnerable to pests and diseases, such as caterpillars and fungal infections like damping-off. While pest management strategies like the use of cypermethrin and malathion sprays have been effective, they require continuous monitoring and application. Fungicide treatment and proper nursery management, including misting rooms and well-drained seed trays, are essential to maintaining healthy seedlings.

## **Genetic Diversity Concerns**

While focusing on plus trees improves genetic quality, there is a risk of narrowing the genetic base if seed collection relies too heavily on a limited number of plus trees. Maintaining genetic diversity within the plantations is essential to ensure the long-term adaptability and resilience of the forest against environmental changes, pests, and diseases.

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**Appendix 1.** Seed procurement of 7 selected species for smallholders involving tree phenology, seed processing and germination.

Species	Seed procurement	
Laran ( <i>Neolamarckia cadamba</i> )	Phenology	Fruiting: July to August; maturing: November to January.
	Process	Fruit: Cut into small pieces and sun-dried. Crush them before sieving. Seed count: 20,000 seeds per gram.
	Germination	2-3 weeks.
Binuang ( <i>Octomeles sumatrana</i> )	Phenology	Fruiting may occur throughout the year with peaks in May and July.
	Process	Fruit: Sun-dry the fruit pods; seeds can be extracted manually after the pods are opened. Seed count: 6-7 mill seeds per kilogram.
	Pre-treatment	Seeds are not dormant and pre-treatment is not necessary, light may be required for germination.
	Germination	One week.
Batai ( <i>Falcataria moluccana</i> )	Phenology	Flowering: April to May, maturing - June to July.
	Process	Fruit: Sun-dry the fruit pods; seeds can be extracted manually after the pods are opened. Seed count: 40,000 seeds per kilogram.
	Pre-treatment	Soak in hot water (90°C for 30 sec), then imbibe in tap water for 24 hours prior to sowing.
	Germination	5-10 days.
Talisai Paya ( <i>Terminalia copelandii</i> )	Phenology	Flowering: April to May; maturing: between August and September.
	Process	Fruit: No process required. Seed count: 160-180 seeds per kilogram.
	Pre-treatment	There are two steps: Treatment 1: Green fruits—keep in a plastic bag for 1 month before moving on to Treatment 2. Treatment 2: Brown fruits—soak in rooting hormone for 24 hours before sowing.
	Germination	2-3 weeks
Mahagony ( <i>Swietenia macrophylla</i> )	Phenology	Flowering: September to October, maturing: -November to January.
	Process	Fruit: Sun-dry the fruit pods; seeds can be extracted manually after the pods are opened. Seed count: 3,350-3,550 seeds/kilogram.
	Pre-treatment	While not necessary, the germination of stored seeds with low moisture content may be enhanced by soaking in water for 12 hours before sowing.
	Germination	2-3 weeks.
<i>Eucalyptus pellita</i>	Phenology	Flowering: June and July (peak); maturing: between August and September.
	Process	Fruit: Sun-dry the fruit pods; seeds can be extracted manually after the pods are opened. Seed count: 1,400 seeds per gram.
	Germination	One week.
<i>Khaya senegalensis</i>	Phenology	n.a
	Process	Fruit: Sun-dry the fruit pods; seeds can be extracted manually after the pods are opened. Seed count: 2,500–7,000 seeds per kilogram.
	Germination	2-3 weeks.

Note: n.a = not available.

**Appendix 2.** Sowing and germinating seeds at the nursery, highlighting the use of coarse river sand as a germination medium for Laran.

	
<p>Seeds are scattered evenly using a pepper shaker.</p>	<p><i>Eucalyptus pellita</i> germinants in BX-50 root formation trays.</p>
	
<p>Laran germinants growing in a coarse river sand medium.</p>	<p>Coarse river sand is recommended as a germination medium for Laran (Janain pers. comm.)</p>
	
<p>Laran germinants infected by fungi.</p>	<p>Laran seedlings.</p>



**Appendix 3.** Distribution of seedlings and providing technical information to smallholders.



Seedlings are being loaded on a vehicle to be distributed to smallholders.



Handing over a book on the "Introduction of Insect Pest of Forest Plantation in Sabah" to a smallholder.