

The Effect of Media Composition and Frequency of Liquid Organic Fertilization Provision on the Early Growth of White Turmeric (*Curcuma alba* L.)

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Abstract

Turmeric white is one of the potential medicinal plants for cultivated. Turmeric White has an important role in human life, such as useful for traditional medicine which can cure various kinds of diseases.

The purpose of this research is to determine the effect of media composition and frequency of liquid organic fertilizer provision to the early growth of white turmeric plants. This research conducted in Mambo sub-district, Palu Utara District, Central Sulawesi Province from July to September 2015, at an altitude of \pm 25 meters above sea level.

The research used Randomized Block Design (RAK) factorial pattern with two treatment factors repeated 3 (three) times. The first factor is a different media composition (M) consisting of 3 treatment levels, namely: M1: Soil M2: Soil + Sand, M3: Soil + Sand + Manure. Secondary frequency Frequency of liquid organic fertilizer (F) consisting of 4 treatment levels, namely: F1: 1 time, F2: 2 times, F3: 3 times, F4: 4 times, with concentration 10 cc / l Water. Each treatment was repeated 3 times so that there were 36 experimental units.

The research results showed that the treatments of media composition, significantly effect on stem diameter, leaf width, and number of shoots aged of 12 WAP. The Frequency of liquid organic fertilizer gave a real effect on the plant's height aged of 12 WAP. The interaction between the composition of the media and the frequency of organic liquid fertilizer gave a significant effect on plant height of 8 WAP and number of leaves aged of 12 WAP. The combination of soil + sand + cow manure and the provision of 4 times frequency of liquid organic fertilizer give better growth compared to other treatment combinations.

Keywords: Media; Liquid organic fertilizer; White tumeric

Introduction

White turmeric is one of the medicinal plants that are potentially cultivated. White turmeric has an important role in everyday life, as useful to be used as a traditional medicine that can cure various diseases. Therefore, it takes a good way of cultivating for the plant to be used feasibly. One them is by giving an attention to the right planting media and also the frequency of applying the right organic liquid fertilizer.

Media planting is one of the factors that influence the plant propagation and growth initially. In order for seed growth to be good, planting medium is expected to have properties such as: media should be loose so root growth is not disturbed and roots can freely penetrate to the soil, moisture should be enough and this can be overcome by watering because water is necessary for plant growth, should be free of weeds, and should contain the necessary nutrients for the plant [1].

The definition of organic fertilizer is a fertilizer composed of living matter, such as weathering the remains of plants and animals. Liquid organic fertilizer is used to improve the physical, chemical, and biological properties of the soil [2]. The content of nutrients in organic liquid fertilizer is Supra A : N 5.52%, P₂O₅ 1.2%, K₂O 4.29%, Mn 0.16%, Fe 0.03%, Cu 0.02%, Zn 0.02%, B 0.11%, C Organik 5.15%, pH 6.5%.

Organic fertilizers are effective in promoting environmental sustainability and plant growth after long-term use, but previous studies have focused primarily on the conventional solid organic fertilizer product, such as straw and manure. Specialized horticultural production has fostered the emergence of new liquid organic fertilizers, which have usually been derived from natural products and their biological activities occur at limited doses. Compared with conventional organic fertilizer, the abundant organic matter and soluble nutrients in the liquid organic fertilizers could maintain soil sustainability and plant health [3].

Research Method and Materials

Time and place of research

The research was conducted at Jalan Manthilayo Kelurahan Mambo, Palu Utara District, from July to October 2015, 25 meters above sea level (MDPL).

Experiment design and implementation technique

This study used a Randomized Design Group (RAK) factorial pattern with two factors of treatment with three replicates. The first factor is different media composition (M) consisting of 3 treatment levels, namely: M1: Soil, M2: Soil+Sand (1:1), M3: Soil+Sand+Manure (2:1:1). The second factor of Frequency of Fertilizer of Organic Liquid "Supra A" (F) consisting of 4 treatment levels, namely: F1: 1 time (4 WAP) with concentration of 10 cc / L water, F2: 2 times (4 and 6 WAP) with Concentration of 10 cc/L water, F3: 3 times (4, 6, 8 WAP) with concentration of 10 cc / L water, F4: 4 times (4, 6, 8 and 10 WAP) with concentration 10 cc / L water, 12 treatment combinations and each treatment was three repeated so that there were 36 experimental units.

To know the effect of treatment on observation parameters, then every observation is statistically analysed (F test 5%). If the effect is

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real, it will be continued with the test of real difference of 5% (Tables 1 and 2).

Results and Discussion

The plant height

The result of observation for height observation of white turmeric aged of 8 WAP showed that media composition, frequency of organic liquid fertilizer and interaction of media composition and frequency of liquid organic fertilizer had significant effect on plant height. The 5% HSD test result in Table 3 shows that the interaction between the mixture composition of soil, sand and manure with the frequency of liquid organic fertilizer 4 times shows the highest average of 68.33 cm. It is different from all treatments.

In observation of plant height aged of 8 WAP and number of leaf aged of 12 WAP, there is an interaction between media composition and frequency of liquid organic fertilizer provision, supposedly because the composition of mixed soil, sand and manure media is the right medium for plant height growth and the frequency of fertilizer provision precisely so that it helps the growth of plant height optimally. This interaction also occurs because there is a reciprocal relationship between the media and the frequency of organic liquid fertilizer provision, where liquid organic fertilizer helps in the process of giving nutrients that are not enough given by the planting medium to the plant.

The Manure in the composition of mixed soil media, sand and the function of the manure is to add nutrients of both macro and micro nutrients into the soil. In addition, manure can encourage the life of soil microorganisms, but because manure is a solid fertilizer so that the decomposition process is slow and requires the help of microorganisms in the soil, so this is where the role of liquid organic fertilizer is

Media Combination (M)	Frequency of Fertilizer Provision (F)			
	F ₁	F ₂	F ₃	F ₄
M ₁	M ₁ F ₁	M ₁ F ₂	M ₁ F ₃	M ₁ F ₄
M ₂	M ₂ F ₁	M ₂ F ₂	M ₂ F ₃	M ₂ F ₄
M ₃	M ₃ F ₁	M ₃ F ₂	M ₃ F ₃	M ₃ F ₄

Table 1: Combination of media composition treatment and frequency of liquid organic fertilizer provision.

Plant Media	Frequency				HSD 5%
	F1	F2	F3	F4	
M1	_p 22.17 ^a	_p 34.90 ^b	_p 37.40 ^b	_p 33.90 ^b	6.34
M2	_{pq} 32.97 ^a	_p 29.13 ^a	_p 34.60 ^{ab}	_p 39.60 ^b	
M3	_q 31.27 ^a	_p 33.77 ^a	_p 39.07 ^b	_q 68.33 ^c	
HSD5%	7.01				

Note: The average followed by the same letter in the same row (p, q) and row (a, b) is not different at 5% HSD level.

Table 2: Average plant height (cm) of white turmeric 8 WAP in media composition and frequency of organic fertilizer provision.

Treatment	Average
M1	1.54 ^a
M2	1.61 ^a
M3	2.81 ^b
HSD 5%	0.62

Note: The average followed by the same letter on the same row is not different to the 5% HSD test.

Table 3: The Average of Tumeric Stem diameter (cm) Age of 12 WAP in media composition and frequency of liquid organic fertilizer.

needed, because liquid organic fertilizer that can quickly overcome the deficiency of Nutrient, no nutrient washing and able to provide nutrients quickly. Provision of liquid organic fertilizer containing nutrients N, P, K, Mg, and Ca, will cause the synthesis and anticlinal cell wall division that will accelerate the increase of plant height [4].

Stem diameter

The result of variance for the observation of the stem diameter aged of 12 WAP, showed that the composition of planting media had significant effect on stem diameter and had no significant effect on the frequency treatment of liquid organic fertilizer, and the interaction between planting media and the frequency of liquid organic fertilizer. The average diameter of white turmeric stems aged of 12 WAP, presented in Table 3 below:

Further test results of 5% HSD in Table 3 shows that planting media mixture of soil, sand and manure (M3) showed the highest average yield of 2.81 cm. This is different from the average yield of soil planting medium (M1) that is 1.54 cm and sand and soil mixture media medium (M2) is 1.61 cm. Observation of stem diameter shows that there is a real influence on the treatment of media kind to stem diameter at 12 WAP. Research result is in line with research Berry Kurniawan et al. [5]; that the use of manure media should not be used singly but combined with other planting media, so that the availability of the necessary elements of the plant is in sufficient state, then the metabolic results will form proteins, enzymes, hormones and carbohydrates so that the enlargement, extension and division of cells takes place quickly.

Number of leaf

The result of variance for the number of leaves of white turmeric aged of 12 WAP, showed that the composition of media, frequency of liquid organic fertilizer provision and the interaction between the composition of the media and the frequency of liquid organic fertilizer provision have a very significant effect on the number of leaves. The average number of white turmeric leaves aged of 12 WAP, presented in Table 4 below:

Further 5% HSD test results in Table 3 shows that the interaction between mixed soil, sand and manure mixture composition with the frequency of 4 times liquid organic fertilizer provision hows the highest average of 9.2 pieces, and different from all treatments. The result of 5% HSD Test shows the interaction between planting media composition and frequency of organic liquid fertilizer provision has significant effect on plant height aged of 8 WAP and number of leaves aged of 12 WAP, while in other treatment no significant effect. The result showed that the interaction between mixed soil, sand and the manure (M3) mixture composition and the frequency of liquid organic fertilizer provision of 4 times (F4) give optimal and good result for plant growth and development.

Planting Media	Frequency				HSD 5%
	F1	F2	F3	F4	
M1	_p 5.53 ^a	_p 5.93 ^a	_p 6.07 ^a	_p 6.3 ^a	1.87
M2	_p 5.97 ^a	_p 6.2 ^a	_p 6.63 ^a	_p 5.73 ^a	
M3	_p 6.07 ^a	_p 6.87 ^a	_p 6.97 ^a	_q 9.2 ^b	
HSD5%	2.07				

Note: The average followed by the same letter in the same row (p, q) and row (a, b) is not different at 5% HSD level.

Table 4: Average number of leaves of white turmeric aged of 12 WAP in media composition and frequency of liquid organic fertilizer provision.

Liquid organic fertilizer has advantages such as rapidly overcome nutrient deficiency and no problem in nutrient leaching. Although often used, liquid organic fertilizer also contains essential macro and micro nutrients (N, P, K, S, Mg, B, Mo, Cu, Fe, Mn) that can stimulate the growth rate of plants and as a chlorophyll that can increase activity of Photosynthesis [6].

The addition of plant height and the number of leaves (*Curcuma alba* L.) is thought to be due to the content of auxin and gibberlin in liquid Supra a organic fertilizer that can disrupt the cell at the end of the stem to immediately hold cell division and magnification especially in the meristematic area. This is in line with Bonner and Glaston's opinion (1951) which says that anticlinal and periclinal divisions and meristematic cell enlargement at the tip of the stem, although the speed rate is not the same.

Salisbury & Ross (1995) say that liquid organic fertilizer in addition to containing nitrogen composed of all proteins; nucleic acids and chlorophyll also contain micro nutrients such as Mn, Zn, Fe, S, B, Ca and Mg elements. The micro nutrient element acts as a catalyst in the process of protein synthesis and chlorophyll formation.

The result of research of Sarjana Parman (2007) on potato plant (*Solanum tuberosum* L.) that liquid organic fertilizer has real effect to plant height, leaf number and leaf area, it is suspected that the content of phosphorus element in liquid organic fertilizer that play a role in storing and transfer energy for the synthesis of carbohydrates, proteins, and the process of photosynthesis. The photosynthetic compounds are stored in the form of organic compounds which are then released in the form of ATP for plant growth. Humic acid and exapat acid as well as growth regulating substances contained in liquid organic fertilizer will support and accelerate plant growth.

The leaf width

The result of this research showed that the composition of planting media had significant effect on the leaf width, and no significant effect on the frequency treatment of different liquid organic fertilizer provision and the interaction between planting media composition and the frequency of different liquid organic fertilizer provision. The average width of white turmeric leaves aged 12 WAP, presented in Table 5 below:

Further 5% HSD test results in Table 6, showed that the composition of mixed soil, sand and cow manure (M3) media showed the highest average yield which is 1496.88 cm². This is different from the result of the average treatment of soil planting media composition (M2) that is 861.17 cm², and the composition treatment of sand and soil mixture media mixture (M1) is 790.67 cm². The media treatment had significant effect on plant leaf area at 12 WAP. According to Harjadi [7], vegetative growth occurs due to cell division and cell extension in meristematic tissue at the point of growing stems, root tip tip, and on cambium. The use of planting media with the addition of manure will further increase the vegetative growth of the plant. Nutrient N, P, and K nutrient content present in this medium is an essential nutrient for plants especially nitrogen. According to Kononova [8] and Janick et al. [9], nitrogen can stimulate vegetative growth of plants and give green color to the leaves. This is in line with the results of research characterized by increased plant height, stem diameter, number of leaves, and number of branches, leaf area, and root growth

Number of shoots

The result of variance observation to observe the number of white turmeric shoots aged of 12 WAP, showed that the composition

Treatment	Average
M1	790.67 ^a
M2	861.17 ^b
M3	1496.88 ^c
HSD 5%	44.46

Note: The Average followed by the same letter at the same rows is not different at the 5% HSD Level

Table 5: The Average of Leaves Width (cm²) of WhiteTurmeric aged of 12 WAP in the media composition and the frequency of liquid organic fertilizer provision.

Treatment	Average
M1	1.13 ^a
M2	1.18 ^a
M3	1.72 ^b
HSD 5%	0.58

Note: The Average followed by the same letter at the same rows is not different at the 5% HSD Test

Table 6: Average number of white turmeric shoots aged of 12 WAP in media composition and frequency of liquid organic fertilizer provision.

of planting media significantly affect the number of shoots, and no significant effect on the frequency treatment of organic liquid fertilizer provision or interaction between planting medium and the frequency of liquid organic fertilizer provision to the average Number of shoots formed [10]. The average number of white turmeric shoots aged 12 of WAP, presented in Table 6 below:

Further 5% HSD test results in Table 6 shows that the composition of mixed soil, sand and cow manure (M₃) mixture composition showed the highest average yield of 1.72 shoots. This is different from the average yield of mixed sand and soil mixture media composition (M₂) which is 1.18 and the composition of soil cultivation media (M₁) 1.13 [11-14]. The function of planting media is able to hold the seeds / cuttings so as not to easily wobble, to provide sufficient moisture and regulate aeration (Ashari 2006) so that the planting medium used should be able to provide enough aeration, have good water holding power and clean of fungi and pathogenic bacteria. From the result of the research, it was found that the early growth of cuttings of good white turmeric on the shoot bud parameter was cuttings grown on media (M3) soil+sand+manure mixture (2: 1: 1), it is presumably because M3 media has the capacity to hold water good, can maintain moisture. The results of this study, in line with the opinion of Priono (2013) which explains that mixed cropping media of organic material has good cation exchange capacity and porosity, has a low C / N ratio that accelerates N available and contains essential nutrients, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (Na) and phosphorus (P) [15-18].

Organic fertilizers derived from animal waste are referred to as manure. The complete ingredients of nutrients such as sodium (N), phosphorus (P), and potassium (K) make manure suitable for use as planting medium. These elements are essential for plant growth and development. In addition, manure has the content of microorganisms that are believed to be able to overhaul organic material that is difficult to digest plants into components that are easier to be absorbed by plants [10,19-22].

In 5% HSD test result showed that the use of mixed soil composition of soil mixture and sand (M2) and composition of planting media using only soil (M1) gave lower yield than the composition of mixture planting media of soil, sand and manure (M3) This is allegedly because the composition of the sand and soil sand media has pores that are

large enough so that the sand will easily wet and dry so that experience greater evaporation. According to (Supriyatna, 2001), sand has macro pores so the sand requires more intensive watering and fertilization [23,24].

Conclusion

Interaction media plant and frequency of organic liquid fertilizer (M3F4) were able to give the highest leaf number of 9.2 on 12 WAP. The growing media treatment (M3) had an effect and gave the highest value on the number of leaves, leaf area, stem diameter and number of shoots at age 12 WAP. The frequency of organic liquid fertilizer (F4) is able to produce the highest plant height of 69.98 cm at 12 WAP.

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