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Effect of Various Composition of Planting Media on the Growth of Calliandra Calothyrsus Meissen Seedlings on Critical Lands

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Abstract

Reforestation of degraded forest land is very important to control economic and ecological functions in a balanced manner. Replanting requires plant species that have rapid growth, can grow in a wide range of climates, and have high economic value. Calliandra mesh (*Calliandra calothyrsus* Meissen) is a popular multipurpose tree species because it is easy to plant, grows quickly, and sprouts again after being pruned repeatedly and has high economic value. The nature of the calliandra mesh plant means that the development of this plant must be carried out in a sustainable manner to be able to meet the ecological and economic needs of the community. However, with soil conditions that have low N, P, K, C Organic and soil CEC values it will be difficult to grow this plant and develop it. The purpose of this study was to determine the effect of various types of planting media on the growth of calliandra mesh (*Calliandra calothyrsus* Meissen) seedlings. The research method used a completely randomized design (CRD) consisting of 4'~treatments, namely: P0 = Soil without fertilizer (control), P1 = Soil + Sand + Soil Liquid Fertilizer + Leaf Liquid Fertilizer, P2 = Soil + Sand + Solid Organic Fertilizer, P3 = Soil + Sand + Solid Organic Fertilizer + Soil Liquid Fertilizer + Leaf Liquid Fertilizer. Each treatment was repeated ten times, so a total of 40 experimental units were needed. The results showed that the treatment of various types of planting media had a very significant effect on the increase in the number of shoots, increase in height, increase in the number of leaves, and stem diameter on the growth of calliandra mesh seedlings (*Calliandra calothyrsus* Meissen). Media soil + sand + solid organic fertilizer + liquid organic fertilizer soil + liquid organic fertilizer leaves is the best media for the growth of calliandra mesh seedlings (*Calliandra calothyrsus* Meissen), on all observed variables.

Keywords: Media Type; *Calliandra Calothyrsus*; Critical Lands

Abbreviations

CRD: Completely Randomized Design, LOF: Liquid Organic Fertilizer.

Introduction

The increasing rate of forest deforestation, which has reached 1.1 million per year, has damaged forests in Indonesia, affecting their function in providing water and other forest resources [1]. Reforestation of damaged forest land is very important to control economic and ecological functions in a balanced manner [2]. In addition, the hydrological function is also very important [3,4]. Replanting requires plant species that have fast growth, can grow in a wide range of climates and have high economic value. Red calliandra (*Calliandra calothyrsus* Meissen) is a popular all-purpose potion species because it is easy to plant, fast growing, and re-sprouts after repeated pruning. In various places in Indonesia, this potion is planted for firewood and livestock forage, conservation and improvement of soil quality, and as a shade tree for other plant species [5], besides that calliandra, which is one of the

legume plants, is a source of livestock protein of 31.35% which has an important role for ruminants [6].

Based on the nature of the red calliandra plant, the development of this plant must be carried out sustainably to be able to meet the ecological and economic needs of the community. Seedling readiness in terms of quality is one of the factors that must be considered in supporting forest development activities. Seedlings that will be used in planting must meet several requirements, namely healthy, appropriate size (30-50cm high), quantity as needed and available on time [7]. These requirements will be met if seedlings are treated and cared for properly. The factors that affect the growth and development of seedlings are media fertility, fertilizer use and planting methods.

Soil conditions at the land location, especially in Air Terang Village, Tiloan Sub-district, Buol Regency, contain N (0.17%-low), P (19.11 mg/l00g-low), K (2.38 mg/100g-very low), C-Organic (0.91%-very low), CEC (16.52 c mol (+) kg l-low) [8]. And the results of the analysis show that the soil quality is not favorable for seedling growth and development. The use of topsoil for media with poor soil quality will cause the growth of plant seedlings to be not optimal so that it requires the addition of fertilizers to the media. Taiyeb [9] reported that the growth of calliandra seedlings on soil media was relatively lower than seedlings on compost mixture media. Types of planting media such as soil, sand, and compost have different characteristics that need to be understood so that the planting media is in accordance with the type of plant. The purpose of this study was to determine the effect of various types of planting media on the growth of calliandra mesh (*Calliandra calothyrsus* Meissen) seedlings.

Methodology

This study used a completely randomized design (CRD) consisting of 4 treatments and 10 replications, so that there were 40 experimental units in total. The treatments given were:

Po : Soil without fertilizer (control)

P1 : Soil + Sand + Liquid Organic Fertilizer Soil + Liquid Organic Fertilizer Leaves in a ratio of 1:1 (1 kg of soil and 1 kg of sand)

P2 : Soil + Sand + Solid Organic Fertilizer with a ratio of 1:1:1 (1 kg of soil, l kg of sand and 1 kg of solid organic fertilizer)

P3 : Soil + Sand + Solid Organic Fertilizer + Soil Liquid Fertilizer + Leaf Liquid Fertilizer with a ratio of 1:1:1 (1 kg soil, 1 kg sand, and 1 kg solid organic fertilizer).

Data obtained based on observations were analyzed using analysis of variance. If a real or very real treatment effect is obtained, it will be further tested using the least significant difference (LSD) test at the level of (5%).

Results

Number of Shoots Increased

Observational data on the increase in the number of shoots are presented in Appendix Table lc and the variance analysis in Table 1. The variance analysis showed that the treatment of various types of planting media had a very significant effect on the increase in the number of shoots of Calliandra red seedlings. The average increase in the number of shoots is presented in Table 1.

SK	Db	JK	KT	F hit	F Table	
					5%	1%
Treatment	3	4,06,750	1,35,583	38,43 **	2,86	4,38
Error	36	1,27,000	0,3528			
Total	39	5,33,750				

Table 1: Analysis of Variance of the Number of Shoots of Red Callandra Seedlings in the Treatment of Various Types of Planting Media Experimented

Treatment	Average (pieces)	BNT 5%	KK (%)
P0	1,30[a]		
P1	2,30[b]	0,00	22,63
P2	2,80[c]		
P3	4,10[d]		

Description: Numbers followed by the same letter in the column indicate that the increase in the number of red kalindra leaves is not significantly different at the 5% test level.

Table 2: Increase in the number of shoots of red calliandra seedlings in the treatment of various types of planting media tested.

The results of the BNT test (Table 2) showed that the highest increase in the number of shoots was obtained in the treatment of soil + sand + solid organic fertilizer + liquid soil and leaf liquid fertilizer (P3), namely 4.10 in contrast to the treatments P0, P1 and P2, while the least was obtained in the treatment without fertilizer/control (PO), namely 1.30.

Height Gain (cm)

Data on height gain observations are presented in Appendix Table 2c and the variance analysis in Table 3. The variance analysis showed that the treatment of various types of planting media had a very significant effect on plant height gain. The average height gain is presented in Table 3.

SK	Db	JK	KT	F hit	F Table	
					5%	1%
Treatment	3	68,96,750	22,98,917	60,28 **	2,86	4,38
Error	36	13,73,000	38,139			
Total	39	82,69,750				

Description: *very significant effect

Table 3: Analysis of Variance of Plant Height Increase in the Treatment of Various Types of Planting Media Experimented

Treatment	Average (pieces)	BNT 5%	KK (%)
P0	1,90[a]		
P1	5,60[b]	3,33	27,80
P2	7,20[c]		
P3	13,40[d]		

Table 4: Plant Height Increase in the Treatment of Different Types of Planting Media Trialed

Notes: Numbers followed by the same letter in the column indicate that the increase in potassium height is not significantly different at the 5% test level.

The results of the BNT test (Table 4) showed that the highest average height increase was obtained in the treatment of soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer (P3) which was 13.40 cm in contrast to the treatments P0, P1 and P2. While the shortest is the treatment of soil without fertilizer/control (PO) which is 1.90 cm.

Number of Leaves (strands)

The observation data of the number of leaves is presented in Appendix Table 3c and the variance analysis in Table 5. The variance analysis showed that the treatment of various planting media had a very significant effect on the increase in the number of leaves on red calliandra plants. The average increase in the number of leaves is presented in Table 5.

SK	Db	JK	KT	F hit	F Table	
					5%	1%
Treatment	3	2,55,08,750	85,02,917	63,18 **	2,86	4,38
Error	36	48,45,000	1,34,583			
Total	39	3,03,53,750				

Description: *very significant effect

Table 5: Average increase in the number of leaves.

Treatment	Average (pieces)	BNT 5%	KK (%)
P0	9,20[a]		
P1	12,90[b]	6,25	19,96
P2	21,60[c]		
P3	29,80[d]		

Notes: Numbers followed by the same letter in the column indicate that the increase in potassium height is not significantly different at the 5% test level.

Table 6: Increase in Number of Leaves in the Treatment of Different Types of Planting Media Experimented.

The results of the BNT test (Table 5) showed that the highest increase in the number of leaves was obtained in the treatment of soil + sand + solid organic fertilizer + liquid soil + liquid leaf fertilizer (P3) which was 29.80 strands in contrast to the treatments P0, P1 and P2, while the slowest was obtained in the treatment of soil without fertilizer/ control (P0) which was 9.20 strands.

Stem Diameter Increase (cm)

The observation data of stem diameter increase is presented in Appendix Table 4c and its variance print in Table 7. The variance analysis showed that the treatment of various types of planting media had a very significant effect on the increase of stem diameter in red calliandra plants. The average stem diameter increase is presented in Table 8.

SK	Db	JK	KT	F hit	F Table	
					5%	1%
Treatment	3	0,7188	0,2396	345,00**	2,86	4,38
Error	36	0,0250	0,0007			
Total	39	0,7438				

Description: *very significant effect

Table 7: Analysis of Variance of Red Calliandra Stem Diameter in the Treatment of Various Types of Planting Media Experimented.

Treatment	Average (pieces)	BNT 5%	KK (%)
P0	0,05[a]		
P1	0,10[b]	0,045	14,05
P2	0,20[c]		
P3	0,40[d]		

Table 8: Diameter of Red Calliandra Stems in the Treatment of Various Types of Planting Media Experimented.

Notes: Numbers followed by the same letter in Mom indicate that the diameter increase of potassium red is not significantly different at the 5% test level.

The results of BNT test (Table 8) showed that the average stem diameter increment of the Red Fern seedlings was the highest in the treatment of soil+sand+solid organic fertilizer+soil liquid fertilizer+leaf liquid fertilizer (P3) which was 0.40 cm in contrast to the treatment of P0, PI and P2. While the smallest was the treatment of soil without fertilizer/control (P0) which was 0.05 cm.

Discussion

Plant growing media is one of the factors that must be considered, because it affects the growth and development of plants to obtain optimal results. The various growing media used must still support the growth and development of plants so that their productivity can be better. The mixture of several materials for planting media must produce an appropriate structure because each type of media has a different effect on plants. Based on the observation data in this study, it shows that the treatment of various types of planting media that were tried had a very significant effect on all observation parameters, namely the increase in the number of shoots, height increase, increase in the number of leaves, and stem diameter in red calliandra seedlings (*Calliandra calothyrsus* Meissen).

Table 1, shows the increase in the number of shoots, in the treatment (P3) soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer showed the highest increase in the number of shoots (4.10), followed by (P2) soil + sand + solid organic fertilizer (2.80), (P1) soil + sand + soil liquid fertilizer + leaf liquid fertilizer (2.30), while the least was obtained in (P0) soil (1.30). It is suspected that the addition of solid organic fertilizer, soil liquid fertilizer, and leaf liquid fertilizer can meet the nutrient needs of red calliandra seedlings, especially N which plays a role in plant vegetative growth. According to Liu [10] the formation of leaves by plants is strongly influenced by the availability of nitrogen and phosphorus nutrients in the medium and available to plants. These two elements play a role in the formation of new cells and the main components of organic compounds in plants such as amino acids, nucleic acids, chlorophyll, ADP and ATP. In the treatment without compost, the plants experienced nutrient deficiency, because the growing medium did not provide enough nutrients.

The highest average seedling height gain was found in the treatment (P3) soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer which amounted to (13.40) showing the highest average seedling height gain,

followed by (P2) soil + sand + solid organic fertilizer at (7.20), (P 1) soil + sand + soil liquid fertilizer + leaf liquid fertilizer at (5.60), while the lowest was obtained in (P0) soil at (1.90). P0 (soil) media gave relatively poor seedling growth compared to other media. This is presumably because the soil media without a mixture of sand and organic fertilizer becomes increasingly dense and not loose, thus slowing down the growth of seedlings. Soil that contains a lot of organic matter with a fine texture has more total pore space and a relatively large proportion is composed of small pores.

The highest average increase in the number of leaves was found in the treatment (P3) soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer of (29.80 strands) showing the highest average increase in the number of leaves, then followed by (P2) soil + sand + solid organic fertilizer of (21.60 strands), (PI) soil + sand + soil liquid fertilizer + leaf liquid fertilizer of (12.90 strands), while the least was obtained in (P0) soil of (9.20 strands). This is thought to be due to the addition of solid organic fertilizer, in addition to the addition of leaf liquid organic fertilizer applied to red calliandra seedlings (*Calliandra calothyrsus* Meissen) so that leaf growth is maximized. Nasaruddin, et al. [11] stated that the provision of liquid organic fertilizer is able to provide essential nutrients for plant growth, especially the element N. The provision of fertilizers with high nitrogen levels can accelerate the growth and development of plant organs so that they experience a faster increase in the number of leaves and the size of the leaf area. The same thing was also stated by Ohorella [12], that liquid organic fertilizer contains potassium element which plays an important role in every metabolic process of plants, namely in the synthesis of amino acids and proteins from ammonium ions and plays a role in maintaining turgor pressure well so as to enable metabolic processes and ensure the continuity of cell elongation.

The highest average increase in stem diameter was found in the treatment (P3) soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer of (0.40) showing the largest average increase in diameter, then followed by (P2) soil + sand + solid organic fertilizer of (0.20), (PI) soil + sand + soil liquid fertilizer + leaf liquid fertilizer of (0.10), while the smallest was obtained in (P0) soil of (0.05). This shows that the combination of solid organic fertilizer not only acts as a source of nutrients but also plays a role in improving chemical, physical, and increasing soil microbial activity which is very beneficial for plants. In addition, the addition of leaf liquid fertilizer which is directly applied through the leaves can increase photosynthetic yields because the nutrients are directly absorbed by the leaves and used for the photosynthetic process, so that the food supply distributed to all parts of the plant can be fulfilled quickly, so that it quickly overcomes nutrient deficiencies and has no problem in leaching nutrients and is also able to provide nutrients quickly [13]. Wulandari [14] reported that jabon seedlings treated with organic leaf fertilizer had better growth compared to other treatments. From the observation, it can be seen that the media in PI and P2 have not been able to provide maximum results on the growth of red calliandra seedlings. This is thought to be due to the incomplete combination of fertilizers so that the completeness of nutrients is not yet optimal for the growth of red calliandra seedlings.

Based on the results of research on all observation parameters, it proves that soil + sand + solid organic fertilizer + soil liquid fertilizer + leaf liquid fertilizer is a medium that suits the needs of red calliandra seedlings and increases soil fertility at the research location so that the growth of red calliandra seedlings based on the observed parameters has a significant effect on the increase in the number of shoots, height increase, increase in the number of leaves, and stem diameter.

Conclusion

Based on the results and discussion of research on the effect of various types of planting media on the growth of red calliandra seedlings (*Calliandra calothyrsus* Meissen) it can be concluded that: The treatment of various types of planting media has a very significant effect on the increase in shoots, height increase, leaf number increase, and stem diameter on the growth of red calliandra seedlings (*Calliandra calothyrsus* Meissen).

Soil+sand+solid organic fertilizer+soil liquid fertilizer+leaf liquid fertilizer (N) is the best media for the growth of red calliandra (*Calliandra calothyrsus* Meissen) seedlings, in all observed variables.

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