



Nutrient Content of Apu-Apu (Pistia stratiotes) Organic Fertilizer and Its Effect on Growth of Cempedak (Artocarpus champeden) Seedlings

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ABSTRACT

This study aims to determine the effect of apu-apu organic fertilizer on the growth of seedlings cempedak. The study was arranged using a Randomized Complete Block Design (RCBD) with the v fertilizer (LOF) L-1 water); a3 (18 g of solid organic fertilizer (SOF) + 6 ml liquid organic fertilizer (LOF) L-1 water); a4 (36 g of solid organic fertilizer (SOF) + 2 ml liquid organic fertilizer (LOF) L-1 water); a5 (36 g of solid organic fertilizer (SOF) + 4 ml liquid organic fertilizer (LOF) L-1 water); a6 (36 g of solid organic fertilizer (SOF) + 6 ml liquid organic fertilizer (LOF) L-1 water); a7 (54 g of solid organic fertilizer (SOF) + 2 ml liquid organic fertilizer (LOF) L-1 water); a8 (54 g of solid organic fertilizer (SOF) + 4 ml liquid organic fertilizer (LOF) L-1 water); and a9 (54 kg of solid organic fertilizer (SOF) + 6 ml liquid organic fertilizer (LOF) L-1 water). The variables observed were nutrient content of solid and liquid organic fertilizers from apu-apu, plant height, leaf number, and stem diameter respectively aged 30, 60, and 90 days after planting (DAP). The results showed that the content of liquid organic fertilizer apu-apu has pH H₂O 4.85; C-Organic 1.42%; N-Total 0.05%; C/N ratio of 26.36; P₂O₅ 0.02 ppm; and K₂O 0.21 ppm. Meanwhile, solid organic fertilizers contain pH H₂O 8.25; C-Organic 22.86; N-total 2.83%; C/N ratio of 8.08; P₂O₅ 0.73 ppm; and K₂O 0.74 ppm. The application of apu-apu organic fertilizer, significantly affect the average height of plant and stem diameter age 60 and 90 DAP, and the number of leaves age 30 DAP. But no significant effect on plant height and stem diameter of 30 DAP, and number of leaves aged 60 and 90 DAP. The treatment of a5, a6, a7, a8, and a9 gave higher growth of plants, number of leaves, and diameter of cempedak seedling better than the control.

INTRODUCTION

Cempedak plants (*Artocarpus champeden*) are classified in the Moraceae family and the *Artocarpus* genus, have fruit that can be consumed and produce wood (De Beer and Mc Dermott, 1996). Cempedak plants have rough-hair leaves (Sunarjono, 2010), shoots and twigs have fine hair (Jansen, 1997). Cempedak is a typical fruit in Southeast Asia, the fruits are plural (Verheij and Coronel 1997), a cempedak tree can produce 60-400 pieces per year, cempedak fruit contains fiber and high nutrition especially vitamin A (Tetty, 2011). Meanwhile, cempedak bark contains flavonoid and antimalarial compounds (Widyawaruyanti, et al., 2011).

The content of every 100 g of edible cempedak fruit contains 3.0 g protein; 0.4 g fat; carbohydrate 28.6 g; calcium 20 mg; phosphorus 30 mg; 1.5 mg of iron; vitamin A 200 SI; vitamin C 15 mg; water 67.0 g; and its energy value is 116 kcal (Astawan, 2009; Sumeru, 2006).

Report of the Department of Food Crops and Horticulture Kutai Kartanegara Regency (2016). In 2014 cempedak had been produce 4.073 t, then in 2015 decreased ie 3.954 t, but in the year 2016 had increase again ie 5.463 t. In 2014 and 2015 the number of cempedak trees and the highest total production was in Samboja District 10,475 trees with total production of 860 t, and 10,456 trees with total production of 1.046 t. However, in the year 2016 the largest number of trees in the district Loa Kulu with the number of plants as many as 9.969 trees with total production of 2.969 t.

Seed is an important factor in improving cempedak plant 's productivity. A good seed will have a good effect on cempedak production. In addition, to obtain a good seed growth required planting medium that has nutrient sufficiency. Therefore, fertilizer needs to be given to ensure the availability of nutrients in soil for plants. Apu-apu (*Pistia stratiotes*) is a plant of the family taro (Araceae) and the only member of the genus *Pistia*, become one of the multifunctional water plants. In addition it serves as aquatic plants, cleaners of water pollution, and one of the easy ornamental plants (Alamendah, 2015).

The results of organic matter analysis conducted in Soil Chemistry Laboratory of Universitas Brawijaya (2012) showed that the content of organic compost apu-apu was 22.8%, while the content of fresh apu-apu organic material was 19.6%. These results indicate that the apu-apu compost and fresh apu-apu can be utilized as a source of organic matter in the soil (Paramita et al., 2012). However, from the laboratory analysis does not know nutrient content of apu-apu organic fertilizer. Therefore, this study aims to determine the nutrient content of organic liquid fertilizer and yield of organic fertilizer apu-apu and its effect on the growth of seedlings cempedak.

METHOD

The study was conducted from February to June 2017 from the preparation of the planting media to the last data collection. Research location at Jalan Antai RT. 09 Sebulu Modern, Sebulu Sub-district, Kutai Kartanegara Regency.

The materials used in this research are cempedak seed, topsoil, solid organic fertilizer and liquid organic fertilizer was made from apu-apu, water, chicken mole, sugar, coconut water, fish laundry water, papaya leaf, and basil leaves. Tools used include: bucket, ruler, handsprayer, 50% paranet, vernier caliper, polybag, and camera.

The design used in this study was Randomized Complete Block Design (RCBD)) and each treatment level was repeated 3 times. The treatment factor is the application of solid organic fertilizer and liquid organic fertilizer apu-apu (a) consisting of 10 levels, namely: a₀ (control); a₁ (18g of SOF + 2 ml LOF L⁻¹ water); a₂ (18g of SOF + 4 ml LOF L⁻¹ water); a₃ (18g of SOF + 6 ml LOF L⁻¹ water); a₄ (36 g of SOF + 2 ml LOF L⁻¹ water); a₅ (36 g of SOF + 4 ml LOF

L⁻¹ water); a₆ (36 g of SOF + 6 ml LOF L⁻¹ water); a₇ (54 g of SOF + 2 ml LOF L⁻¹ water); a₈ (54 g of SOF + 4 ml LOF L⁻¹ water); and a₉ (54 g of SOF + 6 ml LOF L⁻¹ water). Treatment analysis was done by analysis of variance, if the treatment showed significant or very significant, it used the Fisher's Least Significant Difference Test (Fisher's LSD Test) with 5% level.

Place of research made shade of paranet 50% with height 150 cm in east and 120 cm in west. Planting media using top soil that had been dried for 1 day. Furthermore, the top soil weighed for the treatment of a₁, a₂, a₃ was 53.514 kg and 486 g of solid organic fertilizer for 27 polybags, for a₄, a₅, a₆ treatment were 53.028 kg and 972 g of solid organic fertilizer for 27 polybags, and for a₇, a₈, a₉ treatment were 52,542 kg and 1.458 g of solid organic fertilizer for 27 polybags. Then each treatment is mixed evenly. After that, planting medium puts into polybag and is labeled according to treatment. The weight of each polybag planting medium is 2 kg. The total number of polybags in this study was 90 polybags. Polybag's ready for planting is left for 1 week, then arranged according to the research layout.

Cempedak seeds are used derived from the seeds of ripe cempedak fruit on the tree, has a more rounded seed and not attacked by disease (Alamendah, 2014). Before planting, cempedak seeds soaked in cold water for (\pm 1 hour). Then, the soaked seeds were selected and grouped by weight of seeds: group I: 3-4 grams, group II: 4-5 grams, and group III: 5-6 grams. Furthermore, seeds are planted in a medium with a depth of 3 cm from the soil surface. One polybag contains one cempedak seed.

This research used local microorganism from chicken stomach weighing 1 kg, mixed with molasses 250 g, then put's in 1.5 liter bottle, then fermented for 7 days. Organic fertilizer-apu-apu made by: apu-apu chopped, then put in a bucket, then put 10 liters of water, coconut water, fish wash water, and chicken stomach mol. Next, stir until mixed. After that the bucket was closed and fermented for 2 weeks.

LOF is given to the plant according to treatment. LOF was sprayed to the plant. Spraying is done 5 (five) times per plant at age 14, 21, and 28 DAP. 10 (ten) times per plant at 35, 42, 49, and 56 DAP, and 15 (fifteen) times per plant at 63, 70, 77 and 84 DAP. Watering is done in the morning and afternoon or adjusted to the conditions in the field. In the first month (age 1-30 days) after the seeds planted 200 ml watering volume polybag-1. The second month (age 31-60 days) watering volume 400 ml polybag-1. Next, in the third month (age 61-90 days) after transplanting the volume of watering 600 ml polybag-1. The goal is that plants can absorb water as needed. Weeding is done on every plant, inside the polybag and the land around the polybag. During the study there were no pest and disease attacks on cempedak seeds.

The variables observed in this research were nutrient content of organic solid fertilizer, liquid organic fertilizer, plant height, leaf number, and stem diameter were each observed and measured at 30, 60, and 90 DAP.

RESULTS AND DISCUSSIONS

Nutrient Content

The results of analysis showed that the content of liquid organic fertilizer apu-apu has pH H₂O 4.85; C-Organic 1.42%; N-Total 0.05%; C/N ratio of 26.36; P₂O₅ 0.02 ppm; and K₂O 0.21 ppm.

Meanwhile, solid organic fertilizers contain pH H₂O 8.25; C-Organic 22.86; N-total 2.83%; C/N ratio of 8.08; P₂O₅ 0.73 ppm; and K₂O 0.74 ppm, tabel 1.

Table 1. The nutrient content of organic fertilizir apu-apu pH, C-organic, N-Total, C / N ratio, P2O5, and K2O.

Nutrient Contents	Unit	Organic fertilizer	
		Solid	Liquid
pH (H ₂ O)		8.25	4.83
C-Organic	%	22.86	1.42
N-Total	%	2.83	0.05
C/N Ratio		8.08	26.36
P ₂ O ₅	ppm	0.73	0.02
K ₂ O	ppm	0.74	0.21

The content of pH of solid organic fertilizer is 8.25 and liquid organic fertilizer is 4.83. The value of C / N ratio of solid organic fertilizer and liquid organic fertilizer are 8.08 and 26.36 respectively. C/N ratio is very important in composting because the transformation of organic residue into organic fertilizer is influenced by microorganism and C/N ratio. According to Gaur (1982) that organic residue with C/N ratio of 25-40 is quite optimal in composting efficiency.

Growth Of Seeds

Cempedak seeds include class Magnoliopsida (dicotil) consist of 3 layers: the first layer is yellow outer layer of skin, second layer is brownish white; and the third layer is a lot of carbohydrate seeds (Sumeru, 2006; Astawan, 2009). On the 19 days after seed planting have appeared plumula, furthermore than plumula continues to grow, cotyledons have been more open at 14 days after planting. At the age of 24 days the stem and plumula have grown and developed. At the age of 30 days after planting, the plumula has turned into a leaf and there is a prospective formation of new leaves that continue to grow until at age 60 and 90 days after planting, figure 1.

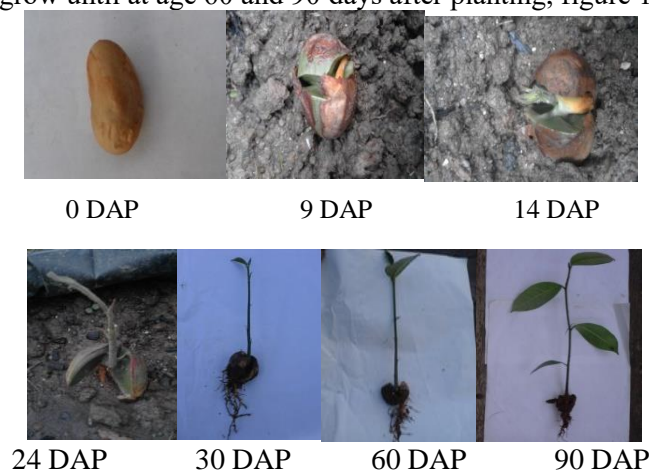


Fig 1. Phase growth and development of seedling cempedak.

Height Plants

The application of apu-apu organic fertilizer at doses a₁, a₂, a₃, to a₄ does not significantly influence the increase of cempedak plant height compared to control. However, when the dose of the apu-apu organic fertilizer is increased up to a₅, a₆, a₇, a₈ to a₉ there is a significant difference in plant height increase compared to controls, a₁, a₂, and a₃. This indicates that the application of apu-apu organic fertilizer at doses a₅, a₆, a₇, a₈ to a₉ have made soil fertility, ie the physical, chemical and biological properties of the soil are good for the high growth of cempedak seedlings, table 1.

Table 1. Height of cempedak seedlings at age 30, 60, and 90 days after planting (DAP).

Organic Fertilizer	Height Plant		
	30 DAP	60 DAP *	90 DAP *
a ₀	15,2	20,67 a	24,50 a
a ₁	15,0	19,70 a	23,80 a
a ₂	13,9	19,90 a	23,30 a
a ₃	15,7	21,50 a	24,70 a
a ₄	14,7	21,90 ab	26,20 ab
a ₅	21,3	28,40 b	33,60 b
a ₆	19,9	26,80 b	30,20 b
a ₇	17,6	26,40 b	30,90 b
a ₈	16,4	27,80 b	31,70 b
a ₉	16,5	29,00 b	33,20 b
LSD-Test 5 %	-	6.14	6.26

*) The average number followed by the same letter shows no significant difference in LSD-Test 5%

Organic fertilizers play a role in improving porosity and soil aeration, texture and soil structure. It also provides nutrient supply for the soil. Based on the analysis results known, apu-apu organic fertilizer has nutrients N, P, and K (table 1). In addition to these roles, the presence of organic fertilizer in cempedak plant media provides an opportunity for the development of microorganisms in the soil. This condition makes rooting cempedak seedlings can develop well so it can absorb nutrients from the soil and give the effect of plant organs on the ground grow and develop better.

Plant's height aged 30 days after planting to age 60 days after planting showed the average increase of plant height is higher than the average height of plant from age 60 days after planting to age 90 days after planting. Treatment a₅ shows the highest development of higher seeds than other treatments, either at 30, 60 or 90 days after planting.

Number of Leaves

Leaves are photosynthetic organ that play a role in synthesizing carbohydrates, the addition of the number of leaves will give a good effect for the growth of cempedak seedlings. The treatment of organic fertilizer apu-apu gave a significant effect on the growth of leaves number at 30 days after planting, but does not give significant effect on the addition of leaves number at age 60 and 90 days after planting, table 2.

Table 2. Number of leaves of cempedak age 30, 60, and 90 days after planting (DAP).

Organic Fertilizer	Number of leaves		
	30 DAP *	60 DAP	90 DAP
a ₀	1,0 a	2,7	3,3
a ₁	1,7 ab	3,3	3,5
a ₂	1,3 ab	3,0	3,4
a ₃	1,7 ab	3,3	3,6
a ₄	2,0 b	3,3	3,7
a ₅	2,0 b	3,7	4,0
a ₆	2,0 b	3,3	4,0
a ₇	2,0 b	3,3	3,7
a ₈	2,0 b	3,7	4,0
a ₉	2,0 b	3,7	4,3
LSD-Test 5 %	0.53	-	-

*) The average number followed by the same letter shows no significant difference in LSD-Test 5%

The data in Table 2 shows that the treatment of organic apu-apu a₄, a₅, a₆, a₇, a₈, until a₉ have more leaf number tendency than all control, either at age 30, 60 or 90 days after planting. This shows that the treatment of organic apu-apu fertilizer into the planting medium can improve soil fertility, meet the nutritional needs, especially for the growth and development of leaves.

The existence of nutrient elements N, P, and K derived from apu-apu organic fertilizer in planting medium causes the growth and development of cempedak leaves. Nitrogen nutrient elements in the media and sprayed to the leaves of cempedak seedlings can be absorbed by plants. The absorbed nitrogen is used to form the necessary chlorophyll in the photosynthesis process. The result of photosynthesis produces the carbohydrates required by meristem tissue for cell division and enlargement in plants so that the number of leaves increases (Sutedjo, 2005). Furthermore Rahman (2014) said that nitrogen has a major function as synthesis of chlorophyll, protein, amino acids, and is needed in large quantities, especially at the time of vegetative growth. there is a tendency to increase the highest number of leaves occur at age 30 to age 60 days after planting than age 60 to 90 days after planting.

Diameter of stem

The diameter of the stem is one of the horizontal growths that occur in plants that have an important role to support the growth of plant organs on the ground. The treatment of organic fertilizer apu-apu gives significant effect to the cempedak stem diameter of 60 and 90 days after planting, but does not give significant effect on age 30 days after planting, table 3.

Table 3. Diameter of cempedak seedlings aged 30, 60, and 90 days after planting (DAP)

Organic Fertilizir	Diameter of stem		
	30 DAP	60 DAP *	90 DAP *
a ₀	0,3	0,33 a	0,38 a
a ₁	0,3	0,34 ab	0,36 a
a ₂	0,3	0,33 a	0,36 a
a ₃	0,3	0,38 b	0,43 ab
a ₄	0,3	0,35 b	0,37 a
a ₅	0,4	0,42 c	0,46 ab
a ₆	0,4	0,44 c	0,47 b
a ₇	0,4	0,40 c	0,45 b
a ₈	0,4	0,46 c	0,50 b
a ₉	0,4	0,40 c	0,44 b
LSD-Test 5 %	-	0.08	0.08

*) The average number followed by the same letter shows no significant difference in LSD-Test 5 %.

There is a tendency that organic apu-apu organic fertilizer treatment gives the greatest diameter of stem than all control treatment, especially in a₅, a₆, a₇, a₈, and a₉ treatments. This indicates that the application of organic apu-apu fertilizer causes the planting medium to become fertile and the required nutrients are available enough to be absorbed by the plant.

One of the nutrient's needed for the development of stem diameter is potassium. Suriatna (2005) reported that potassium has the effect of increasing the synthesis and translocation of carbohydrates, because it can accelerate cell wall thickness, stem strength, and enlargement of plant stem diameter. In addition, potassium plays a role in the growing process of plant growing point on the meristem so that the elongation and enlargement of cells under the meristem area on the stem. the average addition

of stem diameter from age 30 to 60 and 60 to 90 days after planting tends to increase equal to the value of addition <1 cm.

CONCLUSION AND SUGGESTION

The content of liquid organic fertilizer apu-apu has pH H₂O 4.85; C-Organic 1.42%; N-Total 0.05%; C/N ratio of 26.36; P₂O₅ 0.02 ppm; and K₂O 0.21 ppm. Meanwhile, solid organic fertilizers contain pH H₂O 8.25; C-Organic 22.86; N-total 2.83%; C/N ratio of 8.08; P₂O₅ 0.73 ppm; and K₂O 0.74 ppm. The application of apu-apu organic fertilizer has significant effect on the average of plant height and stem diameter of 60 and 90 days after planting, and the number of leaves 30 days after planting. But no significant effect on plant height and stem diameter 30 days after planting, and number of leaves age 60 and 90 days after planting. treatment doses a5, a6, a7, a8, and a9 resulted in higher plant growth, number of leaves, and diameter of cempedak seedlings, better than controls.

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