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ACCLIMATIZATION/TEST ADAPTATION OF ABACA BANANA (*MUSA TEXTITIS*) SEEDLING DERIVED FROM TISSUE CULTURE

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ABSTRACT

This study aims to determine a good growing medium that is capable of supporting the early seedling growth of abaca banana seedling during the period of acclimatization that taken from tissue culture. It has been carried out in a greenhouse located in the Kalukubula Village Sub District Sigi-Biromaru District Sigi Central Sulawesi Province. In this study used a randomized block design (RBD) with three replications. The treatment consists of 6 (six) 'type and composition of growth media were: M1 = soil, M2 = soil + Casting (1: 1), M3 = soil + Bokashi (1: 1), M4 = soil+ rice husk (1.1), M5 = soil + rice Husk Charcoal (1: 1) and M6 = soil + Sawdust (1: 1). The results showed that different types of media can provide different seedling growth which the soil media + rice husk can provide growth of abaca plant higher than other growing media treatments, characterized by the increase in plant height, number of leaves, total plant dry weight, total leaf per plant, net assimilation rate and the rate of growth,

Keywords: Acclimatization, Abaca banana, Growth.

INTRODUCTION

Abaca (*Musa textitis* NEE) included in Musacease, kindom monocotyledoneus. Abaca is a species of banana that is not taken its banana, but its fiber (Suhardiman, 1997). Abaca can not be consumed because of its fruit with small seed and huge numbers (Taora and Carlos, 1975).

Abaca cultivation is now imroving rapidly, because it produces a stronger fiber compared with all the other natural fibers (Heliyanto, *et al*., 1998). Its strength can reach three times stronger than cotton fibers, therefore the demand of abaca fiber for industrial use continues to increase, especially for purposes of thin paper materials such as filter paper, base paper stencil and cigarette paper (Fatima and Mariskah. 1994). Also for the type of paper that requires strength and high storability such as paper money, paper stationery, paper documents and kerta map (Tryanto et al., 1992).

Abaca plant in the tropics, especially in the Philippines which is now known as one of the countries producing abaca fiber has mastered the world market, especially Europe. Thus Central Sulawesi, as part of the tropics have the potential to serve as a regional center for abaca fiber production in Indonesia, it is based on the assumption that the abaca banana cultivated in the tropics and work well. Although the propagation of plantlets abaca on stage has been successful, but the growth of plantlets further at this stage in the field acclimatisation still see a lot of failures, mainly due to environmental factors including plant growing medium (Suratman, 1982).

Abaca seedlings derived from tissue culture laboratory before it was transferred to the field needs to be done at this stage of growth transition acclimatization which aims to control some environmental conditions such as light, temperature, humidity, growing media and others (Hartman *et al*, 1990 ; Widarto, 1996 and Yusuf, *et al*.,2012).

This research was conducted in order to determine the best media that is capable of supporting the growth of early seedling abaca plant derived from tissue culture during the acclimatization period.

Materials and Methods. The experiment was conducted in a plastic house in the village Kalukubula District Sigi Central Sulawesi Province. The materials used in this experiment include abaca seedling derived from tissue culture using Tangongon varieties, polybags size 25 cm x 30 cm, planting medium (topsoil, vermicompost (Rukmana, 1999) , Bokashi, rice husk, rice husk charcoal, sawdust), water, (Gandasil D), fungicides (Dithane), as well as shade materials (beams and paranet) and containment materials (beams, wire and transparent plastic), and others. The equipment used was a hoe, shovel, garden tools, handsprayer, buckets, lux meter, thermometer, sliding ruler, meter, plastic labels, ovens, scales and stationery.

In this study used a randomized block design (RBD) with three replications with groupings based on the size of the plant (plant height). Each treatment was represented by three plantlet, so that there were 54 treated plants. To determine the effect of treatment, plants tested using an analysis of variance, and if treatment significantly affected on the observed parameters further test conducted using

Honestly Significant Difference (HSD) at level 5%.

The treatments were tested consisted of 6 the type and composition of the growing media, namely:

M1 = Soil only (control)
M2 = Soil + Kascing (1:1)
M3 = Soil + Bokashi (1:1)
M4 = Soil + rice hust (1:1)
M5 = Soil + rice hust charcoal (1:1)
M6 = Soil + Sawdust (1:1)

Shade is made using poles and wooden frame (beam size 5/5), while the roof and walls using paranet. Direction shade from East to West and from North to South direction, with a length of 319 cm x width 212 cm x height 135 cm. Lid frame made of wood 78 cm and a height of 45 cm, while the transparant .0.15 mm thick

Growth media as a treatment consist of top soil, topsoil mixing with vermicompost, Bokashi, rice husk, rice husk charcoal and sawdust in the ratio of 1.1. Seedling used in this study was seedlings derived from tissue culture (plantlets).

Plants care included watering, weeding, and fertilizing. Watering was done every 3 days with sprinkledof 250 ml water per plant. Weed control was done by removing all weeds that growed on any polybags.

Observations were made on the following parameters:

1. Plant height (cm), measured from the base of the stem to the tip of the leaves of plants and measurements were performed at the age of 10 and 12 weeks after planting.
2. The number of leaves, calculated all the leaves that have been formed and observed at 10 and 12 weeks after planting.
3. Ratio Leaves Roots, The calculation is performed of the dried plant after an oven at a temperature of 80°C for 24 hours and performed at the age of 45 and 75 days after planting.
4. Plant Total Dry Weight, weighed after the plans were harvested and then oven at a temperature of 80^{o}C for 24 hours, 45 and 75 days after planting.
5. Leaf area per plant (cm^2) measured at the age of 45 and 75 days after planting, using the following formula.

$$LD = \frac{a}{b} \times c$$

where: a = leaf are samples
b = weight of leaf samples
c = weight of leaves per plant

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6. Net Assimilation Rate (NAR) is the rate of increase in plant dry weight (W) per leaf area (A) at a given time (t) and can be calculated using the following formula. :

$$NAR = \frac{W2 - W1}{A2 - A1} X \frac{lnA2 - In\ A1}{t2\_t1} (g/cm2/hari)$$

7. Rate of Growth Per Plant (LTP) increased plant dry weight (W) per unit area at a given time (t) and can be calculated using the following formula:

$$LTP = \frac{W2 - W1}{t2 - t1} (g/cm2/hari)$$

8. Relative Growth rate (LTR) is the rate of increase in dry weight (W) and dry weight were there at a certain time (t) and can be calculated using the following formula:

$$LTP = \frac{lnW2 - lnW1}{t2 - t1} (g/cm2/hari)$$

9. Leaf Area Ratio (LAR) is the ratio area of the plant dry weight (W) at a given moment is calculated using formura as follows:

Where:
w1 = total dry weight of the plant at time t1
W2 = total dry weight of the plant at the time t2
A1 = leaf area of plants at time t1
A2 = leaf area of plants in wdktu t2
t1 = time of first observation (10 DAP)
t2 = time next observation (20 DAP)

Analysis of Plant Growth above is a way to follow the dynamics of photosynthesis as measured by the product of dry matter and leaf area of plants which is the consideration of aspects of plant physiology (Ala, 1997). In addition to the observation of plant growth parameters, observations conducted by measuring the environmental parameters such as the intensity of solar radiation, air temperature and soil temperature (the temperature of plant growth media) the morning, afternoon and evening.

The Results

Plant high. Statistical analysis showed that the treatment of various types and composition of growth media very significant effect on the increase of abaca banana plant height at the age of 10 and 12 WAP.

Number of Leaves. Statistical analysis very significant effect on the increase of abaca banana plant leaves at the age of 10 and 12 MST.

Table 1. The Average Increase in Abaca Height and Number of Leaf on Various Types and Composition of Growth Media (cm).

Media	Plant hight (cm)		No. leaf	
	10 WAP	12 WAP	10WAP	12 WAP
M1	3.44 b	6.61 ab	2.33b	3.67b
M2	3.72 b	5.72 ab	3.33ab	4.33b
M3	3.31 b	4.83 b	2.33b	3.33 b
M4	6.83 a	9.17 a	4.00 a	6.33 a
M5	4.83 ab	7.17 ab	3.00 ab	4.00 b
M6	3.61 b	5.01 ab	3.00 ab	3.67 b
BNJ 5%	2.20	3.57	1.46	1.23

Description: The average number followed by the same letter, are not significantly different at the 0.05 level α HSD test.

Table 2. Average Total Dry Weight and Leaf Area of the Banana Plant Abae.a on Various Media Types and Composition of Growth Between 45 and 75 DAP.

Media	Dry weight (g)		Leaf area (cm^2)	
	45 DAP	75 DAP	45 DAP	75 DAP
M1	0.42 ab	3.37 ab	0.42 ab	44.17 ab
M2	0.29 b	3.44 ab	0.29 b	42.25 ab
M3	0.38 ab	2. 18 b	0.38 ab	23.92 b
M4	0.67 a	4.60 a	0.67 a	49.92 a
M5	0.45 ab	2.58 ab	0.45 ab	32.92 ab
M6	0.26 b	2.00 b	0.26 b	28.50 ab
BNJ 5%	0.34	2.37	0.34	23. 54

Description: The average number followed by the same letter, are not significantly different at the 0.05level α HSD test.

Table 3. Average Ratio of Root Leaf Abaca on Various Types and Composition of Growth Media age 75 DAP.

Treatments	Root Leaf Ratio
M6	0,050 a
M2	0,030 ab
M3	0,030 ab
M4	0,030 ab
M5	0,030 ab
M1	0,023 b
Nilai BNJ α 0,05	0,02

Description: The average number followed by the same letter, are not significantly different at the 0.05 level α HSD test.

Table 4. Average Net Assimilation Rate Abaca Plants in a Variety of Media Types and Composition of 45-75 HST

Treatments	Net AssimilationRate (g/cm2/day)
M4	0,0089 a
M2	0,0064 ab
M1	0,0051 ab
M3	0,0048 ab
M6	0,0041 b
M5	0,0040 b
Nilai BNJ α 0,05	0,004

Description: The average number followed by the same letter, are not significantly different at the 0.05 level α HSD test.

Total Plant Dry Weight. Statistical analysis showed that the treatment of various types and composition of the growing media significantly affected the total dry weight of abaca banana plants at the age of 45 and 75 days after planting (DAP).

Root-Leaf Ratio. Statistical analysis showed significant effect on root leaf ratio of abaca banana plants at the age of 75 DAP.

Net Asimilation Rate of plants. Statistical analysis showed that the treatment of various kinds and composition of growth media significantly affect the net assimilation rate of abaca between 45 and 75 DAP.

Table 5. Average Plant Growth Rate of Abaca in Various Types and Composition of Growth Media Age 45-75 DAP.

Treatments	Plant Growth Rate (g/m2/day)
M4	0,163 a
M2	0,107 ab
M1	0,100 ab
M5	0,073 b
M3	0,060 b
M6	0,057 b
Nilai BNJ α 0,05	0,078

Description: The average number followed by the same letter, are not significantly different at the 0.05 level α HSD test.

Table 6. Average Leaf Area Ratio Abaca Plants in Various and Composition of Growth Media at age 45-75 DAP

Treatments	Leaf Area Ratio (g/cm2)
M6	20,613 a
M5	14,590 ab
M1)	13,997 ab
M2	13,750 ab
M3	12,837 b
M4	10,760 b
Nilai BNJ α 0,05	7,458

Description: The average number followed by the same letter, are not significantly different at the 0.05 level α HSD test.

Plant Growth Rate. Statistical analysis showed that the treatment of various types and composition of growth media significantly affect plant growth rate at age 45-75 DAP.

Leaf Area Ratio. Statistical analysis showed that the treatment of various types and composition of the growing medium significantly affected leaf area ratio of Abaca at the age of 45-75 DAP.

Discussion

The plant growth shown by the increase in size, volume and dry weight of plants that can not reverse (Ashari, 1995 and Sri Setyati, 1979). In addition, plant growth and development is strongly influenced by genetic factors and environmental factors primarily plant growing environment (Jumin, 1992). According to Tabora and Santos (1975) abaca plant requires loose soil for the development of roots. It required materials as porous media which can improve the physical condition of the soil and to support the improvement of chemical and biological properties of the soil according to the needs of plant growth (Hadimiyoto, 1983; Sangatanan and Sangatanan, 1987, and Wijaya, N., 1996).

The results showed that the type of growing media significant effect the plant height and number of leaves at the age of 10 and 12 WAP. Treatments (M4) created the largest plant height and number of leaf. However, this treatmnet (M4) was not significantly different from treatment of other types of media, except the media soil + Bokashi (M3). The increase in the number of leaves of rice husk + soil media treatment was significantly different from all other types of media treatments. This can occur

because the media soil + rice husk has the ability to improve soil aeration, so that the air circulation in the environment is quite good for rooting system. This is primarily to support the root respiration, and cause an increase in the growth of plant height and number of leaves. In contrast to the soil + Bokashi manure (M3) tretment appears to occur excessive water from organic materials which are the basic ingredients bokashi so that an interruption may have occur in the root systems of plants that cause plant growth slightly depressed (Lestari, 1996).

This is agree with Hakim, et al., (1986) that there is a relationship between air in ground with soil physical properties and plant growth which the lack of air in the soil will cause the occurrence of resistance against root respiration which in turn will inhibit the growth and development of plant roots.

Furthermore, the results of various types of media affected on the total dry weight of the plant, the total leaf area of plants, and the roots leaf ratio. HSD test showed that the soil media + rice husk (M4) resulted the highest in a total dry weight and total leaf area of crops. This suggests that the process of photosynthesis takes place more active on abaca banana plant with soil media + rice husk which can lead to total plant dry weight greater than other media treatments.

According to Dwidjoseputro (1991) and Lakitan (2013) that the rate of photosynthesis is affected by the plant leaf area where more extensive areas of the leaf surface, the higher the photosynthesis will take place if there are no leaves overlap. In addition, net dry matter production will be very different with different temperatures. The higher the air temperature at night will accelerate the process of respiration and at the same time this process will reduce the yield of net photosynthesis or plant dry matter (Zulkarnain, 2009 and Sitaniapessy, 1982).

The highest ratio of the root and leaf of the plant obtained on the media soil + sawdust (M6), but not significantly different from other treatments, except with the media of the soil + rice husk (M4). This indicates that the media soil + sawdust root growth was smaller than the media soil + rice husk to produce a different root leaf ratio. Ahmadi *et al*. (1993) stated that the physical properties of the soil are able to be improved by the addition of organic material (rice husk) in the media.

Based on the analysis of plant growth showed that the treatment of various types of media influence on root-leaf ratio, net asimilation rate, plant growth rate, and leaf area ratio. HSD test results indicated that the growing media soil + rice husk (M4) can produce the highest net asimilation rate and plant growth rate, but in general was not significantly different from other media. The increase of net assimilation rate plant can directly contribute to a plant growth rate, because the increase in plant growth rate is determined by in increasing the rate of photosynthesis that can produce photosynthate (Kramer, 1980) .

Conclusion

1. Different type of growth media can provide different growing of abaca seedlings.
2. Media soil + rice husk can generate the highest in plant height, number of leaves, total plant dry weight, leaf area, net assimilation rate and plant growth rate, although generally not significantly different from other growing media treatments.

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