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Guano LOF (Liquid Organic Fertilizer) as a Substitute for AB Mix Nutrition on the Growth and Yield Response of Pakcoy Plants in Hydroponic Wick System

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Abstract
Background: Pakcoy plant (Brassica rapa L.) is a horticulture plant that is widely cultivated in Indonesia. Pakcoy cultivation can also be done using hydroponic techniques or cultivation of plants without using soil. Wick system is one of the simplest hydroponic techniques. Hydroponics uses nutrient solutions that are AB Mix. AB Mix nutrition can basically be replaced with liquid organic fertilizer (LOF). The LOF used was made from guano and was obtained from the Batu Hapu cave located in Batu Hapu Village, Hatungun District, Tapin Regency, South Kalimantan Province, Indonesia. The purpose of this study was to determine the effect of effective dosing of guano LOF on the growth and yield response of pakcoy plants in hydroponic wick system. Research methods used a Completely Randomized Design method, consisting of 1 (one) factor with 7 levels of treatment. The treatments applied were P_0 (Water one liter), P_1 (AB Mix 10 ml/l water), P_2 (LOF 40 ml/l water), P_3 (LOF 80 ml/l water), P_4 (LOF 120 ml/l water), P_5 (LOF 160 ml/l water) and P_6 (LOF 200 ml/l water). The results showed that the administration of guano LOF had a significant effect to the growth and yield of pakcoy plants in hydroponic wick system on the parameters of observation of leaf number, leaf width, plant height and wet weight and treatment P_2 (LOF 40 ml/l water) is an effective dose.

Keywords: *Pakcoy, Hydroponic, Wick system, LOF, Guano.*

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I. Introduction

The pakcoy plant (*Brassica rapa* L.) is a short-lived horticultural plant that is included in annual plants of the Brassica genus group. Pakcoy is a vegetable plant that is widely consumed in Indonesia because it is easily obtained at an economical price. Pakcoy has high levels of vitamins K, A, C, E and folic acid [1].

In Indonesia pakcoy cultivation is conventionally carried out on agricultural land by making land preparations first. Soil cultivation and fertilization need to be done so that the nutrients needed by plants can be fulfilled. Fertilizers used can be either organic or chemical fertilizers in solid or liquid forms. Pakcoy cultivation can also be done using hydroponic techniques, namely cultivation of plants without using soil media. Hydroponic planting media commonly used are water, sand, gravel, brick fragments, husk charcoal and so on. An important factor that determines the success of plant cultivation using hydroponic techniques is the provision of nutrient solutions, water and oxygen [2,3].

Nutrition given in a hydroponic system in the form of a solution called nutrition AB Mix. The formulation of solution A in AB Mix contains calcium and solution B contains sulfate and phosphate [4,5]. AB Mix nutrition can basically be replaced with LOF or liquid organic fertilizer. LOF is liquid fertilizer which is composed of material from the decomposition of organic matter that has been dissolved with solvents such as water, alcohol, or oil. One of the LOFs used is guano-based. Guano used had nutrient content of N 2.26%, P 2.77% and K 2.72%. The guano LOF base material can be obtained from the Batu Hapu cave located in Batu Hapu Village, Hatungun District, Tapin Regency, South Kalimantan Province, Indonesia.The purpose of this study was to determine the effect of effective dosing of guano LOF from Batu Hapu Village, Tapin District on the growth and yield of hydroponic pakcoy plants using a wick system

II. Materials And Methods

2.1 Materials

The ingredients used are Guano (bat droppings), AB Mix, pakcoy Nauli plants F1, water, EM-4, palm sugar, rockwoll and flannel cloth. The tools used are water barrels (30 liter), small buckets (5 liter), sprayer,

measuring cups, rulers, stationery, scales and cameras [5].

2.2 Research Methods

The method used was a Completely Randomized Design (CRD) consisting of 1 factor with 7 treatment levels and repeated 4 times, so that there were 28 experimental units. The following is the levels of treatment in the study:

P_0 = Water 1 liter
P_1 = AB Mix 10 ml/l water
P_2 = LOF Guano 40 ml/l water
P_3 = LOF Guano 80 ml/l water
P_4 = LOF Guano 120 ml/l water
P_5 = LOF Guano 160 ml/l water
P_6 = LOF Guano 200 ml/l water

2.3 Time and Place

This research was conducted from January to March 2019 which took place at the Greenhouse of the Swamp Farm Research Institute (BALITTRA) of South Kalimantan, Indonesia.

2.4 Research Preparation

Making liquid organic fertilizer (LOF). Provide a 30 liter bucket and fill it with 10 liter. water. Make a 1/4 liter sugar solution in a separate place by mixing 500 g of palm sugar with 1/4 liter water. Add the sugar solution made earlier with EM-4 1 / 2 liter and 5 kg guano into the bucket, then add water until the bucket is full. Stir the solution slowly until it is homogeneous and finally close the bucket tightly. The facultative anaerobic fermentation is done by stirring regularly every 3 days for 14 days. After 14 days the Guano fermented filter water is taken and ready to be used as LOF.

Seeding seeds. Seeding is done using a tray container with a width of 20 cm, a length of 30 cm and a height of 5 cm. The media used is rockwoll. Rockwoll media soaked then the seeds are sown on the media, watering is done with a sprayer every day. After being 2 weeks old after being planted or having 3-4 leaves, the seeds are ready to be transferred to the prepared hydroponic media.

Hydroponic media manufacture. First cut the elongated flannel cloth with a length of 30 cm and a width of 3 cm. Second, insert a piece of flannel into the netpot so that it forms an axis. Prepare planting media using a 5 L. bucket. On the lid of the bucket is perforated the size of the netpot.

2.5 Implementation

Planting is done by transfering pakcoy seeds that are 2 weeks old or have 3-4 leaves from the seedling media to the hydroponic media that has been given LOF according to the levels of treatmentP_0 (Water 1 liter) negative control, P_1 (AB Mix 10 ml/l) positive control, P_2 (LOF Guano 40 ml/l water), P_3 (LOF Guano 80 ml/l water), P_4 (LOF Guano 120 ml/l water), P_5 (LOF Guano 160 ml/l water) and P_6 (LOF Guano 200 ml/l water).

2.6 Observation

Plant height (cm). Measured from the base of the stem to the tip of the longest leaf. Measurements were made at weeks 1, 2, 3 and 4 after planting.

Number of leaves (strands). Calculated at weeks 1, 2, 3 and 4 after planting.

Leaf width (cm). Measured by selecting the widest leaves at weeks 1, 2, 3 and 4 after planting.

Gross weight (g). Weighed it at harvest by weighing all parts of the plant after cleaning and washing.

2.7 Data Analysis

Data from observations that have been made are analyzed first with a homogeneity test, the Bartlett test. If the data are homogeneous, then it will be continued with analysis of variance (ANOVA), but if it is not homogeneous, then the transformation of the data will be carried out to be homogeneous and then analysis of variance will be carried out. Variance analysis is performed on observational data using the F-count test and if between treatments have significant or very significant differences, it will be continued with the DMRT (Duncan's Multiple Range Test) test at a 5% real test level to find out which treatments have differences [2].

III. Results And Discussion

3.1 Plant Height

Plant height is influenced by the nutrient content of nitrogen and phosphorus in a given nutrient solution. Nitrogen in plants has a role to stimulate overall plant growth, especially stems, branches and leaves [5,6]. Guano itself contains nitrogen, phosphorus and potassium which are very good for supporting growth,

stimulating roots, strengthening seedlings, and containing micro elements needed by plants [7].

Based on research, the higher LOF dose from treatment (LOF Guano 40 mL/L water) to P_6 treatment (LOF Guano 200 mL/L water) causes a decrease in plant height. The higher the dose of LOF from P_2 treatment (LOF Guano 40 mL/L water) to P_6 treatment (LOF Guano 200 mL/L water) causes a decrease in plant height. This can be seen from the plant height of the 4th week after planting in P_2treatment showed height of 24,73 cm, whereas P_6 treatment showed height of 7,65 cm. This decrease in plant height is due to an increase in concentration of the solution which makes it difficult for plant roots to absorb nutrients. The concentration of nutrient solution is given low, the effectiveness of fertilizers will be reduced, if the concentration of the solution is too high it will cause the plants to wilt and even cause death [8]. Organic fertilizer when applied at the right dosage acts as a growth promoter for plants [9,10], Figure 1.

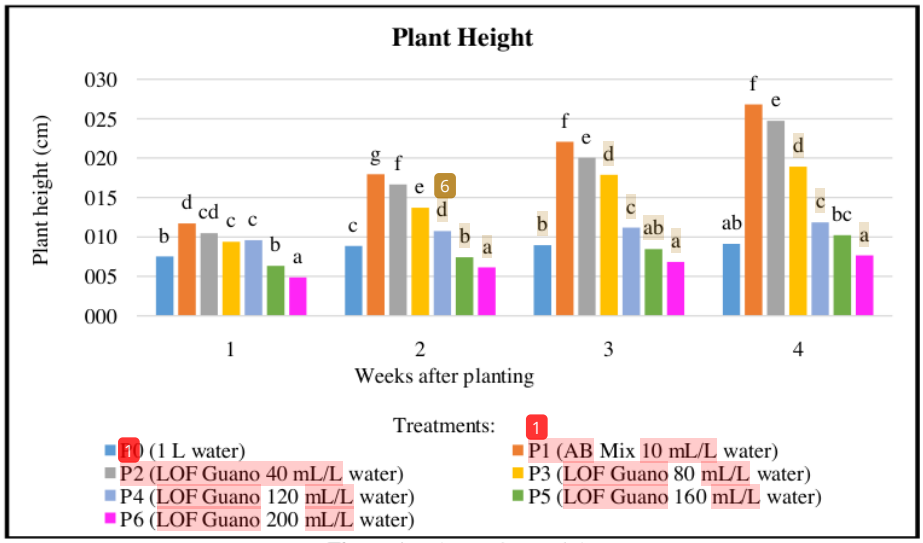

Figure 1. Pakcoy Plant Height

3.2 Leaf Number

The P_1 treatment (AB Mix 10 ml/l water) showed the highest number of leaves at each weekly observation and followed by P_2 treatment (LOF Guano 40 ml/l water) with the second highest number of leaves.The average number of leaves of the 4th week after planting in P_1 treatment had 19,50 strands, P_2 treatment had 17,75 strands and P_6treatment had 6,25 strands. This difference occurs because the nutrients in the LOF is less than the AB Mix nutrition. Many of the least number of leaves influenced by N nutrients contained in nutrient solutions. Nitrogen is a constituent of important compounds in plants such as nucleic acids, chlorophyll, and other enzymes. The lack of elements N and P can affect the number of leaves [11]. Nutrients in guano have high N, P and K values, but after being applied as LOF they have not been able to compensate for the nutrient content in the AB Mix nutrition, Figure 2.

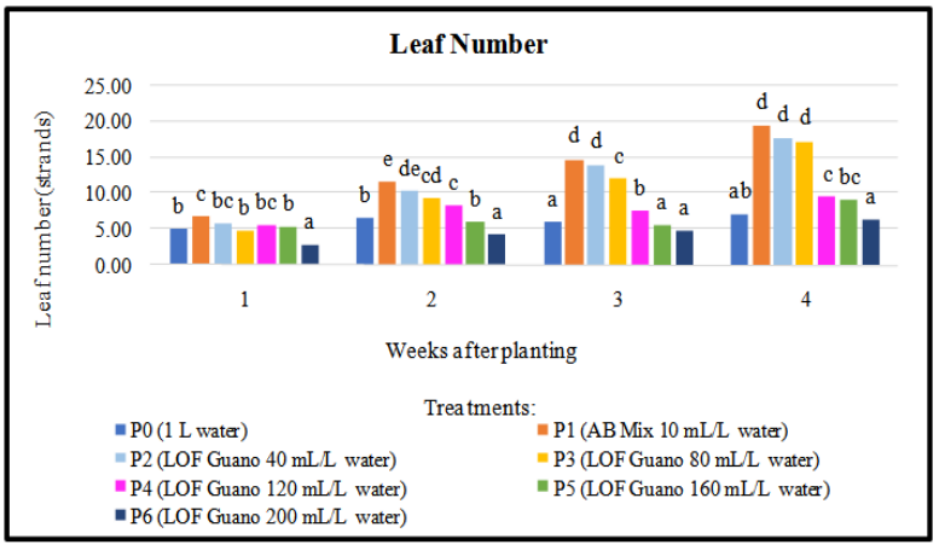

Figure 2. Pakcoy plant leaf number

3.3 Leaf Width

Observation ofleaf width of the 4th week after planting showed that P_1treatment (AB Mix 10 ml/l water) had the highest average of 8,8 cm, whereas P_2 treatment (LOF Guano 40 ml/l water) had a leaf width of 7,7 cm. Plant growth can be increased if N needs are met, as it is known that N elements function to increase leaf growth so that the leaves will become numerous in number and become wider with a greener color [9]. Guano contains major constituent components namely N, Ca, P and Mg, K and S supplementary components which are quite high but not as complete and as much AB Mix [12]. The elements that comprise AB Mix consist of nutrient solution stock A containing N, K, Ca, and Fe and stock B contains Na, S, Zn, Mg, B, Mn, Cu, Mo, and P. Macro and micro nutrients are essential nutrients for support plant growth [3], Figure 3.

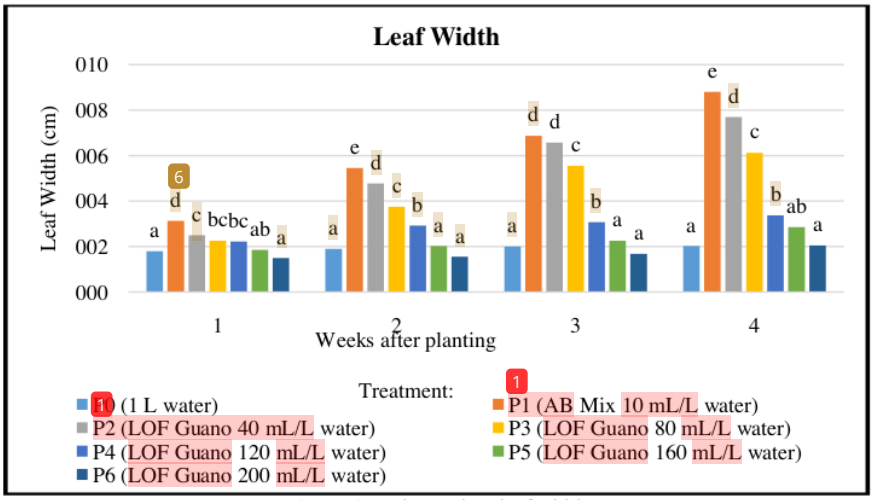

Figure 3. Pakcoy plant leaf width

3.4 Gross Weight

The P_1 treatment (AB Mix 10 ml/l water) has the highest weight which is then followed by treatment P_2 (LOF Guano 40 ml/l water), P_3 (LOF Guano 80 ml/l water), P_4 (LOF Guano 120 ml/l water), P_0 (1 liter water), P_5 (Guano LOF 160 ml/l water) and P_6 (Guano LOF 200 ml/l water). This happens because P_1 (AB Mix 10 ml/l

water) has the highest average value of each parameter observed so that it affects the wet weight of the plant. Increasing plant height and number of leaves will automatically increase plant weight [13]. In P_2 treatment (LOF Guano 40 ml/l water) showed a fairly good response but has not been able to match the AB Mix nutrition which has a special formulation. Based on research conducted P_2 treatment (LOF Guano 40 ml/l water) has the lowest solution concentration among other LOF treatments. The concentration of the solution will affect the plant's absorption of nutrients supplied. The supply of N nutrients is sufficient then the leaves of the plant will grow large and wider, so that it affects the rate of photosynthesis that produces energy for plant growth and development [14,15], Figure 4.

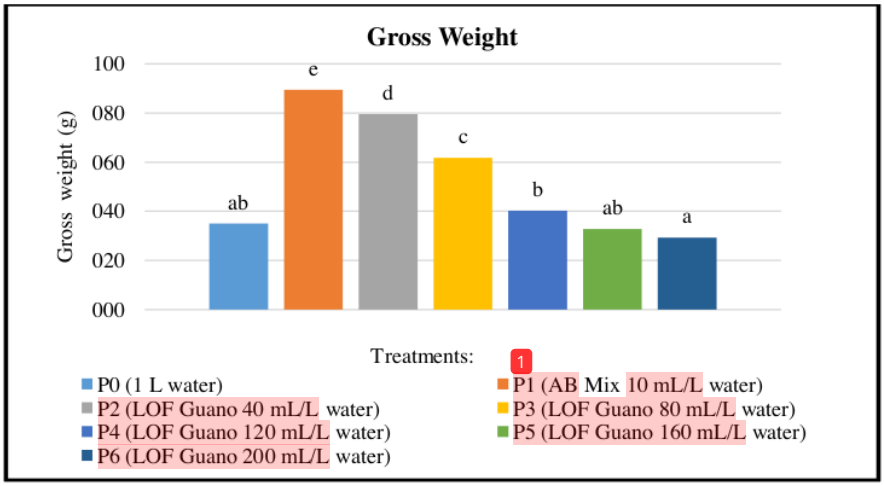

Figure 4. Pakcoy plant gross weight

IV. Conclusion

Guano LOF (liquid organic fertilizer) from Batu Hapu Village, Tapin District, South Kalimantan to the growth and yield of pakcoy plants had a very significant effect on the parameters of observing the number of leaves, leaf width, plant height and gross weight. The P_2 treatment (LOF Guano 40 ml/l water) is an effective dose with the average characteristics of plant height, leaf number, leaf width and gross weight in sequence, namely 24,73 cm, 17,75 strands, 7,70 cm and 79,50 g.

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