

GROWTH IMPROVEMENT OF AREN (*ARENGA PINNATA* MERR.) WITH VARIOUS DOSE OF BIOORGANIC LIQUID FERTILIZER

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ABSTRACT

Aren (Arenga pinnata Merr.) is one of the plants that has many benefits. The fruits can be taken for foodstuff and beverages, It can also produce sap, and the continuation process of making sap water can be processed into sweeteners (sugar). The growth of Aren determines the success of the plot development (as pilot plant). Manipulation of plant growth is necessary, this study aims to determine the effect of fertilization and mulching which has been given on the plant growth.

This study has been done towards the treated sample with the dose of bioorganic liquid fertilizer as about 4 levels (0, 100, 150 and 200 ml/l of water) The treatment was repeated each 10 times that amount to 40 experimental units. The used analysis was completely randomized design (RAL) and advanced test if the treatment give an effect to te experimental units. The results of this Research shows that the treatment gives real effect on each experimental unit in terms of the increase of leaves and discoloration on the leaf color chart observations,

The indication is showed by Annova testing. The ability of growing crops of Aren until the end of this study is still excellent 100%. The improvement of midrib leaves range from 2-3 midrib, while the size of the leaf color changes based on the levels of certain nutrients (N) is shown by the leaf color chart is close to number 4. Further tests shows that the effective dose that should be given is 100 ml/l of water because the result is not significantly different with other higher doses.

Keywords: Aren , fertilizer, bioorganic, silviculture, A. pinnata

INTRODUCTION

Arenga pinnata Merr. is a big and high (up to 25 m) plant, is a multi-purpose plants for fruit, juice and processed sap called *gula merah*. Aren comes from the tropics area, that has extensive habitat such as Indonesia, Philippines, Malaysia, Assam (India), Laos, Cambodia, Vietnam, Sri Lanka and Thailand. *A. pinnata* Merr. is a plant that has many uses and functions, almost all parts of the plant can be utilized. Sugar palm, is an annual plant species and grows in wet climates (the western region of Indonesia) to the dry climate (eastern region of Indonesia), which can be grown in various soil types with a height of 0-1500 meters above sea level, with the average temperature about 25°C, and average rainfall of about 1200 mm. Utilization of palm plants in Indonesia had been done for long time, unfortunately it was not accompanied by the action of cultivation and proper management, so the variety of this plant will become less.

One form of management for this variety is by spurring the starting growth in order to support the seeds for cultivation. Fertilizers are the materials that are organic or inorganic (artificial), which can be added to the soil and can increase nutrient elements. Fertilization is the way of fertilizing or adding other materials such as lime, organic matter, sand or clay in the soil. One type of fertilizer that has several advantages is the bioorganic liquid fertilizer

that is friendly to the environment, because the content can easily absorbed by plants. The fertilizer can be used to any part of the plant (roots, stems and leaves). Furthermore, it is important to know the best dosage to apply towards *A. pinnata* Merr.

The Purposes and Benefits Research

The purpose of this study is to determine the living ability (%), the effect of bio-organic liquid fertilizer on growth of midrib leaf and leaf color change and also observing the best dose of bioorganic liquid fertilizer that gives the best growth for plants *A. pinnata* Merr. The expected benefits can give information for further research or inputs for crop management of *A. pinnata* Merr.

RESEARCH METHODS

This research was conducted in the shade house of the Faculty of Forestry, Lambung Mangkurat University. The time required approximately 5 months. The used tools in this research are: ruler, hand sprayer, plastic labels, polybags, Leaf Colour Chart, and office stationery, the materials that was used are sugar palm seeds, bio-organic liquid fertilizer, water and top soil in the planting area of *A. pinnata* Merr. in Mandiangin.

The procedures are:

1. Research Preparation is to prepare a place for the placement of 40 experimental units, as well to manufacturing the bioorganic liquid fertilizer.
2. The transfer of seedlings to large polybag for fertilizer treatment based on determined dose (A0: no fertilizer BOC; A1: BOC fertilizer 100 ml/l of water; A2: Giving BOC Fertilizer 150 ml/lof water and A3: giving BOC Fertilizer 200 ml/lof water).
3. Observations, observations were made every 10 days for 8 weeks, towards: The ability of life (%), increment of midrib leaf and leaf color change by using BWD (Leaf Colour Chart).

Experimental Design

Data will be analyzed using *CRD (Complette Random Design)* with 4 treatments and repeated 10 times, so there are 40 plants, which the normality and the homogeneity will be tested previously. A general model of a completely randomized design according to Hanafi (2000) are:

$$y_{ij} = \mu + r_i + S_{ij}$$

Where :

Y_{ij} = The observaton value towards the treatment i and repetation j

μ = average value of hope

r_i = The effects of treatment i

ϵ_{ij} = The mistakes of treatment I and repetation j during the observation

Table 1. Analisis of Diversity

Source of Diversity	Free Degree	Square Amount	Middle Square	F Counting	F Tabel 5%	F Tabel 1%
Treatment	$(t - I)$	Jkp	$Jkp/(t - I)$	Ktp/ktg		
Error	$t(r - I)$	jkg	$Jkg/t(r - I)$			
Total	Tr-I					

F test results indicate the degree of influence of the treatment (plant conditions) to the experimental data as follows:

1. The treatment gives real effect on 1% of the test level, if (F count > F table).
2. The treatment gives non real effect of the test level of 5%, if (F count < F table). If the F test shows the effect, real difference test is performed by determining the diversity coefficient firstly, with the following formula:

$$KK = \frac{\sqrt{KT Galat}}{\bar{Y}} \times 100\%$$

Where:

KK = Diversity coefficient

KTGalat = Middle Square Error

\bar{Y} = The average of entire data.

The relationship between the coefficient of diversity with a real difference test (continued) which was used according to the Hanafi (2000) are:

1. If the large of diversity coefficient (at least 10% on the homogeneous condition or at least 20% or heterogeneous conditions), further tests which should be used is the Duncan test
2. If coefficient of diversity is moderate (between 5-10% with a homogeneous or a maximum of between 10- 20% in heterogeneous conditions), the advanced test that should be used was BNT (Smallest Real Difference)
3. If the smallest of coefficient of diversity (5% maximum in homogenous condition or a maximum of 10% on heterogeneous conditions), the advanced test that should be used was BNJ (Honest Real Difference)

RESULTS AND DISCUSSION

The life percentage of the seedlings *Arenga pinnata* Merr. is 100% until the end of this study, It shows that the growth plants ability give a good response against bioorganic liquid fertilizer . The life percentage is a key to asses the adaptation capability with the environment. Plant is stated to die when the color of the leaves is changed, and stems become pale, stems cannot stand on, not long after that, the plant will wilt and die (Dwijoseputro, 1980)

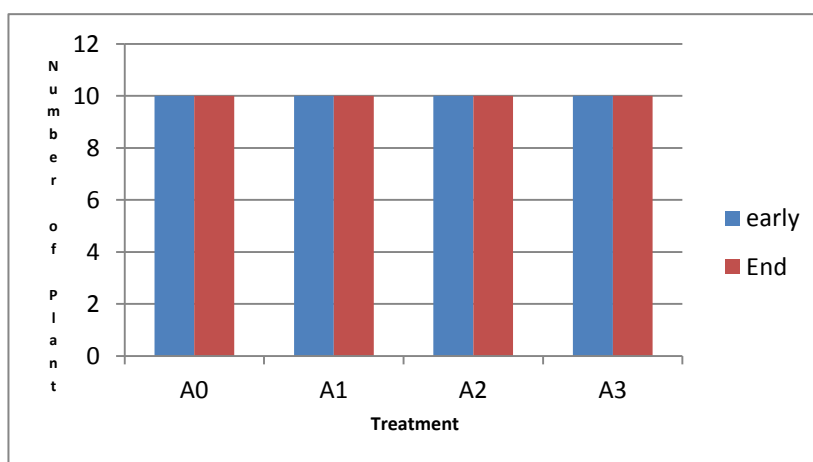


Figure 1. The ability to live of *A. pinnata* Merr.

Description: A0: Without BOC Fertilizers; A1: 100ml/l BOC; A2 150 ml / l BOC; A3

200 ml /l BOC Fertilizer.

The function of Rice husk is as a binder of heavy metals, and also serves to loosen the soil so it can simplify the roots to absorb nutrients in it. The three combination of nutrients has prepared well nutrient for further growth. According to Hanum (2008) there are two factors that can affect plant growth. The external factors and internal factors.

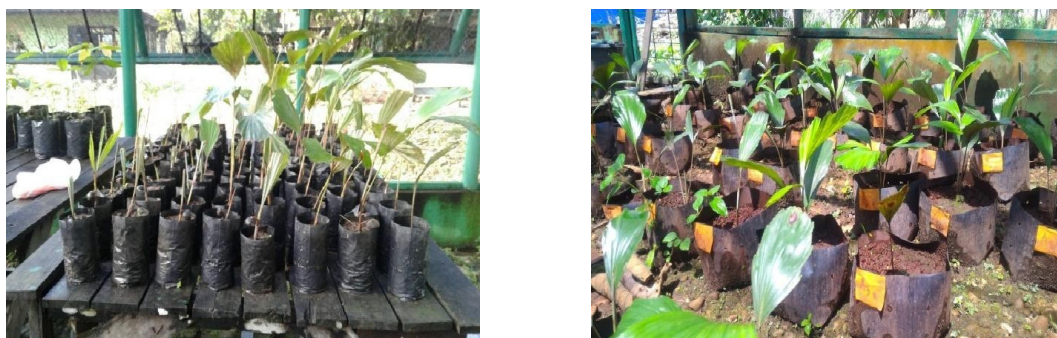


Figure 2. The initial and final conditions at the end of the study of *A. pinnata* Merr.

The Enhancement of Seedlings Leaves of *A. pinnata* Merr.

The growth and development of the leaves needs nitrogen as a network-forming leaves and chlorophyll that can improve the quality of crops to produce many leaves. Besides photosynthesis, The existence of leaves on the plant, also support the growth of the roots and also make the effect of fertilizer is stronger .

The leaves of the seedling also give an impact towards the survival of the seedlings, because the seed will get faster water loss due to transpiration process, so the plants will get wither and dry quickly. Besides, the leaves that have been perfect development will provide the perfect ingredients for growth through photosynthesis (Winarni et al, 2015). The following data is an average improvement of the amount of midrib leaf of *A. pinnata* Merr.

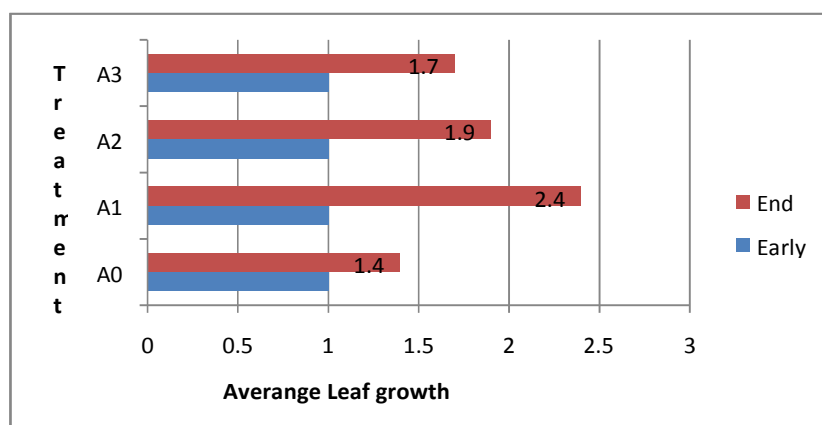


Figure 3. Average Number of the improvement of midrib leaves of *A. pinnata* Merr.

Description: A0: Without Fertilizers BOC; A1: 100ml/l BOC; A2 150 ml/l BOC; A3 200 ml/l BOC Fertilizer.

Variety Analysis showed that the bioorganic liquid fertilizer treatment gives real influence in terms of themidrib leaves growth of *A. pinnata* Merr. Through Duncan advanced test, the dosages are very different to the parameter of A1 treatment or fertilizer treatments of bioorganic liquid with a dose of 100 ml/l of water.

Table 2. Analysis of the diversity towards the improvement of leaves of *A. pinnata* Merr

Source of Diversity	Free Degree	Square amount	Middle Square	FCount	Ftabel	
					5%	1%
Treatment	3	1092.75	364.25	6.58 **	2.87	4.38
Error	36	1993.81	55.38			
Total	39	3086.57				

Description: KK = 12.48% ** = Give real effect

The Growth of leaves can not be separated from the influence of other growth, leavesrelated to the gain of height, so it can be said that the growth in the number of leaves can not be separated from the treatment which has been given. According to Hanafi (1985), element N is an essential element for the growth of the plants which the lack of this element can reduce the active photosynthesis up to 60% of its original state. Nitrogen is also needed to form important compounds like chlorophyll, nucleic acid and nitrogen enzym. Because of that, enzym is required in relatively large amounts at growth stage of the plants, especially in the vegetative growth stages such as forming new shoots or stems and leaf development.

Table 3. The Duncan Test of the improvement of the leaves

Treatment	Middle	Different Value		
		A1	A2	A3
A1	666.87			
A2	615.91	50.96		
A3	579.04	87.83**	36.87**	
A0	523.74	143.13**	92.17**	55.30**
D	5%	9.56	10.06	10.32
	1%	12.81	13.37	13.71

Description: ** = Significantly different.

* = Not significantly different.



Figure 4. the increase of midrib leaf *A. pinnata* Merr

The color of the seedling leaves of *Aren* (*A. pinnata* Merr)

To determine the effectiveness of the use of nutrient N, we can use Leaf Color Chart (LCC) with a scale of 2 - 5. According to Winarni (2000) when nitrogen (N) is limited, the color of the upper leaves will become yellowish green, otherwise when nitrogen (N) is increased the color of the upper leaves will become green. The results showed an average result of Leaf Colour Chart scale ranges between 3- 4.

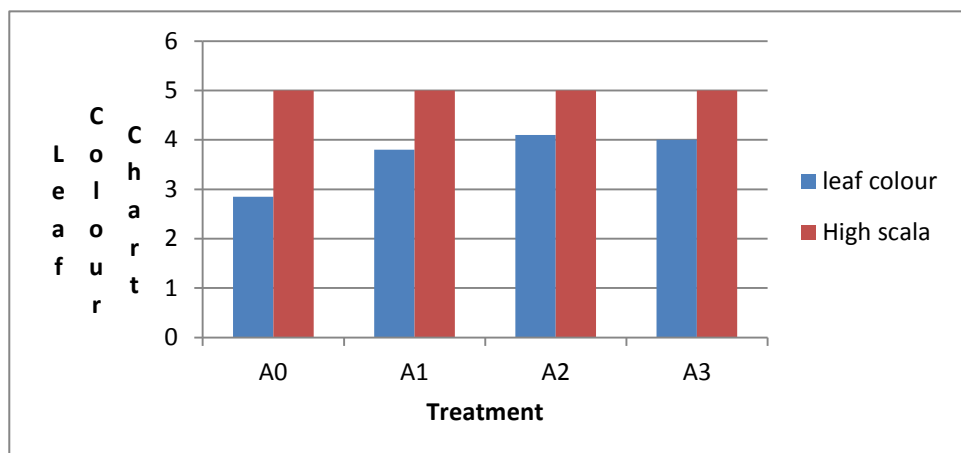


Figure 5. Observation Leaf Colour Chart of *A. pinnata* Merr.

Description: A0: Without BOC Fertilizers; A1: 100ml/l BOC; A2 150 ml/l BOC; A3 200 ml/l BOC Fertilizer

According to Salisbury and Ross, (1991), the green color comes from chlorophyll from the chloroplasts in palisade parenchyma and spongy leaves of parenchyma, in higher level plants, chlorophyll a and chlorophyll b is the main pigment of photosynthetic, which acts to absorb light violet, blue, red and reflecting green light. The diversity test showed that giving bioorganic liquid fertilizer give a significant influence in leaf color measurement data which also stated the fullness of N that can be absorbed by plants (*A. pinnata* Merr.).

Table 8. Diversity Analysis of the color of the leaves of *A. pinnata* Merr.

Source of Diversity	Free Degree	The amount of Square	Middle Square	F Count	F table	
					2.87	4.38
Total	39	16.34				

Description : KK = 11.55%

** = Give real effects

Duncan test results shows that the doses give significant influence compared with no fertilizer although it is not significantly different for each dose which is given. This can be caused by the content of bioorganic liquid fertilizer on N is sufficiently needed, so the color difference is not too flashy.

Tabel 9. Duncan Test of the color of the seedling leaves of *Aren* (*A. pinnata* Merr.)

Treatment	Middle Value	Different Value		
		A2	A3	A1
		0.10		
A1	3.80	0.30	0.20	
A0	2.85	1.25*	1.15*	0.95*
D	5%	0.55	0.58	0.59
	1%	0.73	0.77	0.78

Description: ** = significantly different. * = Not significantly different.

According to Winarni (2000) when nitrogen (N) is limited, the color of the upper leaves will become yellowish green, otherwise when nitrogen (N) increases, the color of the upper leaves will become green. Chemical analysis of the soil in the media indicate that the N content ranged from 0.17 to 0.25%, but can be absorbed relatively towards the plant tissue in dose of 200 ml / liter.

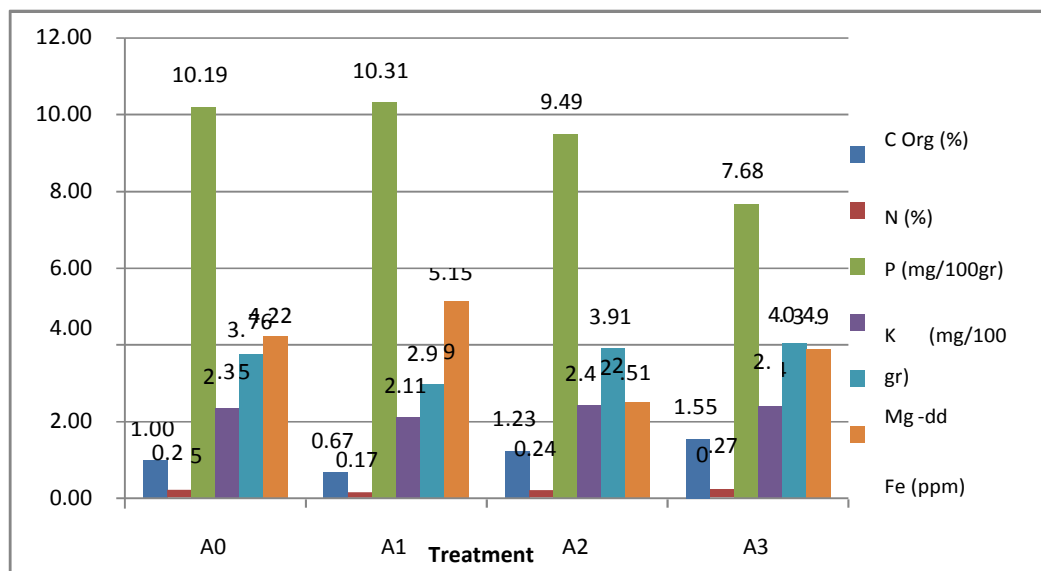


Figure 1. Soil Chemical Analysis

Description: A0: without BOC Fertilizers; A1: 100 ml/l BOC; A2 150 ml/l BOC; A3: 200 ml/l BOC Fertilizer

CONCLUSIONS

The conclusions are:

1. The ability growth of plants *Arenga pinnata* Merr. was 100% in healthy condition until the end of the study.
2. Bioorganic liquid Fertilizer given a very significant effect in terms of the growing number of midrib leaf, with increasing average and best dose of fertilizer used is 100 ml/l of water.
3. Effect of dosage of a gives real effect on changing the color of the leaves with the number 4.1, with giving the dose of 150 ml/l of water.

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