

Peat Swamp Plant Germination Test at Green House Cimtrop University Palangka Raya

Sampang Gaman¹, Reni Rahmawati², Patricia E. Putir³, Yosefin A.S⁴, Untung Darung⁵, Eritha K.F.⁶

Universitas Palangka Raya, Indonesia
Email: sampang@for.upr.ac.id

Abstract: Peat swamp forest degradation in Central Kalimantan has become a serious problem that impacts biodiversity and carbon storage. One of the rehabilitation efforts is through planting local species that are resistant to peat swamp conditions. This study aims to evaluate the germination techniques of Kapurnaga (*Palaquium sclerophllum*) and Marabungkan (*Lauracea*) seeds with various growing media, and identify the most effective media in supporting seed viability and early growth. The research was conducted in the green house of Palangka Raya University using five growing media methods: peat, sand, rice husk + fertile soil, burnt husk, and control (no treatment). Data were analyzed using ANOVA test to evaluate the effect of media on germination percentage. The results showed that peat media and the combination of rice husk + fertile soil produced the highest germination percentage in Kapurnaga (88.89%), while in Marabungkan, peat media also gave the best results. The control media produced the lowest germination percentage in both seed types. This study implies that the use of appropriate growing media is very important in increasing the germination success of local seeds in peat swamp ecosystems, which can support sustainable peat forest rehabilitation efforts.

Keywords: Sprouts, Green House, Forest Rehabilitation.

INTRODUCTION

Rehabilitation of degraded peat-swamp forests, especially in Central Kalimantan Province, is becoming increasingly important to restore the ecological function of the area and maintain biodiversity and carbon pools. One obstacle encountered in these rehabilitation efforts is the limited knowledge of rehabilitation techniques on peat swamplands using local species (Rusdiansyah et al., 2019). This is because this area is often inundated with water during the rainy season, which greatly affects the growth of the peatland species (Santhiawan & Suwardike, 2019).

Peat swamp forests are dominated by tree species with recalcitrant seeds that cannot be stored for long periods. The species that can grow on peatlands are minimal due to the acidic nature of the soil, the possibility of forest fires during the dry season, and the presence of non-periodic inundation during the rainy season (Maimunah, 2014).

In order to support the success of planting these species, proper seed handling is required to increase the seeds' viability. To determine the viability or quality of the seeds, it is necessary to test the germination rate (Rohandi & Widayani, 2017). Germination is an embryo activation that results in the seed coat's opening and young plants' emergence. Seed germination is also one of the indicators related to seed quality (Rohandi & Widayani, 2019); (Saupe, 2009). Germination environmental conditions, such as water, temperature, light, and media influence seed germination (Dewi, 2019). Seed germination begins with the process of imbibition or water absorption (Siregar, 2010); (Santoso & Purwoko, 2008). Seed germination provides information to seed users on the ability of seeds to grow generally into plants that produce reasonably under optimum biophysical conditions in the field (Sutopo, 2010); (Pramono, 2009). Factors that affect the seed germination process are water, temperature, oxygen, and moisture (Susilowarno, 2014).

The unwise expansion of peat utilization has caused a rapid rate of peat degradation in Indonesia. This rate of peat degradation has led to the reduction or loss of the multifunctionality of peatlands, both ecologically and socio-economically. For this reason, it is necessary to rehabilitate the degraded peat swamp forest. One consideration for rehabilitation is the selection of local species suitable for the local ecological conditions (Baskin & Baskin, 2014).

Local species still need to be widely selected; some are Kapurnaga and Marabungkan. For this reason, it is necessary to research silvicultural techniques so that the propagation method can be known, applied, and developed (Neves et al., 2019). One of the ways to propagate species is by collecting seeds from nature and conducting seed germination tests through several growing media.

Based on the above background, this study aims to analyze the development of silviculture techniques through the growing media method of seed germination. This research aims to evaluate propagation techniques through seed germination tests on various growing media so that the most influential media can be identified to support seed viability and initial growth in peat swamp ecosystems. The benefit of this research is to enrich scientific knowledge regarding peat swamp endemic plant cultivation techniques, especially in preparing suitable seedlings for forest rehabilitation activities. This research is also expected to contribute to the selection of plant species that are more suitable for the ecological conditions of peatlands, thereby increasing the success of rehabilitation and restoration programs for degraded ecosystems. In addition, the results of this study are expected to provide practical guidance for practitioners in efforts to conserve and restore peat swamp forests in Indonesia.

MATERIALS AND METHODS

Place and Time

This research was conducted from November to December 2023 in the greenhouse of Palangka Raya University's Cimtrop nursery.

Tools and Materials

The tools used were plastic tubs, parents, sprinklers, digital cameras, and tally sheets. The materials used were kapurnaga seeds (*Palaquium sclerophllum*), Marabungkan (*Lauracea*), and several germination media (peat, sand, rice husk, and mineral soil).

Research Implementation

- a. Site and media preparation
 - 1) Tool preparation
 - 2) Making sprout media
- b. Preparation of plant material
 - 1) Seed supply
 - 2) Seed selection
 - 3) Sowing seeds
- c. Maintenance
 - 1) Intensive watering
 - 2) Fungicide spraying
- d. Observation and Data Collection
 - 1) Seed germination
 - 2) Germination percentage

Data Analysis

The study's parameters included the percentage of germination of Kapurnaga (*Palaquium sclerophyll*) and Marabungkan (*Lauracea*) seeds in each treatment; the seeds' moisture content was also measured as supporting data.

The calculation formula for the parameters observed in this study is:

1. Seed germination percentage

Germination percentage was calculated using percent units based on the following formula:

$$\text{Germination percentage} = \frac{n}{N} \times 100\%$$

Description:

(n): Number of seeds that germinated;

(N) : Number of seeds tested

2. Each treatment had 9 seedlings, each with three replications, and each replication contained 3 seedlings, so the total observation unit was 27 plants. Measurement data were analyzed using an ANOVA test using Microsoft Office Excel and SMARTSTATXL software. If the results of the ANOVA test analysis of variance significantly influenced ($\alpha = 0.05$), then further examination was carried out with the Duncan test ($\alpha = 0.05$). In this study, data analysis was calculated using the variables of plant height, growth percentage, and initial plant height.

3. At the end of the study, soil analysis was conducted at the Analytical Laboratory of Palangka Raya University to determine the nutrient elements and the effect of sprouting media on the growing seeds.

RESULTS AND DISCUSSION

Germination Percentage of Kapurnaga (*Palaquium sclerophyll*) Seeds

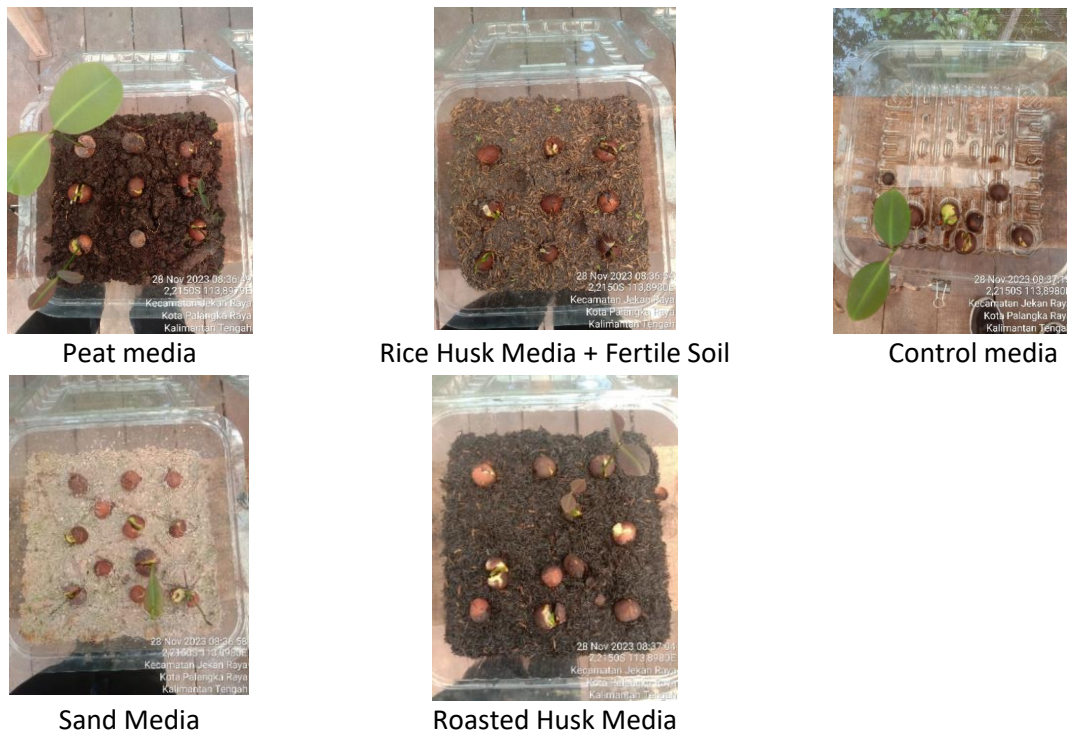


Figure 1. Kapurnaga (*Palaquium sclerophyll*) seeds on several media

Source: Research Results, 2023

Table 1 and Figure 1 present data from the average percentage of kapurnaga seed germination on several sprouting media for 2 (two) months.

Table 1. The results of the calculation of the average percentage of germination

Treatment	Average Germination Percentage (%)
Control	44,44
Peat Media	88,89
Sand Media	77,78
SP Media + Fertile Soil	88,89
Roasted Husk Media	66,67

Source: Research Results, 2023

Based on Table 1 and Figure 1, it can be seen that the percentage of Kapurnaga (*Palaquium sclerophllum*) seed germination in the treatment of peat media and a combination of fertile soil rice husk (SP) media has a value of 88.89%, the percentage of germination in the treatment with sand media has a value of 77.78%, the percentage of germination in the treatment of burnt husk media is 66.67%. In comparison, the percentage of germination in untreated kapurnaga seeds has a percentage value of 44.44%. So from the five treatments above, it can be seen that the highest percentage value of germination is in the cardamom seeds treated with peat media and SP media combined with fertile Soil (88.89%), while the lowest percentage value is in the untreated cardamom seeds/control (44.44%).

Based on the results of the effect of sprouting media on kapurnaga seeds, the control and peat media increased by 50%; the control and sand media increased by 42.86%; the control and SP + fertile soil media increased by 50%; and the control and bake husk media increased by 33.34%.

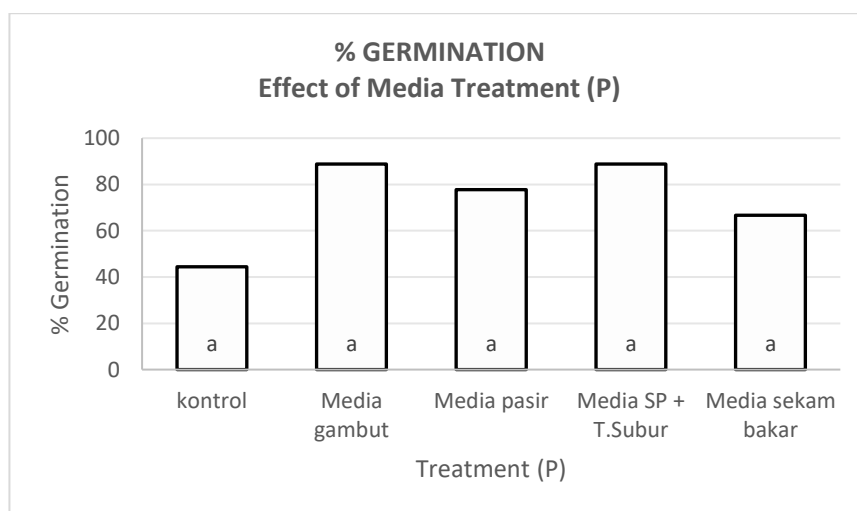


Figure 2 Percentage of Kapurnag seedlings alive on several germination media

Source: Research Results, 2023

Based on the analysis of variance (ANOVA table), the germination percentage of cardamom shows that the effect of sprouting media does not show significant differences. The results of the analysis are presented in Table 2.

Table 2. Results of variance of germination percentage cardamom seeds on several sprouting media

Variety Source	DB	JK	KT	F-Count	P-Value	F-0,05	F-0,01
Treatment (P)	4	4148.1481	1037.0370	2,000 in	0.171	3.478	5.994
Error	10	5185.1852	518.5185				
Total	14	9333.3333					

Description:

Variety Source	DB	JK	KT	F-Count	P-Value	F-0,05	F-0,01
* = significantly different at 5% real level; ** = significantly different at 1% real level; tn = not significantly different.							
KK = 31.05%							

Source: Research Results, 2023

Germination Percentage of Marabungkan Seeds

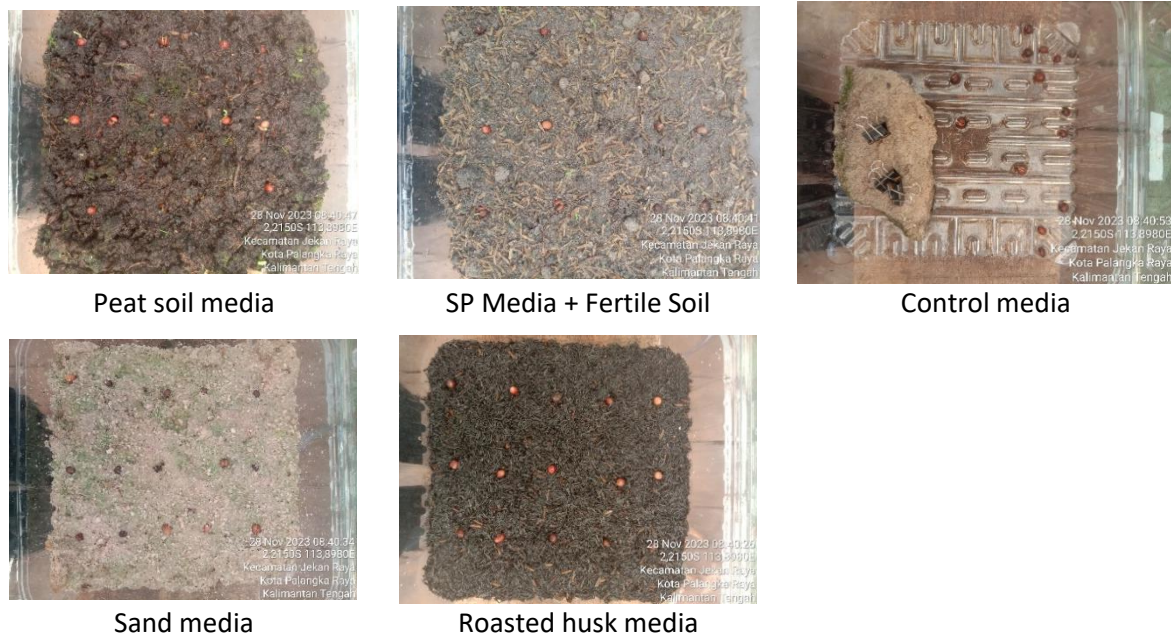


Figure 3. Marabungkan (Litsea sp) seeds on several media

Table 3 and Figure 4 present data on the germination percentage of Marabungkan seeds on several sprouting media for 2 (two) months.

Table 3. Calculation results of the average percentage of germination

Treatment	Average Germination Percentage (%)
Control	6,67 a
Peat Media	66,67 b
Sand Media	26.67 ab
SP Media + Fertile Soil	46.67 ab
Roasted Husk Media	6,67 a

Source: Research Results, 2023

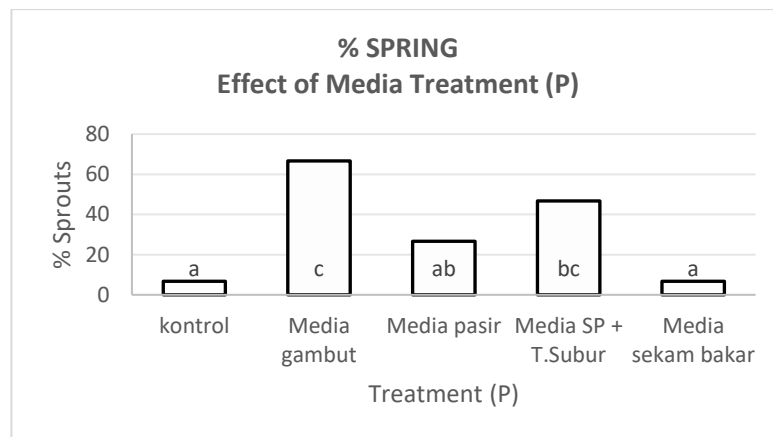


Figure 4. Percentage of Marabungkan seedlings alive in different germination media

Source: Research Results, 2023

Based on the variance analysis (ANOVA table), the germination percentage of marabungkan shows a very significant difference in the effect of sprouting media. The results of the analysis are presented in Table 4.

**Table 4. Results of variance of seed germination percentage
Incorporate some sprouting media**

Variety Source	DB	JK	KT	F-Count	P-Value	F-0,05	F-0,01
Treatment (P)	4	8160.0000	2040.0000	6.955 **	0.006	3.478	5.994
Error	10	2933.3333	293.3333				
Total	14	11093.3333					

Description:

* = significantly different at 5% real level; ** = significantly different at 1% real level; tn = not significantly different.

KK = 55.85%

Source: Research Results, 2023

The results of the analysis of nutrient content in the sprout media are as follows:

Table 5. Lab analysis results of sprout media

No.	Sample code	Analyzed parameters		
		N (%)	P (mg/kg)	K (me/100g)
1.	Peat Media	1.70 Very High	107.82 Very High	0.25 Low
2.	Sand Media	0.25 Medium	17.02 Medium	1.90 Very High
3.	SP media + Fertile soil	0.49 Medium	128.48 Very High	1.42 Very High
4.	Roasted Husk Media	0.64 High	391.95 Very High	10.89 Very High
5.	Control/peat water media	1.17 Very High	0.21 Very Low	1.82 Very High

Source: Research Results, 2023 (Salam, 2020)

Based on Table 5, the N content in each media ranged from medium to very high, the P content ranged from very low to very high, and the K content ranged from low to very high. The available K nutrient content in the peat media is low. K is an essential cation that is easily leached to other elements. In contrast, the P nutrient content in the control is shallow. Hence, the media tends to be infertile compared to other growing media.

The availability of N, P, and K, which are essential nutrients in each medium, will benefit the seedlings in their further growth because such soils tend to be fertile. During germination, the required growing medium is one that provides good aeration and porosity so that the seeds can germinate.

The results of analysis of variance (ANOVA) showed that the treatment of growing media on Kapurnaga germination had no significant effect ($p < 0.05$) on all measurement variables, namely peat media, sand media, SP media and fertile Soil, burnt husk media, and control. While the germination of Marabungkan seeds was done, the results of the variance analysis showed that the treatment of growing media had a very significant effect on the germination of Marabungkan seeds.

In general, the sprouting time of Kapurnaga seeds in all treatments was not significantly different from the control. The sand media treatment, SP media fertile Soil, and fireclay media showed the longest sprout emergence time (week 2), but the peat media treatment had the fastest sprout emergence time (week 1). Meanwhile, all treatments' combined seed germination time significantly differed from the control treatment. Peat media, sand media, and SP + fertile soil media showed the fastest germination time (week 1) compared to the control treatment (week 2).

The control treatment experienced obstacles in germination caused by the absence of treatment, so the seed coat was relatively hard. For seeds not given preliminary treatment, the seed coat is still in a rigid and impermeable state that hinders imbibition and gas exchange. Dormancy inhibits the seeds' growth, resulting in the longest seed germination. In contrast to seeds given a growing medium, the sprouts emerge faster in this time. The provision of growth media aims to make the seeds germinate quickly.

Germination analysis of Marabungkan seeds in peat and SP + fertile soil media treatments resulted in the highest germination percentage of 88.89%. In comparison, sand media (77.78%) and burnt husk media showed a germination percentage of 66.67%. In treating peat media and SP + fertile soil media, the seed coat may have been able to absorb water optimally to support germination. Seeds given peat media and SP + fertile soil media grew well until the end of the study. At the same time, the control showed the lowest percentage (44.44%) because the seed coat was still hard, resulting in minimum sprout growth. (Farida, 2016) mentioned that the accuracy of the selection of dormancy-breaking methods results in dormant seeds that will germinate faster and produce uniform growth. The selection of dormancy-breaking treatment methods on seeds is determined by the type of dormancy on the seeds.

In his research, Satya et al. (2015) stated that the ability of seeds to absorb water, the ability of the embryo to come out and germinate, and the accuracy in giving concentration to the treatment of seeds are related to the time span required for the emergence of radicle or plumula in seeds. Therefore, seeds with soaking treatment can germinate in a relatively short time compared to those that are not soaked.

The results of the analysis of all parameters showed that the treatment of various growing media was able to increase germination in Kapurnaga seeds and Marabungkan seeds because they could germinate well. In the control treatment, if the seeds are soaked for too long, it will damage the seeds, which results in inhibited seed germination. The increased germination speed causes the seeds to grow optimally, and the sprouts will grow faster on peat media, SP + fertile soil media, sand media, and burnt husk media. According to (Yuniarti et al., 2014), seeds with high vigor will be able to produce normally in sub-optimum conditions and above-normal conditions, can grow synchronously and quickly, and are more resistant to storage in conditions that are not ideal (Lesilolo et al., 2018) stated that fast-growing seeds can better deal with suboptimal field conditions.

The availability of nutrients N, P, and K, which are essential nutrients in each media, will benefit the seedlings in their further growth because such soils tend to be fertile, while at the time of germination, the required growing media is a medium that provides good aeration and porosity so that the seeds can germinate. The P nutrient content in the control was shallow. Hence, the media tended to be less fertile than other growing media. The main nutrient problem in peat soils is low P availability and P retention because organic compounds bind P ions, which are quickly released and carried away by beachheads.

CONCLUSION

Growth media treatment did not significantly affect the germination percentage of kapurnaga seeds. In contrast, the growth media treatment significantly affected the germination percentage of marabungkan seeds. The test results showed differences in the fertility of the growing media in each treatment and the type of seed germinating, indicating variations in results based on the media and type of seed used. As a suggestion, further research needs to be conducted focusing on specific

germination media treatments for endemic species in peat swamp areas. It is important to understand further the effect of growing media on these endemic species.

The future contribution of this study is to provide initial insights into the effect of growing media on the germination of different seed types, particularly for marabungkan and kapurnaga species. While the growing medium had no significant effect on kapurnaga seeds, the findings suggest that the growing medium factor has a more significant impact on marabungkan seeds. This study can serve as a foundation for further in-depth research, especially focusing on understanding the mechanism of growing media on the germination of endemic species in peatlands. In addition, future research can explore other variations of growing media, such as a mixture of organic materials or microorganisms that can increase germination rates. This research can also contribute to conservation and reforestation efforts of endemic species in peatland habitats, as well as provide recommendations for best practices to improve plant growth success in this vulnerable ecosystem.

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