

Effect of Growing Media Composition and Watering Intervals on the growth of *Gmelina arborea* Roxb seedlings

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Abstract: *Gmelina arborea* Roxb is one type of forestry plant that has the potential to be cultivated. This is because in addition to having a high economic value, *Gmelina arborea* Roxb is a plant that is able to grow in critical areas and has a short life cycle. In addition, *Gmelina arborea* Roxb is one type of wood that has high productivity, high economic value, has a wide natural distribution, has a large genetic variation, can be bred easily, easy to master cultivation techniques, and is resistant to pests and diseases. The purpose of this study was the effect of planting media composition and watering interval on the growth of *Gmelina arborea* Roxb seedlings. The study used a complete randomised design (RCD) factorial pattern consisting of two factors: The first factor: the composition of planting media, the second factor: watering interval. The results showed that the treatment of media composition and watering intensity treatment and the combination of treatments had a significant effect on the growth of *gmelina* seedlings. The treatment with the composition of 750 g soil and 250 g cocopeat with watering intensity once a day gave the best results for the growth of *gmelina* seedlings.

Keywords: *Gmelina arborea*; Growth; Planting media; Seedling.

Introduction

Gmelina arborea Roxb is one type of forestry plant that has the potential to be cultivated (Zulkaidhah et al., 2022). This is because in addition to having a high economic value, *Gmelina arborea* Roxb is a plant that can grow in critical areas and has a short life cycle (Biswas et al., 2022). In addition, *Gmelina arborea* Roxb is one type of wood that has high productivity, high economic value, has a wide natural distribution, has a large genetic variation, can be bred easily, easy to master cultivation techniques, and is resistant to pests and diseases (Nuraeni et al., 2018; Onwe et al., 2023). Quality seedlings are the first most important thing in plant culture (Rahmawati et al., 2020). To produce plant seeds, it is necessary to take the right methods, one of which is by paying attention to the conditions and composition of the media needed according to the needs and absorption

capacity of the plants in the nursery. Some efforts that can improve the quality of the media where seedlings grow can be made through the addition of organic materials to nutrient-poor soils so that good quality seedlings can meet the expectations of good growth later in the field (Nagase & Dunnett, 2011).

The advantages of using organic matter as a growing medium are that it has a structure that can maintain aeration balance, organic materials, especially those derived from waste, which are abundant and cheap, can be used as an alternative growing medium (Chen et al., 2020; Suominen et al., 2021). Organic materials have squeezing properties so that air, water, and roots easily enter the soil and can bind water (Galstyan et al., 2020). One of the organic materials that can be used as a growing medium is coconut coir waste (Mariotti et al., 2020). Processed coconut fibre used as a seedling growing medium is called cocopeat. Cocopeat

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is one of the growing media produced from the coconut fibre crushing process (Gagassage et al., 2022). The coir crushing process produces fibre or fibre, and fine powder or cocopeat (Arbiwati et al., 2020). The utilisation of organic materials such as cocopeat and rice husk charcoal has the potential to be used as an alternative growing media composite to reduce the use of topsoil. One of the advantages of using organic materials as planting media is that they have a structure that can maintain aeration balance. Organic materials, especially waste materials, which are abundant and cheap, can be used as an alternative growing medium that is difficult to replace (Horue et al., 2021). This is very important for the roots of plant seedlings because the growing medium is closely related to root growth or the nature of plant roots (Ultisol, 2021). In addition to growing media, there are other factors that influence plant growth, namely: temperature, light, water, nutrients and soil (Onwuka & Mang, 2018). Water is one of the physical components that is very vital and needed in large quantities for plant growth and development (Gavrilescu, 2021). As much as 85-90% of the fresh weight of cells and tissues of tall plants is water (Akıncı & Lösel, 2012).

The use of soil and husk charcoal media composition on the parameters of crown dry weight, root dry weight and total dry weight showed equally good results in treatments using 100% soil and 80% soil composition + 20% husk charcoal with the best results in crown dry weight reaching 4.39 g, in root dry weight reaching 3.42 g, and in total dry weight reaching 7.77 g (Irawan & Kafiar, 2015). This study aims to determine the effect of the composition of planting media on watering intervals and their interaction on the growth of *Gmelina arborea* Roxb seedlings. This study aims to determine the effect of the composition of planting media watering intervals and their interactions on the growth of *Gmelina arborea* Roxb seedlings.

Method

Research Location

This research was conducted for 3 months from June to August 2024. Located at the Permanent Nursery of the Palu- Poso Watershed Management Centre (BPDAS), Palu, Central Sulawesi.

Stages of implementation/research design

This study used a randomised complete block design (CRD) Factorial Pattern, which consisted of two factors:

First Factor: Composition of growing media (M), consisting of:

- M0 = Soil (control)
- M1 = 750g soil + 250g husk charcoal
- M2 = 750gr soil + 250gr cocopeat

Second Factor: Watering Interval (P), consisting of:

- P1 = Watering 1 time a day (300 ml)
- P2 = Watering every 3 days (300ml)

So there are $3 \times 2 = 6$ treatment combinations, namely:

- M0P1 = Soil + watering once a day (300 ml)
- M0P2 = Soil + watering every 3 days (300ml)
- M1P1 = 750g soil + 250g husk charcoal + watering once a day (300ml)
- M1P2 = 750gr soil + 250gr husk charcoal + watering 3 days a day (300ml)
- M2P2 = 750gr soil + 250gr cocopeat + watering once a day (300ml);
- M2P2 = 750gr soil + 250gr cocopeat + watering 3 days a day (300 ml)

Each treatment combination was repeated 6 times so that in total there were $6 \times 6 = 36$ experimental units. The treatment randomisation model is as shown below:

Table 1. Treatment combination

Treatment					Combination
M0P1(1)	M1P2(2)	M2P1(1)	M0P1(6)	M1P1(2)	M2P2(1)
M0P2(1)	M2P1(4)	M2P1(5)	M0P2(3)	M2P2(5)	M1P1(3)
M1P1(1)	M0P1(2)	M1P2(1)	M1P2(5)	M0P2(4)	M2P1(3)
M1P2(3)	M2P2(3)	M0P2(2)	M0P1(3)	M1P1(4)	M2P2(6)
M2P1(6)	M1P1(5)	M1P2(4)	M2P1(2)	M0P2(5)	M0P1(4)
M2P2(2)	M0P2(6)	M2P2(4)	M0P1(5)	M1P2(6)	M1P1(6)

Media preparation

The planting media used were soil, husk charcoal and cocopeat based on the treatment according to each treatment. The mixed media was put into polybags measuring 25x17 cm.

Seedling preparation

The seedlings used were *Gmelina* seedlings that were about 3 months old. The seedlings were sorted based on height, number of leaves and almost the same diameter.

Planting of seedlings was done in the afternoon under shade (paranet) in polybags measuring 25x17 cm. After planting, *Gmelina* seedlings were placed for three

months under shade (paranet). Watering was done according to each treatment. Observations were made twice during the study, namely at the beginning of the study (7 days after planting), and at week 12. The observation parameters were as follows: seedling height gain (cm); increase in stem diameter (mm); and increase in number of leaves (blade). The difference between the final measurement and the initial measurement is the increment value.

Data from the study were analysed using a randomised complete block design (CRD) factorial pattern and the 5% level of least significant difference

(LSD) further test. Data processing using Microsoft Office 365 (excel) programme (Zulkaidhah et al., 2022). Research design and method should be clearly defined.

Result and Discussion

Height gain of gmelina seedlings (cm)

The results of the study of the average height gain of gmelina seedlings based on the composition of planting media and watering intervals can be seen in Figure 1.

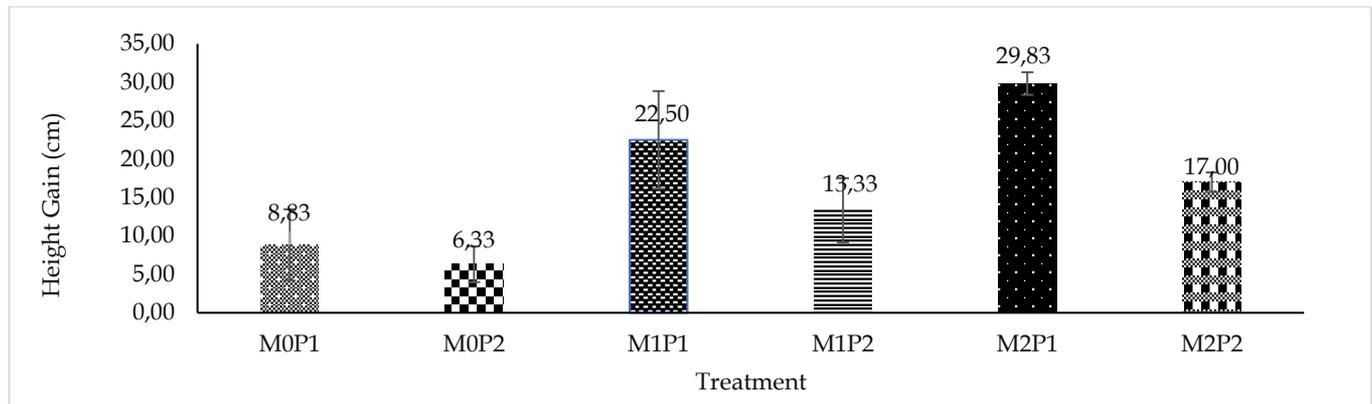


Figure 1. Graph of average height gain of gmelina seedlings

To determine the effect of single treatment and interaction treatment of planting media composition and

watering interval on the height increase of gmelina seedlings, the analysis of variance is shown in Table 2.

Table 2. Analysis of variance of height gain of gmelina seedlings

Source of variation	Db	Sum of squares	Centre square	F Count	F Table
Composition of growing media (M)	2	1550.88	775.44	52.65*	3.32
Watering Interval (P).	1	600.25	600.25	40.75*	4.14
Interaction (M*P)	2	164.67	82.33	5.59*	3.32
Error	30	441.83	14.72		
Total (Total)	35	2757.63			

Notes: * significantly different at 0.05 test level

The results of the analysis of variance in Table 2 show that the treatment of planting media composition (M), watering interval (P) and the interaction of the treatment of planting media composition and watering interval have a significant effect on the height gain of gmelina seedlings. To determine the differences in the effect of the treatment of the composition of the planting media, the Least Significant Difference (LSD) further test was conducted. The results of the single factor LSD further test of the composition of planting media on the height gain of gmelina seedlings are shown in Table 3.

Table 3. Results of LSD further test on the treatment of planting media composition

Treatment	Average	LSD value
M0 (Soil/Control)	7.58a	3.19
M1 (750g soil + 250g husk charcoal)	17.92b	
M2 750gr soil + 250gr cocopeat	23.42c	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 3 show that all planting media composition treatments give significantly different effects. The control treatment M0 (100% soil) has an increase in the height of gmelina seedlings by 7.5 cm, significantly different from the M1 treatment (750g soil + 250 g husk charcoal) is also

significantly different from the M2 treatment (750g soil + 250 g cocopeat), as well as the M1 treatment is also different from the M2 treatment. The M2 treatment has the best average height gain of Gmelina seedlings of 23.42 cm. This is because cocopeat has higher C-organic and N levels compared to husk charcoal (Cahyo et al., 2019; Harman & Zulkaidhah, 2019). The mixture of planting media with cocopeat is also a lighter media compared to husk charcoal planting media and has micro pores that can inhibit greater water movement, causing higher water availability (Ramadhan, 2017). This planting media has the ability to store water better so that the nature of the planting media with cocopeat mixture will tend to be more humid. This is because cocopeat is a planting medium that can absorb water six to eight times more than other media (Irawan & Kafiar, 2015; Mariotti et al., 2020).

To determine differences in the effect of watering interval treatment, the Least Significant Difference (LSD) further test was conducted. The results of the single factor LSD further test of the treatment interval on the height increase of gmelina seedlings are shown in Table 4.

Table 4. LSD further test results of planting media composition treatment

Treatment	Average	LSD value
P1 Watering once a day (300 ml)	20.39a	2.61
P2 Watering once every 3 days (300 ml)	12.22b	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 4 show that the treatment of watering intervals gives a significantly different effect. Treatment P1 (Watering 1 time a day) has a height increase of gmelina seedlings of 20.39 cm, significantly different from the treatment P2 treatment with watering 3 days a day. P1 treatment has a better average height gain of gmelina seedlings compared to

P2 treatment with watering every 3 days. This is because Gmelina is a woody plant that requires sufficient water and is susceptible to drought so that watering done every day can meet the water needs of plants compared to giving water at intervals of 3 days (López Aguirre & Barrios Trilleras, 2024). Water has an important role for plants, namely as a basic material for plant metabolism, plays a role in respiration and photosynthesis, a solvent in the soil for plant nutrients, regulates temperature through transpiration, regulates cell turgidity, and is involved in the transport of metabolites from roots to leaves (Rodriguez-Iturbe et al., 2001). Plants need water for their survival. Water that is too stagnant can cause high humidity, which can be a good place for pests and diseases to grow. In addition, excess stagnant water can cause a decrease in oxygen supply so that it can interfere with the plant growth process (López Aguirre & Barrios Trilleras, 2024). Conversely, lack of water can cause drought stress for plants, which has an impact on plant growth that is not optimal and tends to decline (Akıncı & Lösel, 2012).

Plants need water for their survival. Water that is too stagnant can cause high humidity, which can be a good place for pests and diseases to grow. In addition, excess stagnant water can cause a decrease in oxygen supply so that it can interfere with the plant growth process (Ultisol, 2021). Lack of water can cause drought stress for plants which has an impact on plant growth which is not optimal and tends to decline.

To determine the difference in the effect of the interaction of the treatment of planting media composition and watering interval, the Least Significant Difference (LSD) further test was conducted. The results of the LSD further test of the interaction of the treatment of planting media composition and watering intervals on the height gain of gmelina seedlings are shown in Table 5.

Table 5. LSD further test results of interaction treatment of planting media composition and watering interval

Treatment	Average	LSD value
M0P2 (Soil + watering every 3 days)	6.33a	4.53
M0P1 (Soil + watering once a day)	8.83ab	
M1P2 (750g soil + 250g husk charcoal + watering 3 days a day)	13.33bc	
M2P2 (750gr soil + 250gr cocopeat + watering 3 days a day)	17.00c	
M1P1 (750g soil + 250g husk charcoal + watering once a day)	22.50d	
M2P1 (750gr soil + 250gr cocopeat + watering once a day)	29.83e	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 5 show that the M2P1 treatment interaction of the composition of planting media 750g soil and 250g cocopeat with a watering interval of 1 time per day is significantly

different from all other treatment interactions. The M1P1 treatment is also significantly different from all other treatment interactions. M2P2 treatment was not significantly different from M1P2 but significantly

different from M1P1 and M2P1 treatments. The M2P1 treatment interaction has the best average height gain of gmelina seedlings of 29.83 cm. This is because watering every day causes sufficient water availability in supporting the growth of gmelina seedlings. In addition, it is influenced by the ability of cocopeat to store water better than the husk charcoal media, so that gmelina seedlings do not experience drought stress. Good and healthy seedling growth is not only influenced by genetic factors, but also influenced by maintenance factors during nursery, including the availability of nutrients and water (moisture) sufficient for growth (López Aguirre & Barrios Trilleras, 2024). Seedling growth is influenced by two factors, namely internal factors and external factors (Lynch et al., 2012). External factors include water and minerals, light, water volume and so on. While the internal factors that influence are the different genetic qualities of plants (Verma & Shukla, 2015).

Cocopeat as a growing medium has characteristics that can bind and store water strongly, and contains essential nutrients, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (N), and phosphorus (P) (Cahyo et al., 2019; Ramadhan, 2017). Plant height is closely related to macro nutrients, namely N, P and K. Ramadhan (2017) said that the N element absorbed by plants plays a role in supporting vegetative growth of plants such as roots. Phosphorus also has a role in the process of cell division at a growing point that affects plant height. The nutrient potassium also has a role as an activator of various essential enzymes in photosynthetic reactions. Photosynthate that has been produced is then used for plants in the process of cell division of plants, so that plants will increase in height.

Diameter increment of Gmelina seedling stem (mm)

The results of the average diameter increase of gmelina seedlings based on the composition of planting media and watering intervals can be seen in Figure 2.

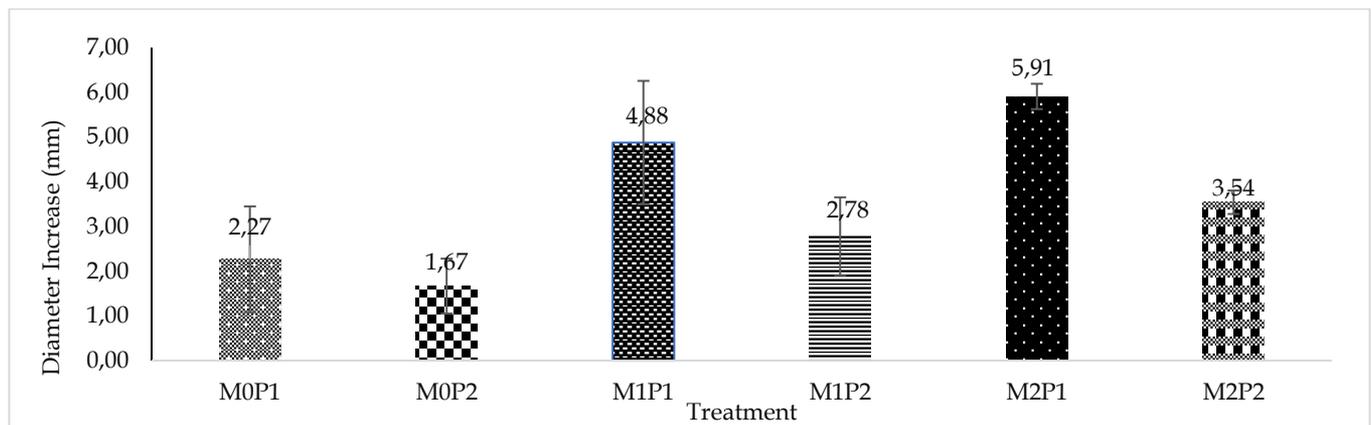


Figure 2. Graph of the average diameter increase of gmelina seedlings

To determine the effect of single treatment and interaction treatment of planting media composition and watering interval on the diameter increase of gmelina

seedlings, an analysis of variance was carried out which is shown in Table 6.

Table 6. Analysis of variance of diameter increase of gmelina seedlings

Source of variation	Db	Sum of squares	Centre square	F Count	F Table
Composition of growing media (M)	2	47.54	23.77	31.06*	3.32
Watering Interval (P).	1	25.62	25.62	33.48*	4.14
Interaction (M*P)	2	5.44	2.72	3.55*	3.32
Error	30	22.96	0.76		
Total	35	101.57			

Notes: * significantly different at 0.05 test level

The results of the analysis of variance in Table 6 show that the treatment of planting media composition (M), watering interval (P) and the interaction of planting media composition and watering interval have a significant effect on the increase in diameter of gmelina seedlings. To determine the differences in the effect of

the treatment of the composition of the planting media, the Least Significant Difference (LSD) further test was conducted. The results of the LSD further test of a single factor of planting media composition on the diameter increment of gmelina seedlings are shown in Table 7.

Table 7. Results of LSD further test on the treatment of planting media composition

Treatment	Average	LSD value
M0 (Soil/Control)	23.59a	0.73
M1 (750g soil + 250g husk charcoal)	45.94b	
M2 750gr soil + 250gr cocopeat	56.70c	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 7 show that all planting media composition treatments give significantly different effects. The M0 control treatment (100% soil) has an increase in the diameter of gmelina seedlings of 23.59 mm, significantly different from the M1 treatment (750g soil + 250 g husk charcoal) is also significantly different from the M2 treatment (750g soil + 250 g cocopeat, as well as the M1 treatment is also different from the M2 treatment. M2 treatment has the best average diameter increase of gmelina seedlings of 56.70 mm. This is because cocopeat is one of the organic materials that has good aeration and can be used as a soil improver that can improve the physical, chemical and biological properties of soil. Cocopeat to absorb water up to 6-8 times its dry weight so that mixing in the planting media will increase the moisture evenly distributed and contains complete essential nutrients. The nutrients contained in *cocopeat* are 0.31% nitrogen, which contributes to increasing the growth of oil palm seedlings. Nitrogen element plays an important role in plant vegetative growth. The results of this study are in line, comparing the composition of weaning media against manglid plants (*fast growing species*) and obtained that the soil + cocopeat media mixture produced the best manglid seedling quality index of 0.132 while the lowest seedling quality index was produced in the soil + rice husk media mixture which was only 0.042.

To determine differences in the effect of watering interval treatment, the Least Significant Difference (LSD) further test was conducted. The results of the single factor LSD further test of treatment interval on the diameter increase of gmelina seedlings are shown in Table 8.

Table 8. LSD further test results of planting media composition treatment

Treatment	Average	LSD value
P1 Watering once a day (300 ml)	4.35a	0.60
P2 Watering once every 3 days (300 ml)	2.66b	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 8 show that the treatment of watering intervals gives a significantly different effect. Treatment P1 (Watering 1 time a day) has an increase in the diameter of gmelina seedlings by 4.35 mm, significantly different from the treatment P2 treatment with watering 3 days a day. P1 treatment has a better average diameter increase of gmelina seedlings when compared to P2 treatment with watering every 3 days. This is because. in the vegetative growth vase, the plant's need for water is very influential so that watering done every day can support seedling growth well. According to Gardner et al. (2017), the role of water for plant growth is as the main constituent of plant tissue, solvent and medium for cellular metabolic reactions. Water that can be absorbed by plants is water that lies between the state of field capacity and the state of permanent wilting. The water content in this state is called water available to plants. In this case, it is suspected that watering once a day the water content is still in the condition of water available to plants so that plants can still carry out the growth process by increasing the diameter of the stem. On the other hand, in water-limited conditions (watering every three days) seedlings experience water shortage / water stress conditions that can cause changes in biochemical and physiological processes in plant cells.

To determine the difference in the effect of the interaction of the treatment of planting media composition and watering interval, the Least Significant Difference (LSD) further test was conducted. The results of the LSD further test of the interaction of the treatment of planting media composition and watering interval on the diameter increase of gmelina seedlings are shown in Table 9.

Table 9. LSD further test results of interaction treatment of planting media composition and watering interval

Treatment	Average	LSD value
M0P2 (Soil + watering every 3 days)	1.67a	1.03
M0P1 (Soil + watering once a day)	2.26ab	
M1P2 (750g soil + 250g husk charcoal + watering 3 days a day)	2.78bc	
M2P2 (750gr soil + 250gr cocopeat + watering 3 days a day)	3.54c	
M1P1 (750g soil + 250g husk charcoal + watering once a day)	4.88d	
M2P1 (750gr soil + 250gr cocopeat + watering once a day)	5.91e	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 9 show that the M2P1 treatment interaction of the composition of planting media 750g soil and 250g cocopeat with a watering interval of 1 time per day is significantly different from all other treatment interactions. The M1P1 treatment was also significantly different from the other treatment interactions. M2P2 treatment was not significantly different from M1P2 but significantly different from M1P1 and M2P1 treatments. The M2P1 treatment interaction has the best average diameter increase of gmelina seedlings of 5.91 mm. This is because the cocopeat used as a mixture of planting media has characteristics that can bind and store water strongly, as well as watering which is done every day causing the seedlings not to experience water shortages. In general, cocopeat has macro pores that can inhibit greater water movement so that it causes higher water availability, cocopeat also has macro pores that are not too dense so

that air circulation is very good for plant roots so that it greatly supports vegetative plant growth.

The nitrogen content in cocopeat, 0.67%, is quite good because it meets the compost quality standards according to SNI-19-7030-2004 with C-Organic content (9.80-32%), N (>0.40%), P (>0.10%) and K (>0.20%) (National Standardisation Agency, 2004) so that plants can use it for growth, one of which is stem diameter. Cocopeat contains beneficial bacteria such as *Klebsiella* sp., *Pseudomonas* sp., *Citrobacter* sp., *B. circularis*, *B. megaterium*, and *B. Firmus*. These bacteria could produce growth regulators that can increase plant growth.

Increase in the number of leaves of gmelina seedlings (blade)

The results of the study of the average increase in the number of leaves of gmelina seedlings based on the composition of planting media and watering intervals can be seen in Figure 3.

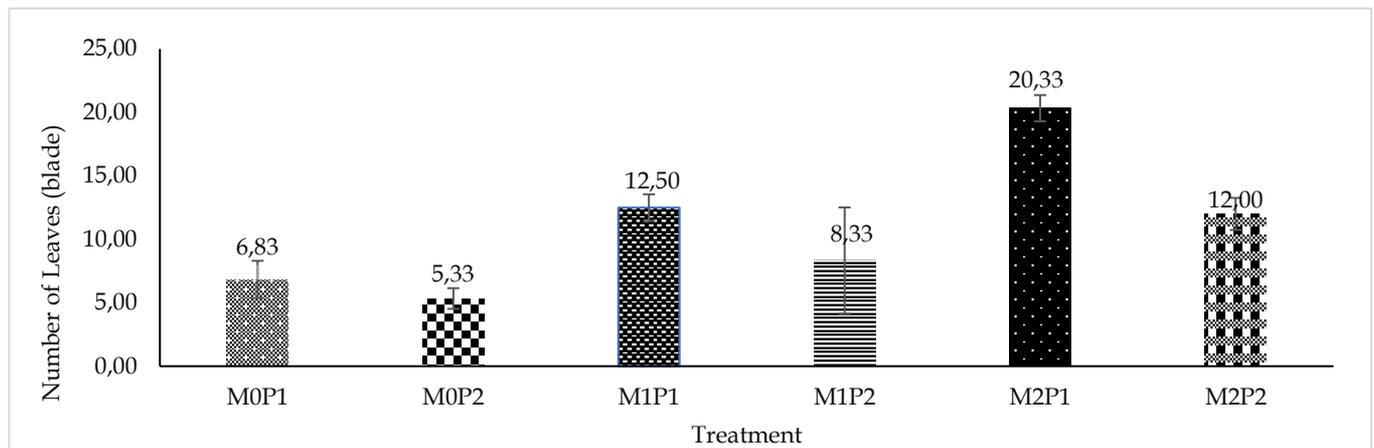


Figure 3. Graph of the average increase in number of leaves of gmelina seedlings

To determine the effect of single treatment and interaction treatment of planting media composition and watering interval on the increase in the number of leaves

of gmelina seedlings, an analysis of variance was carried out which is shown in Table 10.

Table 10. Analysis of variance for the increase in the number of leaves of gmelina seedlings

Source of variation	Db	Sum of squares	Centre square	F Count	F Table
Composition of growing media (M)	2	614.06	307.03	76.54*	3.32
Watering Interval (P).	1	196.00	196.00	48.86*	4.14
Interaction (M*P)	2	71.17	35.58	8.87*	3.32
Error	30	120.33	4.01		
Total	35	1001.56			

Notes: * significantly different at 0.05 test level

The results of the analysis of variance in Table 10 show that the treatment of planting media composition (M), watering interval (P) and the interaction of planting media composition and watering interval have a significant effect on the increase in the number of leaves of gmelina seedlings. To determine the differences in the effect of the treatment of the composition of the planting media, the Least Significant Difference (LSD) further test

was conducted. The results of the single factor LSD further test of the composition of planting media on the increase in the number of leaves of gmelina seedlings are shown in Table 11.

Table 11. Results of LSD further test on the treatment of planting media composition

Treatment	Average	LSD value
M0 (Soil/Control)	6.08a	1.67
M1 (750g soil + 250g husk charcoal)	10.42b	
M2 750gr soil + 250gr cocopeat	16.17c	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 10 show that all planting media composition treatments give significantly different effects. The M0 control treatment (100% soil) has an average increase in the number of leaves of gmelina seedlings of 6.08 strands, significantly different from the M1 treatment (750g soil + 250 g husk charcoal) and M2 treatment (750g soil + 250 g cocopeat), as well as the M1 treatment is also significantly different from the M2 treatment. M2 treatment has the best average increase in the number of leaves of gmelina seedlings of 16.17 strands. This is because *cocopeat* has a high N nutrient content which is sufficient so that plants can use it for their growth. Andri *et al.* (2016) stated that leaf area growth is influenced by nitrogen availability. This is because nitrogen stimulates plant growth where the N element plays a role in the photosynthesis process. If the photosynthesis process increases, it will produce carbohydrates and other compounds used by plants for growth. The addition of *cocopeat* to the planting media increases the N content in the soil so that the N element is absorbed by plants, resulting in the growth of more leaves.

To determine differences in the effect of watering interval treatment, the Least Significant Difference (LSD) further test was conducted. The results of the single factor LSD further test of the treatment interval on the increase in the number of leaves of gmelina seedlings are shown in Table 12.

Table 12. Results of LSD further test on the treatment of planting media composition

Treatment	Average	LSD value
P1 Watering once a day (300 ml)	13.22a	1.34
P2 Watering once every 3 days (300 ml)	8.56b	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 12 show that the treatment of watering intervals gives a significantly different effect. Treatment P1 (Watering 1 time a day) has an increase in the number of leaves of gmelina seedlings as much as 13.22 strands significantly different from the treatment of P2 treatment with watering every 3 days. P1 treatment has an average increase in the

number of leaves of gmelina seedlings better when compared to P2 treatment with watering every 3 days. This is because watering which is done every day is considered capable of preventing plants from water shortage conditions. Adequate water availability can support optimal plant growth. Water shortages that occur in the vegetative phase inhibit plant growth, reduce cell division and elongation. So the number of leaves in the vegetative phase will be greater in treatments with daily watering intervals compared to watering once every 3 days. Water is one of the most vital physical components and is needed in large quantities for plant growth and development. As much as 85-90% of the fresh weight of plant cells and tissues is water. Likewise, leaves are a vital organ of plants, because in this part the process of photosynthesis occurs.

To determine the difference in the effect of the interaction of the treatment of planting media composition and watering interval, the Least Significant Difference (LSD) further test was conducted. The results of the LSD further test of the interaction of the treatment of planting media composition and watering intervals on the increase in the number of leaves of gmelina seedlings are shown in Table 13.

Table 13. LSD further test results of interaction treatment of planting media composition and watering interval

Treatment	Average	LSD value
M0P2 (Soil + watering every 3 days)	5.33a	2.36
M0P1 (Soil + watering once a day)	6.83ab	
M1P2 (750g soil + 250g husk charcoal + watering 3 days a day)	8.33b	
M2P2 (750gr soil + 250gr cocopeat + watering 3 days a day)	12.00c	
M1P1 (750g soil + 250g husk charcoal + watering once a day)	12.50c	
M2P1 (750gr soil + 250gr cocopeat + watering once a day)	20.33d	

Description: Means followed by the same letter are not significantly different at the 0.05 test level.

The results of further tests in Table 13 show that the interaction of M2P1 treatment with the composition of planting media 750g soil and 250g cocopeat with a watering interval of 1 time per day is significantly different from all other treatment interactions. The M1P1 treatment was not significantly different from the M2P2 treatment but significantly different from the other treatments. The M2P1 treatment interaction has the best average increase in the number of leaves of gmelina seedlings of 20.33 strands. This is because. It is suspected that this treatment can provide nitrogen nutrients that

are needed by plants so that the process of forming leaf vegetative organs in plants can run optimally. Plant growth will increase if the need for N nutrients is sufficient, so, as is known, the N element has the function of increasing growth and development in leaves so that the leaves become more numerous and will become wider with a greener color which will increase the protein content in the plant body (Marschner & Rengel, 2023; Onwuka & Mang, 2018).

The availability of nutrients in cocopeat and watering that is done every day really helps the process of running the speed of plant growth and the smooth absorption of nutrients by plants can spur the photosynthesis process optimally, so that it will produce an optimal number of leaves. Because the higher the plant, the more the number of leaves. The increasing process of plant height also causes the number of internodes and books to increase, causing the number of leaves to increase, this is because the internodes and books are the place for the leaves to attach (Marschner & Rengel, 2023; Riastuti et al., 2021).

Conclusion

Gmelina seedlings are a type of plant that requires water in its growth. To get maximum growth in gmelina seedlings, a soil media composition that has sufficient porosity such as husk charcoal and cocopeat is needed. To get the best growth of gmelina seedlings at the beginning of growth, watering should be done once a day and the composition of soil media using a mixture of soil and cocopeat.

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Conceptualization and writing original draft preparation, Diah Rifdha Fadilah and Zulkaidhah; methodology, Rahmawati, Retno Wulandari and Yusran; validation and writing original draft preparation, Gilang Ramahdhan Syahputra. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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