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Supplying Liquid Organic Fertilizer (POC) With Organic Waste Materials On The Growth And Product of Lettuce *(Lactuca Sativa L.)*

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ABSTRACT

Liquid organic fertilizers can come from feces (animals, humans), agricultural waste, agricultural processing waste, household waste, urban waste, and production waste. Waste in general is a case of environmental pollution which can cause environmental problems and deteriorate health for the community, this is caused by liquid waste obtained from various industrial activities, hospitals, markets, households, especially in food industry waste, because in the process it still leaves elements that can become part of the process water and discharged into the environment. The use of various wastes to become organic fertilizers is an effort to overcome the problem of environmental pollution, with high organic matter, waste can act as an organic source of food by microbial growth. The purpose of this study was to determine the various POC materials from organic waste that would have a better effect on growth and yield in lettuce plants. Based on the results of the study, it can be concluded as follows:There is a significant effect on plant length variables on wet weight per plant with R Square of 0.69884 (69.88%) at 28 days of age observation and number of leaves with R Square of 0 , 7025 (70.25%) at 35 days after transplanting and there was a significant effect of the K3 treatment (POC 12%), plant length and number of leaves on the wet weight per plant which gave a higher value than the K1 and K2 treatments with Adjusted R Square of 0.935293 (93.53%); but statistically not significant difference with treatment K2 (POC 8%) with Adjusted R Square of 0.706472 (70.65%).

Keywords: *Liquid Organic Fertilizer, Organic Waste*

1. INTRODUCTION

Lettuce is one of the oldest vegetables originating from West Asia, but some literature states that lettuce germplasm originates from the American region. It is said that the lettuce plant has been cultivated since 2,500 years ago, which is evidenced by the ancient writings on theplant *lettuce* around 500 BC. Lettuce centers include the Caribbean, Malaysia, the Philippines, and East, Central and West Africa. Countries that pay great attention to creating and developing superior varieties of lettuce include Japan, Taiwan, the United States, the Netherlands, and Taiwan (Manuhuttu et al., 2018).

Lettuce is a nutrient rich source of vitamin A and beta carotene. Vitamin A, also called retinol, helps the eyes see clearly day and night, maintains the immune system, improves liver and thyroid function, helps the healing process of growth and reproduction, and provides nutrients for the skin, eyes, hair, nails, and adrenal glands (Wardhana et al., 2016).

Liquid organic fertilizers used can come from feces (animals, humans), agricultural waste, agricultural product processing waste, household waste, urban waste, and production waste (Hariyadi & Ali, 2020). Waste in general is a case of environmental pollution which can cause environmental problems and deteriorate health for the community, this is caused by liquid waste obtained from various industrial activities, hospitals, markets, households, especially in food industry waste, because in the process it still leaves elements that can become part of the process water and discharged into the environment.

Organic fertilizers are fertilizers that are composed of living matter. like manure. plant remains, animal and human waste. Organic fertilizers can be solid or liquid which can be used to improve soil physical, chemical and biological properties. One source of organic material is green manure (Pratiwi et al., 2019).

Green manure is a natural fertilizer derived from plant residues, especially legumes or nuts, leaves, stems and roots. Natural fertilizers are fertilizers that can be formed through natural processes. Formed in this case through the process of decay carried out by microorganisms or decomposing living things (detritivores). Microorganisms can decompose carcasses. waste, animal manure into soil containing nutrient elements which are essential for plant growth (Nugroho et al., 2013).

Liquid organic fertilizer is a solution resulting from the decomposition of organic materials from plant residues, animal and human manure which contains more than one element. The advantages of liquid organic fertilizers are that they can quickly overcome nutrient deficiencies, have no problems in nutrient leaching and are able to provide nutrients quickly. In general, liquid organic fertilizers do not damage soil and plants even though they are used as often as possible (Muhammad et al., 2019).

Liquid Organic Fertilizer is an organic fertilizer that is produced through a fermentation process and with nutrient enrichment technology. Apart from containing essential nutrients, these environmental products also contain a variety of beneficial microorganisms capable of increasing and maintaining soil fertility, suppressing the growth of disease bacteria so that roots, leaves, stems and flowers will grow and develop properly and optimally.

Liquid organic fertilizers are easier for plants to use because the elements contained in the form are easily absorbed by plants. The advantage of using liquid organic fertilizer is that it is done faster than using fertilizer in solid form. Even so, liquid organic fertilizers have disadvantages, namely that they evaporate easily and can damage leaf tissue and their absorption depends on the leaf surface layer, namely the hair and cuticle layer (Gunawan, 2018).

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Liquid organic fertilizer provides several advantages, for example this fertilizer can be used by sprinkling it to the roots or spraying it on plants and it saves energy, so the watering process can keep the soil moist. The implementation of liquid organic fertilizers in fertilization is clearly more evenly distributed, there will be no accumulation of fertilizer concentrations in one place, this is because liquid organic fertilizer is 100 percent soluble, so that it quickly overcomes nutrient deficiencies and does not have problems in washing nutrients and is also able to provide nutrients quickly (Zulia et al., 2017).

In the application, farmers usually carry out solid organic fertilization which is given through the soil. The drawback of giving organic fertilizers through the soil is that some of the nutrients have dissolved in advance and are lost with percolation water or have been fixed by soil colloids, so they cannot be absorbed by plants. In saturated water conditions it also causes the infiltration process to not go smoothly into the soil which causes nutrients not to reach the plant roots, for example, during the rainy season. Efforts that can be taken to make fertilization more effective and efficient are spraying the fertilizer solution through the plant leaves with liquid fertilizer. It is intended that the nutrients provided will be absorbed directly by plants through stomata.

Liquid Organic Fertilizer contains complete nutrients. There are even other organic compounds that are beneficial to plants. such as humic acid, fulvic acid, and other organic compounds. Most of the nutrients contained in Liquid Organic Fertilizer consist of simple sugar and protein groups with a solution reaction in the form of amino acids, organic acids, vitamins, growth hormone (gibberellin auxin) macro-micro elements. This element is needed to encourage optimal and sustainable plant growth and health, so as to increase crop yields.

The macro and microconsists of:

a) nutrient contentMac nutrient content, namely carbon (C), hydrogen (H), oxygen (O), sodium (N), phosphate (P), potassium (K), sulfur (S).), magnesium (Mg), and calcium (Ca).
b) The required micro nutrient content is molybdenum (Mo). copper (Cu), boron (B), zinc (Zn), iron (Fe), chlorine (CI), and manganese (Mn). The elements mentioned above can be obtained through several sources, such as air, water, minerals in planting media and fertilizers (Muhammad et al., 2019).

The use of liquid organic fertilizers can be useful for repairing soil structure damaged by the use of chemical fertilizers for years. In addition, organic fertilizers are used to loosen the soil again. Various microbes and batteries contained in organic fertilizers will be able to dissolve and bind the substances needed by the soil for increased productivity.

Research results by Bambang Wicaksono Hariyadi, Wegias Kogoya and Bambang Gunawan (2017) state that there is a very significant effect on plant height, number of leaves and plant wet weight per polybag of land spinach (*Ipomoea reptans Poir*) due to the application of 10 cc of Tambsil liquid organic fertilizer. per liter of water which produced the highest growth and yield, although statistically not significantly different from the treatment concentration of 8 cc per liter of water (optimum).

Soil is the most important component in life because it is a natural medium in which plants grow. As the most important natural resource, the use of land greatly affects plant growth if the plants become less productive, but if the use is correct, namely by paying attention to the physical, chemical and biological properties of the soil, it will be able to produce high yielding plants on an ongoing basis (Zulia et al., 2017).

The use of various wastes to become organic fertilizers is an effort to overcome the problem of environmental pollution, with high organic matter, waste can act as an organic source of food by microbial growth. This research is about the use of various concentrations of several organic waste materials that have an effect on the growth and yield of more optimal lettuce plants.

2. RESEARCH METHOD

This study used a regression test to the combination treatment of the type of raw material POC consisted of 7 levels, namely:$_{PO}$: without the application of liquid organic fertilizer; P_1: given POC made from a mixture of ingredients 2 to 7; P_2 : given POC made from vegetable waste; P_3 : given POC made from fruit waste; P_4 : given POC made from sprouts waste; P_5 : given a POC made from food waste (catering); P_6 : given POC made from catfish waste (jerohan); P_7 : given POC made from cut animal waste (blood) with a concentration of POC administration consisting of 3 levels, namely: K_1: POC 4 concentration%% (40 ml / liter); K_2 : POC 8 concentration%% (80 ml / liter); K3: POC concentration of 12%% (120 ml / liter).

3. RESULTS AND DISCUSSION

Plant Length.

The statistical results with regression analysis showed that the relationship between plant length variables and wet weight per plant as the dependent variable showed insignificant influence on observations of age 14 days after transplanting (0.1025> 0.05) with an R Square value of 0.1277. This means that a number of 12.77% are affected by the provision of POC, then the observation of the age of 28 days after transplanting shows a significant effect (1.26954E-06

<0.05) with an R Square value of 0.69884 meaning 69.88% due to because of the influence of POC treatment while a number of 30.12% was caused by other factors outside the POC treatment. Furthermore, observations of age 35 days after transplanting also showed a significant effect (0.00033 <0.05) with an R Square value of 0.4832 (48.32%). The regression equation obtained at the age observation 28 days after transplanting is **y = 6.1096x - 39,871**; while the observation of age 35 days after transplanting, namely **y = 1.7695x + 2.4987.**

Furthermore, to illustrate the distribution of the relationship between plant length variables and wet weight per plant as a result of POC treatment, it is presented in the graph below.

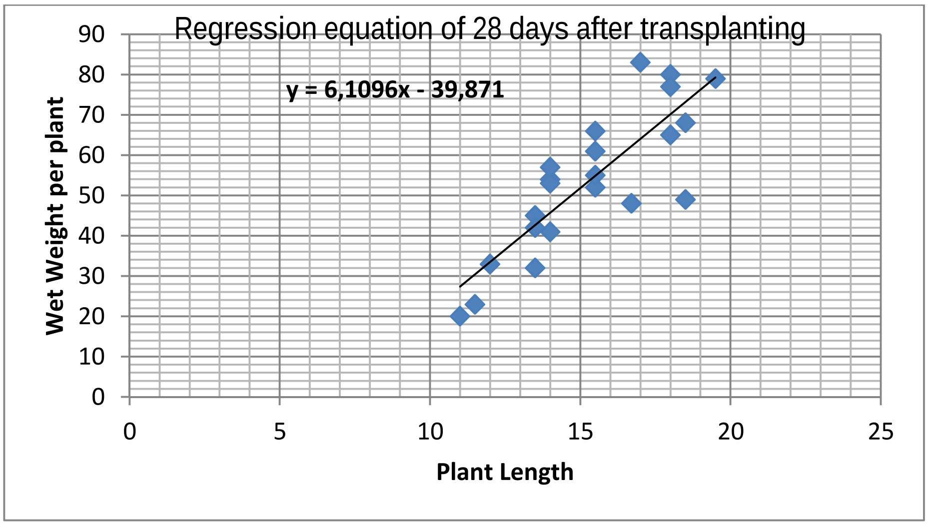

Figure 1: Variable Relationship between Plant Length and Wet Weight per Plant at Age Observations 28 Days After Transplanting.

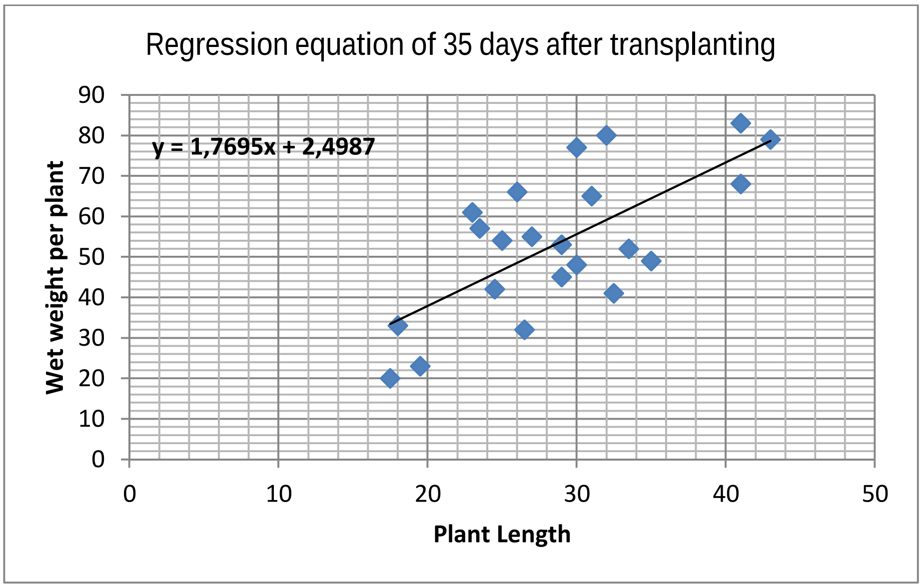

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Figure 2: Variable Relationship between Plant Length and Wet Weight per Plant at Age Observations 35 Days After Transplanting.

According to Wahyudi (2011) that the content of *Lactobacillus* sp. in EM-4 is a microbe that plays a role in helping the fermentation process of organic matter into lactic acid compounds that can be absorbed by plants.

The use of organic fertilizers in the planting medium is carried out to reduce the negative impact caused by the use of inorganic fertilizers which have a high risk of physical soil. The results of the above research prove that the organic matter is able to increase the effectiveness of using organic fertilizers and inorganic fertilizers which is shown by being able to significantly increase the growth of lettuce plants.

Number of Leaves

The statistical results with regression analysis show that the relationship between the number of leaves and the wet weight per plant as the dependent variable shows an insignificant effect on observations of age 14 days after transplanting (0.8037> 0.05) with an R Square value of 0 , 003163686 means that there is no effect shown by the variable number of leaves due to POC administration in all treatments. Observation of age 28 days after transplanting showed a significant effect (0.00017 <0.05) with an R Square value of 0.5149, meaning that 51.49% was due to the influence of POC treatment. Furthermore, observations of age 35 days after transplanting also showed a significant effect (1.11923E-06 <0.05) with an R Square value of 0.7025, meaning that 70.25% was due to the influence of POC treatment while 29.75% was due to by other factors outside the POC treatment. The regression equation obtained at the age observation 28 days after transplanting is **y = 10.75x - 31.25**; while the observation of age 35 days after transplanting, namely **y = 5,5342x - 26,473.**

Furthermore, to describe the distribution of the relationship between the variable number of lettuce leaves and the wet weight per plant as a result of POC treatment, it is presented in the graph below.

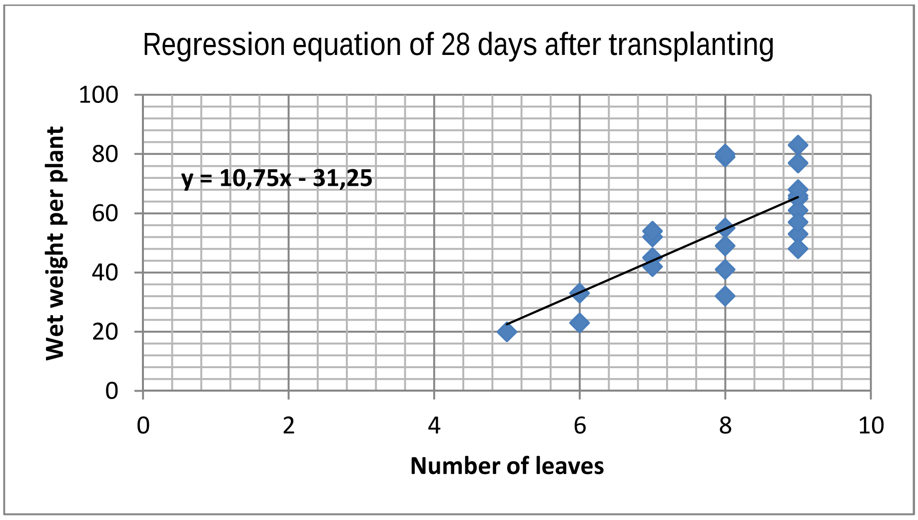

Figure 3: Variable Relationship between Number of Leaves and Wet Weight per Plant at Age Observation of 28 Days After Transplanting.

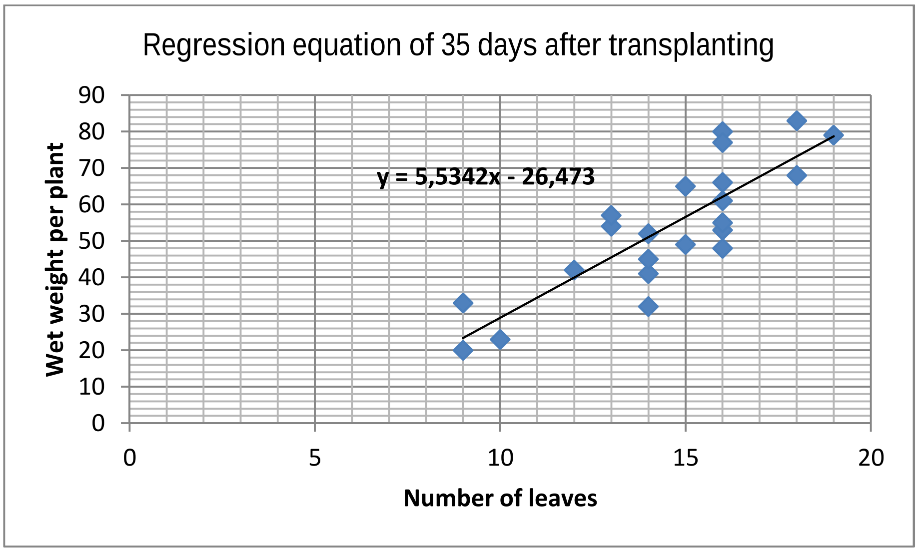

Figure 4: Variable Relationship between Number of Leaves and Wet Weight per Plant at Age Observations 35 Days After Transplanting.

According to Gardner et.*al* (1991) stated that the number of leaves has an effect on the results of photosynthesis, where the leaves allow the maximum light to be captured to meet the needs of the photosynthetic process, because the leaves contain chlorophyll and several other pigments. The process of photosynthesis as a producer of carbohydrates which has an important role in the growth and formation of plant biomass.

Cellulolytic microbes contained in the process of making POC are microbes that produce

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cellulose enzymes which will accelerate the process of decaying organic matter. Phosphate solubilizing microbes are microbes that function to help dissolve P elements in phosphate fertilizers (TSP, SP-36, SP-18) and P elements that are bound to soil silicate clay so that they become phosphate compounds available and easily absorbed by plants (Wahyudi, 2011) .

Concentration of giving POC.

The statistical results of multiple regression analysis of each concentration of POC (K), plant length and number of leaves on wet weight per plant at the end of 35 days after transplanting showed that there was a significant effect (5.49E-05 <0.05) with an Adjusted R Square value of 0.653043 (65.30%). However, in the regression test the treatment factor K1 (POC concentration 4%) showed insignificant effect (0.368032> 0.05) with an Adjusted R Square value of 0.208823 (20.88%). The treatment factor K2 (POC concentration 8%) shows a significant effect (0.020077097 <0.05) with an Adjusted R Square value of 0.706472, meaning 70.65%. Furthermore, the K3 treatment (POC concentration 12%) also showed a significant effect (0.009783 <0.05) with an Adjusted R Square value of 0.935293, meaning that it was 93.53% due to the influence of the variable POC concentration, plant length and amount. leaves, while 6.47% was caused by other factors.

Based on the data above, the K3 treatment, namely the POC concentration of 12%, showed better growth and yields than the other two treatments, namely K1 and K2, although the effect of K3 was not significantly different from the K2 treatment (POC concentration 8%).

According to Simanungkalit, *et al*. (2006), that a number of nutrient-providing bacteria have a dual role in addition to blocking $N_{2,}$ also producing growth hormones (such as IAA, gibberellin, cytokinins, ethylene, and others); also other microbial groups such as mycorrhizal fungi also have a multifunctional role, where these fungi can increase nutrient uptake, increase plant resistance to soil-borne diseases, increase plant tolerance to drought, stabilize soil aggregates and so on, and are based on research results which there is a role as nutrient provider more prominent than other roles.

4. CONCLUSION

Based on the research results, it can be concluded as follows:

1. There is a significant effect on plant length variables on wet weight per plant with R Square of 0.69884 (69.88%) at 28 days of age observation and the number of leaves with R Square of 0.7025 (70.25%) at 35 days after transplanting.
2. There was a significant effect of the K3 treatment (POC 12%), plant length and number of

leaves on the wet weight per plant which gave a higher value than the K1 and K2 treatments with Adjusted R Square of 0.935293 (93.53%); but statistically not significant difference with treatment K2 (POC 8%) with Adjusted R Square of 0.706472 (70.65%).

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