

Organic Fertilizer Application of Shrimp Pond Waste Sediment For Growth And Productivity (Lactuca Sativa Crispa L)

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ABSTRACT

Curly lettuce is one of the types of vegetables favoured by the community, but lately, organic vegetables are more in demand. One effort to get organic vegetables by using organic fertilizer during the planting period. Organic fertilizers come from nature, one of which is shrimp pond sediment whose utilization is not optimal. This study aims to determine the effect of shrimp pond sediment organic fertilizer application for growth and productivity of curly lettuce (Lactuca sativa crispa L). The study was conducted for 40 days, this type of research experiments using a Completely Randomized Design (CRD) with four treatments and one control and six replications. The parameters used include plant height and wet weight of curly lettuce plants. The main data is tabulated and analyzed using the SPSS 16.0 application, which includes the Multivariate Analysis of Variance (MANOVA). It was concluded that the organic fertilizer of shrimp pond sediment variation P1 (the composition of 100% shrimp pond sediment) provided the most optimal effect on the growth and productivity of curly lettuce (Lactuca sativa crispa L). Brochure validation results indicate that the brochure is very suitable to be used as a source of information about pond organic sediment fertilizer.

Keywords: curly lettuce, growth and productivity, shrimp pond sediment

INTRODUCTION

Lettuce is one of the quite popular vegetables among the public, although it is not a native plant from Indonesia. Lettuce plant was historically from Europe and Asia. Lettuce is also one of the fresh vegetables which often found in people's daily lives, even the number of lettuce enthusiasts are quite high, but unfortunately, most of the lettuce found in the community is non-organic lettuce.

The good lettuce plants to consume are plants that are raised naturally. To produce good lettuce and safe to consume can be undertaken by noticing the fertilizer used during the planting period. Fertilizer is the nutrient source that will be absorbed by the plants. Nutritional requirements that must be fulfilled by curly lettuce during growth period are N 70-250 ppm, P 15-80 ppm, K 150-400 ppm, Ca 70-200 ppm, Fe 0.8-6 ppm, Zn 0.1-0, 5 pp (Sutiyoso, 2003). The organic fertilizer, as one of the fertilizers, used publicly can be applied to maintain the quality of plants safely from the accumulation of hazardous substances. It can also be implemented to improve soil structure, to increase the plant production from subsequent lettuce plants as well.

Fulfilling the needs of organic vegetables can actually be made by the community itself, namely by utilizing organic materials available in the environment. One of them is the shrimp pond sediments found in the Pasir Sakti village, East Lampung, Indonesia. The shrimp pond sediment has quite high organic content, and it is a potential substance of organic fertilizer. Through the utilization of the organic material found in the surrounding environment as shrimp pond sediments, it will be able to meet the needs of organic vegetables

where one of them is a curly lettuce plant. The content existed in shrimp pond sediments will greatly help the growth of the lettuce, among them are clay shrimp pond sediment with organic carbon content (C) $1.45\% \pm 0.44\%$, Nitrogen (N) $0.11 \pm 0.03\%$, the ratio C / N 13 and phosphorus (P) 59 ppm (Riyanto et al., 2012). "Super intensive shrimp pond sediment solid waste has high nutrient content such as N total 0.67%, P₂O₅ 4.78%, K₂O 1%, C-organic 17.84%, pH 6.25 and content water 15.60% " (Suwoyo, 2016).

The results of a study conducted by (Sutanto et al., 2020), indicated that the shrimp pond sediment waste has a Nitrogen content of 0.83%; thus it indicates that the shrimp pond sediment deserves to be organic fertilizer.

So that, using the shrimp pond sediment as organic fertilizer to plant the lettuce can be expected as fulfilling the nutritional requirements of curly lettuce to grow and increase its productivity. The shrimp pond sediment is also useful to help the soil in improving its fertility. (Sutanto et al., 2016) states that organic fertilizer can significantly influence the growth of pineapple and orchids.

METHOD

It is an experimental study. It is focused to determine the effect of the composition variation of the organic fertilizer sediment in shrimp ponds to the productivity level of curly lettuce (*Lactuca sativa*). This study uses a Completely Randomized Design (CRD) with one control and four treatment combinations and repeated six times.

P0 = Without applying fertilizer

P1 = 100% of shrimp pond sediment

P2 = 50% of shrimp pond sediment +
25% of leaf litter + 25% of
husk charcoal

P3 = 50% of shrimp pond sediment +
12.5% of leaf waste + 37.5% of
husk charcoal

P4 = 50% of shrimp pond sediment +
37.5% of leaf waste + 12.5 of husks

The analysis used to determine whether there is an influence of organic fertilizer application of shrimp pond sediment to grow and increase the curly lettuce productivity is Multivariate Analysis of Variance (MANOVA). However, it previously underwent the prerequisite tests, namely Normality and Homogeneity Variance Tests.

The final result of this study is also in the form of brochure production, which is used to undergo the socialization of applying the formula to the public—the feasibility test of the brochure measured by a questionnaire given to the professional designers and material experts.

Outcome. The resulted study of the organic fertilizer application of shrimp pond sediments to grow and increase the productivity of curly lettuce (*Lactuca sativa crispa* L) was observed by two aspects; the height of the curly lettuce plant, and the wet weight of the curly lettuce plant. The result of this study is obtained by implementing a statistical test, to measure the plant height and the wet weight of the plants, it used the parametric test, namely the Multivariate Analysis of Variance (MANOVA) test.

Height Of The Curly Lettuce Plants. The statistical analysis showed that administering the shrimp pond organic fertilizer to the curly lettuce plants have influenced the height of the curly lettuce (*Lactuca sativa*). It can be seen in Figure 1. Nugroho (2017: 604), he states that the standard height of lettuce is 15.25 cm per crop.

Wet Weight of the Curly Lettuce Plants. The statistical analysis result showed that the organic fertilizer application of shrimp pond sediment influences the wet weight of the curly lettuce plants (*Lactuca sativa*). It can be seen in Figure 2. Nugroho (2017: 604) states that the standard weight of lettuce is 6.42 grams of the crop.

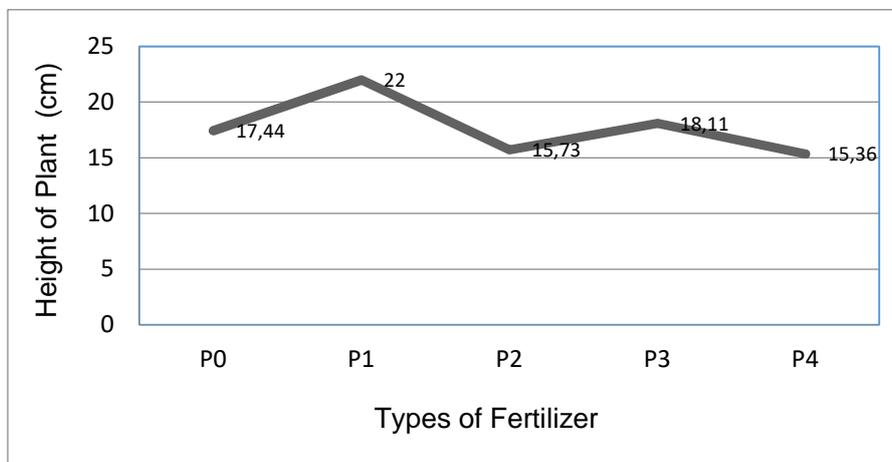


Figure 1. The Height Rate Differences of The Curly Lettuce Plants

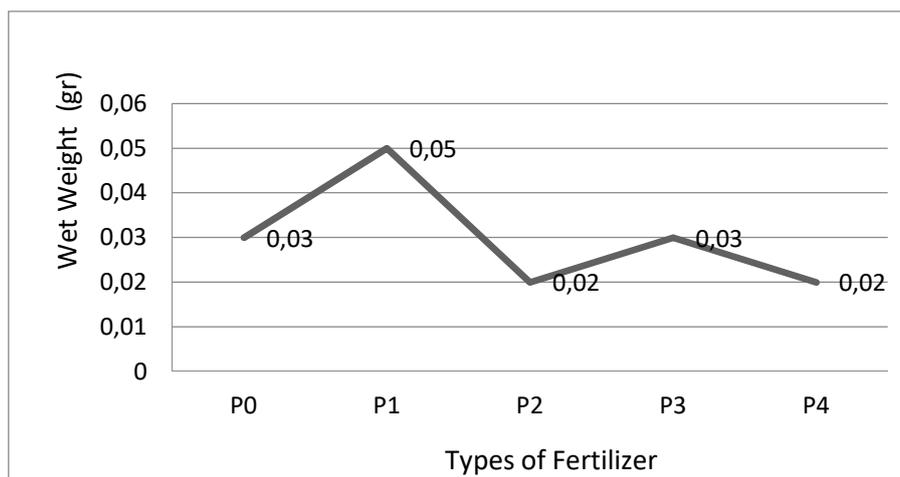


Figure 2. The Wet Weight Differences of The Curly Lettuce Plants.

Analysis Results of Testing the Effect. Based on the Multivariate Tests output obtained that sig. 0.001 < α 0.05, thus H_0 is rejected. It means that there is a difference between the growth (Y1) and the productivity (Y2) of the organic fertilizer sediment shrimp ponds of P0, P1, P2, P3, and P4. Based on the output Tests of Between-Subjects Effects of the relationship between the type of fertilizer with the growth (high) has a significant level of $0,000 < 0.05$. It indicates that there are differences in growths caused by the differences in fertilizer types. The relationship between the type of fertilizer with productivity (wet weight) has a significant level of $0,000 < 0.05$. It indicates that there are differences in growth caused by differences in fertilizer types.

DISCUSSION

The Effect of Shrimp Pond Sediment Fertilizer Application. The growth of the curly lettuce plants are observed through the height increases of the plants, and the productivity of the curly lettuce plants are observed through the wet weight seen at the end of the harvest. Based on the results of the Multivariate Analysis

of Variance (MANOVA), a parametric hypothesis test; the first hypothesis is accepted when the influence of the application of shrimp pond sediment organic fertilizer to the growth and the productivity of curly lettuce plants proved. It is accepted as the Multivariate test table obtained sig values. $0.001 < \text{of } 0.05$, thus H_0 is rejected. It means that there is a difference in growth (Y1) and productivity (Y2) among P0, P1, P2, P3, and P4.

The growth and the productivity of the plants are influenced by two main factors, and they are internal and external factors. The internal factors include genes and hormones, while the external factors include the environmental conditions to grow the plants. The success of the plants' growth is closely related to the environmental conditions where the plants grow. So, the optimal environmental conditions are needed to support the growth and the enhancement of the plants.

The external/environmental factors affect the growth of the plants are temperature, climate, light and nutrient availabilities. Rina (2015) states that plants are not only controlled by internal factors but also determined by the external factors. One of the external factors is essential nutrients. The essential nutrients are the elements needed for the plant growths.

Some nutrients that are needed for plants are Nitrogen (N), Phosphorus (P), Potassium (K). Each of these elements has a different role in the plant's growth. One of the very influential external factors is the availability of nutrients in the growing media. The nutrient content in planting media is N, P, K, and other organic materials can also accelerate the metabolism or vice versa, and it can slow down the metabolism in the plant bodies.

The implementation of the shrimp pond sediment as the organic fertilizer is able to influence the growth and the productivity of the curly lettuce plants due to the degradation of the shrimp ponds by indigenous bacteria. As a study conducted by (Sutanto et al., 2016) showed that LCN organic fertilizer is able to significantly influence the growth of pineapples and orchids. The pineapple waste indigenous bacteria may neutralize the pH; they are *Bacillus cereus*, *Acinobacter baumannii*, *Bacillus subtilis* and *Pseudomonas pseudomallei*. These indigenous bacteria are able to neutralize the pH and potential to decompose (Wagiman & Sutanto, 2018).

As it was said by Agustina (2004: 15) that the nutritional status of plants that effect plant growths and yields are in the deficiency zone, deficient zone, or poisoning zone (excess). Utilizing shrimp pond sediment as organic fertilizer in lettuce planting media is one of the ways to create environmental conditions may support growth and productivity. The content of N, P, K in shrimp pond sediments serves the acceleration of height and weight increasing processes in lettuce, Millya (2007) states that nitrogen contains important compounds such as chlorophyll, nucleic acids, and enzymes. Therefore nitrogen is needed to form sprouts and to develop stems and leaves.

Furthermore, (Wijiyanti et al., 2019) asserted that the availability of sufficient nutrients would help the enhancement of the plant growth like the height increase and the leaf formation, so that, it affects the wet weight of the plant. The fulfilment of nutrient needs in plants will help accelerate a plant growing process, especially during the vegetative formation of tutas and the development of stems and leaves.

Shrimp Pond Sediment Organic Fertilizer Composition. Utilizing the shrimp pond sediment organic fertilizer influences the height of the curly lettuce plants. The organic fertilizer application is mixed with the growing media in a different composition. The given comparisons are in P0, P1, P2, P3 and P4. The optimal results obtained are in P1 (100% composition of shrimp pond sediment) with an average height measurement of 22.00 cm. The average yields of the plant height by using the organic fertilizer sediment shrimp ponds is higher than the height of curly lettuce in general that is 15.25 cm, then the second hypothesis for lettuce height is accepted, namely, the composition of organic fertilizer for a little shrimp pond in P1 has given an optimal effect on lettuce growth (*Lactuca sativacrispa* L).

Applying shrimp pond sediment greatly affects the growth of lettuce plant, it is caused by the high content of nutrients N, P, and K. The each content of these nutrients has different functions in influencing the acceleration of the plant growth. As Nitrogen and Pospor elements, Mukhlis (2017) states that the presence of N (Nitrogen) elements in collaboration with the P (phosphor) element may influence the growth of curly lettuce plants, nitrogen has the main function as a synthesis material for chlorophyll, protein, and amino acids, so these amino acids are needed in large amounts during the vegetative period.

According to (Sari et al., 2017) that cell division process will proceed quickly with the availability of sufficient in N elements. The element of N has the main function to stimulate the overall growth, and specifically, the stem growth enables to stimulate plant height growth.

The Nitrogen element helps the photosynthesis process. The results of the photosynthesis process will be transplanted throughout all parts of the plant body. However, nitrogen can not work itself, and it needs assistance from Potassium to meet one of the basic ingredients of photosynthesis, it is carbon dioxide. Potassium has the ability to absorb carbon dioxide in the surrounding environment. Setiawan (2016: 67) stated that potassium element increases the absorption of carbon dioxide, transfer sugar to form starches and proteins; it also helps the mechanism of opening and closing stomata.

(Fahmi et al., 2010) stated that nitrogen and phosphorus nutrients are the essential nutrients needed by the plants when they are deficient in nutrients, their growth will be stunted, and plants become stunted. So, the fulfilment of nutrient is needed by the plant with adequate sunlight to make photosynthesis process goes well. Photosynthesis may optimally produce optimal photosynthetic as well so that the impact on the growth of curly lettuce plants resulted in the plant height increase.

Shrimp Pond Sediment Organic Fertilizer Composition Outcomes. Utilizing the shrimp pond sediment organic fertilizer has influenced the wet weight of curly lettuce plants. The given organic fertilizer is mixed with the planting media by using different composition. Comparisons are P0, P1, P2, P3 and P4. The optimal results obtained are in P1 (100% composition of shrimp pond sediment) with the highest wet weight measurement of 0.05 kg, the results of lettuce weight measurement by administering organic fertilizer of shrimp pond sediment are lower than the standard lettuce weight in general which is 6.25 g thus the third hypothesis for lettuce plant height has not been accepted, namely the composition of organic fertilizer sediment shrimp pond P1 has not yet had an optimal influence on the productivity of lettuce (*Lactuca sativacrispa* L).

The wet weight of a plant is influenced by the availability of sufficient nutrients which help the enhancement of the plant height growth and leaf formation. (Harjadi et al., 2007), the availability of nutrients plays an important role in influencing the wet weight of a plant. It has occurred since enough nutrient plants will process their photosynthesis well, and they will produce good photosynthate too so that growth will increase and the wet weight also enhance.

(Noviansyah & Chalimah, 2015) asserted the weight of a plant is basically influenced by plant height and the number of leaves undergoes photosynthesis, the more number of leaves have, the more photosynthesis process will go well. The high process of photosynthesis will produce greater energy for plant growth and its development. The wet weight of a crop can also be used as an indicator of the growth as the wet weight indicates the yield of the plant obtained from the total growth and the development of the plant during its lifetime.

CONCLUSION

Shrimp pond sediment organic fertilizer outcomes significant effect on the growth and the productivity of the curly lettuce plants. The organic fertilizer compositions of shrimp pond sediment mostly may optimize the growth, and the productivity of curly lettuce plant is P1 fertilizer, which is the composition of 100% shrimp pond sediment.

SUGGESTION

Based on the results of the study, the authors find several suggestions to further researchers to applying the organic fertilizer sediment shrimp ponds on other plants, it is recommended for plants that have yielded such as chillies / tomatoes.

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