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Evaluating The Physical Quality of Trembesi Seedlings (*Samanea saman*) in The Permanent Nursery of BPDAS Indragiri Rokan, Pekanbaru City, Riau Province

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ABSTRACT

The availability of high-quality seedlings is crucial for reforestation and forest rehabilitation initiatives aimed at mitigating deforestation. This study assesses the physical quality of rain tree (*Samanea saman*) seedlings produced by the Permanent Nursery of BPDAS Indragiri Rokan, located in Pekanbaru, Riau Province. A systematic sampling method with a random start was employed, involving 15,155 raintree seedlings that were six months old, from which a sample size of 200 seedlings was selected following SNI 8420 of 2018. The parameters observed included seedling height, stem diameter, leaf count (LCR), compactness of the planting medium, and root crown ratio. Data analysis was conducted based on the general and specific quality requirements outlined in SNI and Perdirjen RLPS No. P.05/V-Set/2009. The findings revealed that 66.5% of the seedlings satisfied the general requirements, while 72.38% met the specific requirements. The rain tree seedlings were classified within quality class D, with a percentage of normal seedlings falling below 95% and several samples exhibiting damage from pests and diseases. These results underscore the necessity for enhancements in nursery management, particularly concerning pest and disease control, to elevate the quality of raintree seedlings in future production.

Keywords: Forest Rehabilitation, Nurseries, Physical Quality, Reforestation, Seedlings

1. INTRODUCTION

The availability of seedlings is a critical factor in initiatives to mitigate and address deforestation. According to data provided by the Auriga Nusantara Foundation in the article "World Forest Day: Deforestation in Indonesia Reaches 257 Thousand Hectares in 2023, " implementing reforestation and forest rehabilitation activities is essential to curtail the ongoing deforestation.

Rehabilitation and reforestation depend on the success of plants to grow optimally in the field (Rahayu et al., 2023). According to Fatma et al. (2022), rehabilitation and reforestation require quality seedlings ready to be planted. Indriyanto and Asmarahman (2020) state that low-quality seedlings exhibit poor adaptability to the environment, which impacts their survival rates. Nurhasybi et al. (2019) define quality seedlings as possessing genetic, physical, and physiological advantages. Using quality seedlings in planting can enhance plant adaptation, accelerate rapid growth, and produce the desired morphological conditions.

High-quality seedlings are produced through a comprehensive assessment process. The evaluation of seedlings is conducted by considering their physical quality, genetic quality, and physiological quality. Physical quality is generally easier to understand compared to genetic and physiological quality. According to Ramadhan et al. (2022), physical quality evaluation can determine seedling quality quickly and effectively, contributing to better management practices.

The evaluation of the physical quality of seedlings refers to the Regulation of the Director General of Land Rehabilitation and Social Forestry (Perdirjen RLPS) No. P.05/V-Set/2009 concerning Guidelines for the Certification of Forest Plant Seed Quality. In addition to this regulation, seed quality standards are also issued by the National Standardization Agency (BSN) in the form of the Indonesian National Standard (SNI) number 8420 of 2018 concerning Forest Plant Seedlings. Although voluntary, the substance of this SNI is not different from Perdirjen RLPS No. P.05/V-Set/2009.

Evaluation of the physical quality of seedlings has been carried out by previous researchers, for example, by Wulandari et al. (2023), who evaluated the physical quality of eucalyptus (Eucalyptus pellita) seedlings in BPDAS Citarum Ciliwung. Research on the evaluation of the physical quality of seedlings, especially trembesi (*Samanea saman*) seedlings, conducted at the Indragiri Rokan Watershed Management Agency (BPDAS) in Pekanbaru City has never been conducted. BPDAS Indragiri Rokan Pekanbaru City Riau Province has a permanent nursery to procure seedlings to be distributed to the community to meet the needs of forest and land rehabilitation. One of the types of seedlings produced is trembesi (*Samanea saman*) seedlings.

According to Sofyan et al. (2014), the trembesi tree has a significant capacity to absorb carbon, reaching 28,488.39 kg of CO_2 per tree annually. Furthermore, the roots of the trembesi have been utilized as a remedy for cancer prevention and treating flu, headaches, and intestinal diseases. The demand for trembesi seedlings at the Permanent Nursery of the Indragiri Rokan Watershed Management Agency in 2023 is projected to be 20,000. Considering the diverse benefits and the high demand for trembesi seedlings, it is essential to evaluate the physical quality of these seedlings at the Permanent Nursery of the Indragiri Rokan Watershed Management Agency.

2. MATERIAL AND METHODS

2.1 Time and Place

This research was conducted at the Permanent Nursery of BPDAS Indragiri Rokan, Pekanbaru City, Riau Province, Indonesia, coordinates 0°27'23

"N 101°23'28" E. This research was conducted from June to July 2024.

2.2 Tools and Materials

The materials used in this study were trembesi seedlings produced at the Permanent Nursery of the Indragiri Ro River Watershed Management Center (BPDAS), bred generatively from seeds. The trembesi seeds used were sourced from local products and sent directly from seed breeders in Nganjuk, East Java. Tools used included stationery, ruler or measuring tape, calipers, knife, machete, raffia rope, and laptop. Data processing was conducted using Microsoft Excel 2010 software.

2.3 Research Implementation

Sampling was done systematically with a random start. Test sampling was based on the number of seedlings to be examined (Table 1). The samples used amounted to 200 seedlings from 15,155 ready-to-plant 6-month-old trembesi seedlings.

Table 1. Number of seed samples used (SNI 8420 of 2019).

Number of ready-to-plant seedlings (ea)	Number of samples (ea)
< 1.000	10
1.000 - 10.000	100
10.000 - 50.000	200
50.000 – 100.000	500
100.000 – 1.000.000	1.000
≥ 1.000.000	2.000

The parameters observed included observation of normal seedling conditions, measurement of seedling height, seedling diameter, number of leaves/LCR, compactness of the planting media. Seedling samples used were observed for root crown ratio. The research implementation is presented in Figure 1.

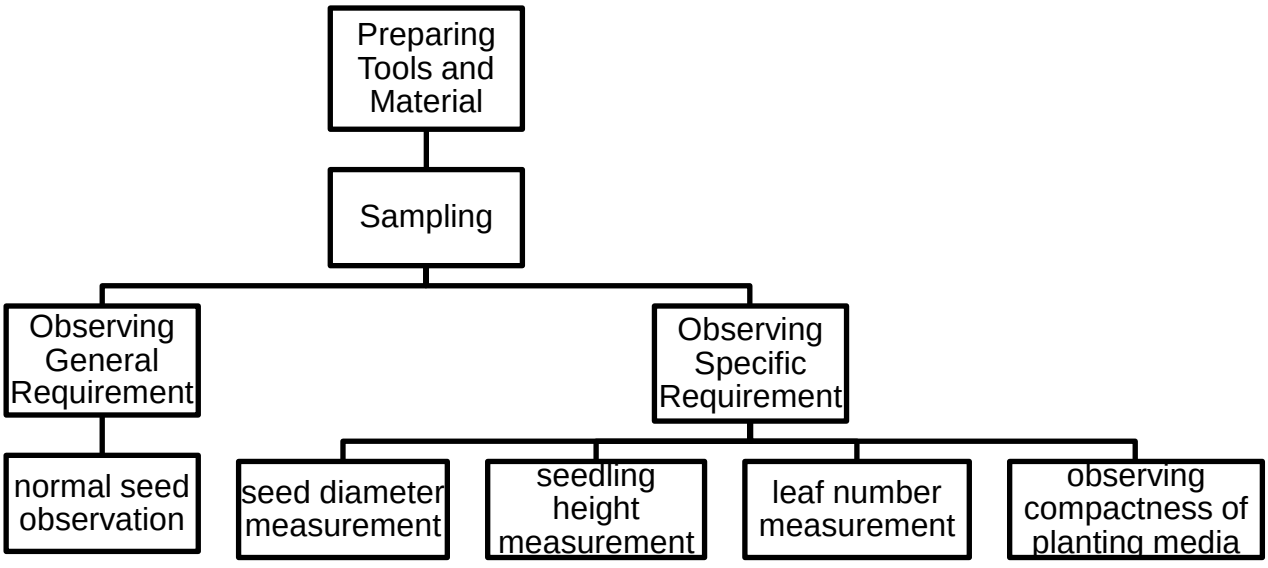

Figure 1. Research Flow Diagram

2.4 Data Analysis

The data obtained were then analyzed based on the provisions of SNI 8420 of 2018 concerning Forest Plant Seedlings, which include general requirements and special requirements for seedling quality. General requirements include a certificate of the

seeds used and normal seedling conditions (healthy seedlings and having a single, straight, woody stem). Special requirements include several parameters, including height, stem diameter, compactness of the planting medium, number of leaves, or LCR. The general and special requirements that have been identified are then calculated for their respective percentages.

Raintree seedlings are declared to have passed the physical quality test according to SNI 8420 of 2018 if they meet the specified requirements; namely, they are classified as P quality class if the normal seedling value is >95% and the average value of special requirements is >90%. If the normal seedling value ranges from 75% to 95% and the average special requirements are between 70% to 90%, they are classified as D quality class.

3. RESULT AND DISCUSSION

3.1 Normal Seeds

Normal seedlings are obtained through observation of seedling health and stem condition. Seedling health evaluation is seen from the general condition of the seedlings, whether they are affected by pests and diseases. The results of the evaluation of the health of trembesi seedlings show that 40% of the observed trembesi seedlings are free from pest attacks. The presence of perforated leaves indicates damage to seedlings due to pests found. Damage to seedlings due to disease is found in brown leaf spots, yellow leaves, and leaf rust. Symptoms of disease in trembesi seedlings are only found on the leaves. Healthy trembesi seedlings are indicated by green leaves without any disease symptoms, while in sick seedlings, disease symptoms are found on trembesi leaves. Symptoms of disease found in trembesi seedlings are yellow leaves, leaf spots, and leaf rust (Table 2).

Seedlings attacked by pests and diseases experience losses in growth and planting success in the field. Seedlings that are attacked tend to have lower quality and face a higher risk of death (Yustika et al., 2022). The economic impact is also significant, given the need for special treatment and additional pest and disease control costs.

The health evaluation results of trembesi seedlings showed that 60% of trembesi seedlings were attacked by pests and diseases. Seedling damage due to pests was found in trembesi seedling samples, namely perforated leaves. Seedling damage due to disease was found in brown leaf spots, yellow leaves, and leaf rust (Figure 2). Symptoms of disease found in trembesi seedling samples are shown in Table 2.

Table 2. Symptoms of rain tree seedling disease attack

Seed health condition	Symptom
Yellowing leaves	The entire leaf surface is yellow.
Brown leaf spots	Brown spots with irregular shapes and small sizes spread on the leaf surface.
Leaf rust	There are yellow spots on the sides of the leaves, some of which turn brown and dry out.

Observations in the nursery showed that leaf damage, such as holes, was often caused by pests, especially leaf rollers and grasshoppers. Damage to leaves needs to be addressed to maintain seedling growth and development. According to Satria et al. (2015), leaves are essential for seedlings because they function as the main photosynthesis organ. Healthy and intact leaves support optimal seedling growth and development, while damaged leaves can interfere with photosynthesis and cause seedlings' losses.

Yellowing leaves are a change in leaf color in plants that indicates an abnormality, where leaves that should be green turn yellow, indicating that the plant

may be experiencing a disease or nutrient deficiency that causes the color change (Putri et al., 2021). According to Muliya et al. (2021), yellowing leaves are caused by disruption of chlorophyll activity, in addition to being caused by pests carrying yellow virus vectors, excess and lack of water, and insufficient sunlight and nutrient nutrition.

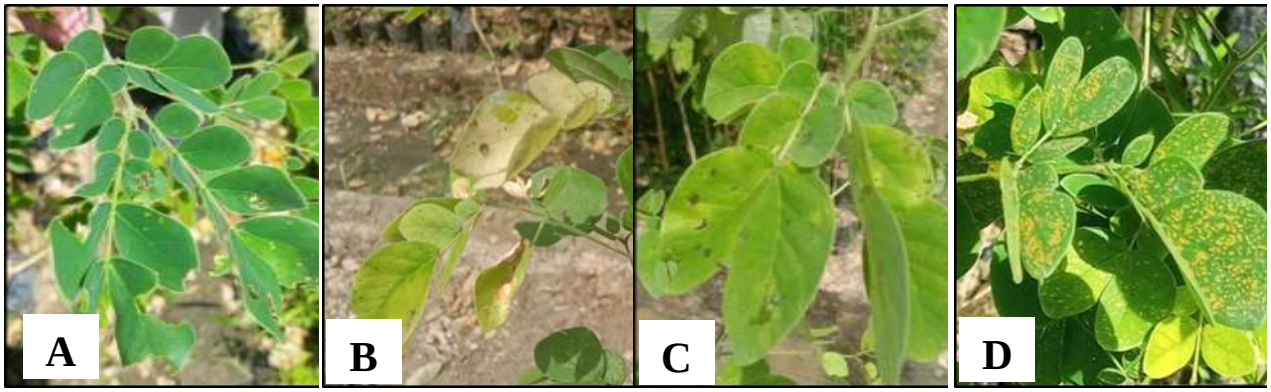

Figure 2. Damage to rain tree seedlings A. Holey leaves; B. Yellowing leaves; C. Leaf spots; D. Leaf rust.

The study results showed that leaf spot disease, often found in the field, is characterized by the appearance of brown spots on the surface of the leaves. These spots are usually brown spots that spread on the leaves. According to Rahmawati et al. (2022), this leaf spot is caused by the fungus Pestalotia sp., which produces symptoms in the form of brown spots with yellowish edges and can be found on both sides of the leaf, according to Muliya et al. (2021) explained that the development of leaf spot disease is greatly influenced by supportive environmental conditions, especially relative humidity between 95% and 100%.

Leaf spot disease can cause the gradual death of seedlings. According to Walida et al. (2024), leaf spot disease can reduce photosynthetic capacity, leading to premature leaf fall. The death of roots then follows this process and stems.

The study's results also showed the presence of leaf rust disease in plants. According to Mirsam et al. (2021), leaf rust is a plant disease caused by the fungus Puccinia polysora and is commonly found in tropical areas. Symptoms observed in the field include the appearance of yellow spots on the surface of the leaves. To control this disease, nursery managers maintain good sanitation and use pesticides to stop the spread of leaf rust.

The condition of the stem that indicates that the seedlings are normal is when the stem is straight, single, and woody. The results of observations showed that 77% of raintree seedlings had straight, single, and woody stems. Straight and single seedlings are the desired and ideal condition in nurseries (Gunawan, 2011).

3.2 Seedling height

The results of the measurement of the height of the seedlings showed that the average height of the raintree seedlings was 64 cm. According to SNI 8420 2018, seedlings are declared ready to plant if they reach a height of ≥50 cm and are around 6 months old. Based on observations, the average height of raintree seedlings meets these criteria. For example, from 200 samples tested, 74% have a height of ≥50 cm, so they can be said to be ready to plant.

Seedlings that meet the height requirements for being ready to plant are an essential indicator of resilience in the field. Seedlings with optimal height can better meet the needs of sunlight and nutrition, thus supporting better growth.

This follows the research of Yusuf et al. (2023) that shows that the need for nutrition affects the height of the seedlings. In addition to fulfilling nutrition, the distance between seedlings in the nursery affects the height of the seedlings (Mufikha & WDP, 2016).

3.3 Seedling diameter

The results of the seedling diameter measurement showed that the average diameter of the sample seedlings was 6.59 mm, which exceeded the standard for the diameter of raintree seedlings based on SNI 8420 in 2018, which was 5 mm. The rain tree seedlings met the requirements for planting in the field, with 73.5% of them meeting the criteria. The evaluation results showed that the availability of nutrients in the planting medium was good enough to stimulate the growth of the height and diameter of the seedlings.

Height and diameter parameters are fundamental indicators in assessing plant growth. This is in line with the statement of Pasaribu et al. (2016) that the increase in seedling diameter increases linearly with seedling height growth.

3.4 Number of leaves or LCR

The evaluation showed that the average number of leaves/LCR was 47.46%. Of the total seedlings tested, 132 met the LCR standard of 40%. Leaves are one of the essential organs for seedlings, and the photosynthesis process occurs in them. The growth in the number of leaves/LCR is in line with the growth in seedling height. This follows the statement of Panggabean et al. (2023) that the number of leaves is related to the height of the seedlings; the taller the seedlings, the more leaves the plant has.

Leaf growth is influenced by the nutrients provided, especially nitrogen (N) and phosphorus (F) (Rizal, 2017). The N element helps increase the width and length of the leaves, while the P element plays a role in stimulating root growth and development. These elements are obtained from the fertilizer and planting media provided.

3.5 Compactness of planting media

The compactness parameter of garden media is a parameter that determines the extent to which the planting media has a structure and consistency that supports the growth of plant roots. The planting media functions as a medium or place for roots or potential roots to grow and develop (Jansen et al., 2018). According to Pasir Hakim (2014), the quality of the planting media will affect plant growth and production results.

According to Irmayanti et al. (2020), the compactness of the planting media significantly affects plant growth, especially root growth. Optimal root growth contributes to a high survival rate of seedlings when transferred to the field.

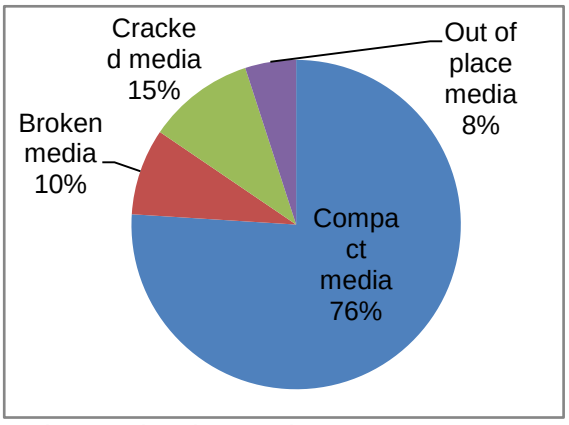

Figure 3. Results of the evaluation of the compactness of the planting media

The compactness of the planting media for rain tree seedlings is assessed based on SNI 8420 of 2018, which consists of four criteria: compact media,

broken media, cracked media, and loose media (Figure 3). The results of the evaluation of the compactness of the planting media were that 76% of the planting media seedlings were compact and intact, which indicates that the planting media used was of good quality, both for the nursery (Figure 3). According to Yustika et al. (2022), the composition of the materials used influences the compactness of the planting media. The Permanent Nursery of BPDAS Indragiri Rokan uses a planting medium consisting of a mixture of black soil, manure, and rice husks with a dosage ratio of 3:1:1. Safitri et al. (2020) stated that in addition to the planting media material, the density of the planting media also affects the compactness of the planting media.

3.6 Root crown ratio

The root crown ratio compares the dry weight of the crown and the dry weight of the roots. According to Kakanga et al. (2017), the root crown ratio is a parameter that shows the balance between root and crown growth. According to Ardiansyah et al. (2024), the root crown ratio value will provide information related to the balance of crown growth as a place where photosynthesis occurs and root growth as a place to absorb nutrients and water.

The results of the study obtained a root crown ratio value of 1.94. This result indicates that the growth of raintree seedlings is more focused on crown growth. According to Riswandi & Sari. (2021), the root crown ratio value >1 indicates that photosynthate accumulation in plant seedlings tends towards crown growth. According to Ardiansyah et al. (2024), a high root-crown ratio indicates that crown growth exceeds root growth. According to Riswandi & Sari. (2021), the root crown ratio in plant growth describes the efficiency of plants in absorbing nutrients and the metabolic processes that occur. According to Wasonowati et al. (2022), plants that prioritize root growth better survive in dry conditions. Optimal root growth allows for increased crown growth, while good crown growth can increase the production of assimilates to strengthen and expand roots.

3.7 Physical Quality Class of Trembesi Seedlings

Seedling quality standards are determined after evaluating the general and specific requirements based on SNI: 2018. Seedling quality is categorized according to Perdirjen RLPS No. P.05/V-Set/2009 divides quality into three categories: first quality (P), second quality (D), and the category does not meet quality standards. The evaluation results were obtained from 200 seedlings from 15,155 trembesi seedlings (Table 3).

Table 3. Results of the physical quality evaluation of raintree seedlings

Physical quality requirements for seeds		Evaluation Result (%)		Quality class (%)		Remarks
		Variable	Mean	P	D	
General requirements	Normal seeds	66.5	66.5	>95	75 – 95	It needs to be repaired.
Special requirements	BST	74	72.38	>90	70 – 90	Includes quality class D
	BSD	73.5				
	BSJD	66				
	BMK	76				

Remark: BST = seedlings that meet height standards; BSD = seedlings that meet diameter standards; BSJD = seedlings that meet leaf number/LCR standards; BMK = seedlings that meet planting media compactness standards.

Evaluation of the quality of trembesi seedlings at the Permanent Nursery of BPDAS Indragiri Rokan showed that 66.5% of the seedlings met the general requirements test, and 72.38% of the seedlings passed the special requirements test. Based on Perdirjen RLPS No. P.05/V-Set/2009, trembesi seedlings meet exceptional standards with quality class D, but

improvements are needed in the quality of the seedlings to meet the general requirements because many samples were damaged by pests and infected with diseases..

According to Damayanti et al. (2022), to achieve the first quality class (P), the quality of nursery management must be improved. This improvement can be achieved with more intensive care of seedlings, which includes fertilization, weeding, and effective watering management. In addition to improving management, determining the planting distance also affects the number of seedlings that do not pass the test.

According to Abdulrahman and Ngatiman (2020), the size of the planting distance affects the growth of diameter, stem condition, and number of plants. Field observations show that maintenance, especially seedling thinning, affects the height and diameter of seedlings. The older the seedlings, the greater the canopy growth. Without thinning or adjusting the planting distance, the seedlings' canopies will cover each other, causing competition for sunlight (Wulandari *et al*., 2023).

4. CONCLUSION

Ready-to-plant trembesi seedlings that are 6 months old and produced at the Permanent Nursery of BPDAS Indragiri Rokan were tested for physical quality based on SNI 8420 in 2018. The results of the evaluation of trembesi seedlings that met the general requirements were 66.5%, and the particular requirements were 72.38%. For special requirements they are included in quality class D, while general requirements need to be improved because pests and diseases attack many seedlings.

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