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The effect of organic fertilizers and inorganic fertilizer on mustard growth in Bahway village, Balik Bukit district, West Lampung regency

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Abstract. Soil fertility is the relationship between the physical, chemical and biological properties needed by plants to grow and develop. The land used as a medium for growing mustard greens is taken from Bahway Village. The soil is treated with organic and inorganic fertilizers to test its fertility. The data analysis used was one way ANOVA and the least significant difference test and a randomized block design with three treatments and two replications. The treatments were: P1=100% organic fertilizer, P2= 100% inorganic fertilizer, P3= 50% organic fertilizer + 50% inorganic fertilizer and control. Based on the research results, it is known that the type of soil texture in P1 and P2 has a clay-sand texture, while P3 and C have a sandy loam texture. In terms of chemical properties, the pH at P1, P2, P3 and C are 5.53, 5.79, 5.50 and 6.20. For available P values, P1 = 188.31 ppm, P2 = 7.44 ppm, P3 = 113.62 ppm, and C = 2.48. Availability of Cation Exchange Capacity P1 = 22.56me/100g, P2 = 21.80me /100g, P3 = 23.19me/100g, and C = 23.75me/100g. From these results, what showed that the growth of mustard plants increased was the P3 treatment.

Keywords: fertilizer, mustard plant, soil characteristics

1. Introduction

The Soil is a growing medium, besides soil also provides water, air, and nutrients needed by living things. If the land is considered well and the balance between harvesting and maintenance of the land is appropriate, then the desire for agricultural business will be realized. Soil fertility is the relationship between the physical, chemical and biological properties that plants need to grow and develop. The characteristics of the soil profile and soil properties can be seen from its physical, chemical and biological characteristics. Soil physics is a branch of soil science, which studies the physical properties of soil, physical measurements of soil and physical processes that occur in the soil. As for the physical properties of the soil, namely texture, structure, soil color, and others [1]. Soil chemical properties, including soil pH, organic matter content, nitrogen content, etc. [2] Meanwhile, soil biological characteristics, including microorganisms and organic matter [3]. One of the land used is in Bahway Village, Balik Bukit District, West Lampung Regency, because West Lampung Regency is divided into three units, namely lowland areas with an altitude of 0-600 meters above sea level, hilly plains with an altitude of 600-1000 meters above sea level, and highlands with an altitude of 1000-2000 meters above sea level [4], making it suitable for use as agricultural land. This is evident from the results of a



preliminary study conducted by researchers through interviews with 20 farmers in Bahway Village and Village Officials, it was found that 60% of farmers only rely on agricultural products without any other income, this is based on documentation data in the village that the livelihoods of the villagers, namely 60% farmers, 20% laborers, 9% self-employed, 9% traders, 1% civil servants, and 1% TNI / POLRI [5]. Agriculture is an activity that utilizes natural resources by managing land, namely through the use of land it can produce food, feed, clothing, shelter and bio-energy that can support human life, one of which is mustard plants. The mustard plant is one type of vegetable that is very popular in Indonesia. This mustard plant contains many nutrients, so it is good for the health of the body. The mustard plant is a plant that is very easy to plant, both in the lowlands and the highlands. However, mustard greens are more suitable for planting in uplands with an altitude of 5-1200 meters above sea level (masl) [6]. To increase mustard production, farmers apply large amounts of chemical fertilizers and relatively small amounts of organic fertilizers, which in turn can affect soil health as well as humans [7].

There are two types of fertilizers that are often sold in the market, namely inorganic fertilizers and organic fertilizers. Inorganic fertilizers are fertilizers as a result of chemical, physical and or biological engineering processes and are industrial products or fertilizer manufacturing plants (chemical fertilizers). Meanwhile, organic fertilizers are fertilizers which mostly or entirely consist of organic material derived from plants and/or animals which have gone through an engineering process, which can be formed as solid or liquid which is used to supply organic matter and improve the physical, chemical and biological properties of the soil. The application of organic fertilizers can improve soil structure, increase soil absorption material for water, improve living conditions in the soil, and as a source of nutrients for plants. While the application of inorganic fertilizers can stimulate overall growth, especially branches, stems, leaves, and plays an important role in the formation of green leaves [8]. The application of chemical fertilizers alone can only contribute one or several nutrients to plants. On the other hand, giving organic input can only improve the physical properties and biological environment but the nutrient content is low [9]. Fertilization aims to replace lost nutrients and increase the nutrient supply needed by plants to increase crop production and quality. The availability of complete and balanced nutrients that can be absorbed by plants is a factor that determines plant growth and production [10]. Therefore, integrated nutrient management between organic and chemical fertilizers is an important requirement today for increasing crop productivity [11]. The main objective of integrated nutrient management is to cultivate land in such a way that the soil can be sustainable with maximum crop production and quality [12].

The parameters observed from the growth of these mustard plants were plant height, number of leaves, and leaf color. Apart from the nutritional content of mustard greens which is very good for the health of the body, another reason for the researchers taking the mustard plant as the object of research is because the green mustard plant in the Bahway area has a low selling value, lack of consumer interest, so this research can produce mustard plants that have high quality. better. In addition, plants were given 3 treatments and 1 without treatment.

2. Research Method

This research was conducted through 2 stages, the field stage (research in the field) and the Laboratory stage (conducted in the Laboratory). At the field stage, a green mustard plant was planted in Bahway Village, Balik Bukit District, West Lampung Regency, harvested at the age of 30 days. Harvesting was done manually by taking directly from the polybag experiment. Moreover, the Laboratory stage was carried out at the Soil Science Laboratory, Faculty of Agriculture, University of Lampung. This study was designed using a randomized block design (RBD) consisting of 3 treatments. These treatments are P1 = 100% (organic fertilizer), P2 = 100% inorganic fertilizer, and P3 = 50% organic fertilizer + 50% inorganic fertilizer.

Each treatment was repeated twice so that six experimental pots were obtained. A randomized block design (RBD) is a randomized design that is carried out by experimental grouping units into homogeneous groups and then determining the random treatment in each group. Soil sampling was carried out in each treatment in the experimental polybag. After taking soil samples in the field, the

samples were then analyzed in the Laboratory to determine the physical and chemical content of the soil contained in the polybags. The parameters observed in mustard greens were plant height, number of leaves, and leaf color. Whereas in the physical and chemical properties of soil, the data collection was carried out after the mustard greens were harvested. In this study, it was using non-test research instrument types, namely observation and documentation. In this study, using one-way ANOVA analysis and the least significant difference test (LSD).

3. Results and Discussion

This study was designed using a randomized block design (RBD) with three plants were given treatments and one without treatment. In research activities, the data collection process was carried out once every seven days after the seeding period, i.e., after eight days of seeding until the harvest period at the age of 30 days after planting. The following is data from research that has been carried out including soil chemistry, soil texture, plant height, number of leaves, leaf color. In soil chemistry, what was seen is pH, phosphorus content (P_2O_5 -ters) and cation exchange capacity (CEC), where the results can be seen in table 1:

Table 1. Soil Chemical Samples

Sample	Treatment			
	P1	P2	P3	C
pH	5.53	5.79	5.50	6.20
P_2O_5 -ters	188.31	7.44	113.62	2.48
CEC	22.56	21.80	23.19	23.75

The optimal soil pH for mustard greens is pH 5.5 to pH 6.5 [13]. Soil chemical characteristics of available P was higher in treatment P1 so that when viewed from the P-available nutrients from the highest to the lowest were P1, P3, P2, and C. Giving organic and inorganic fertilizers to mustard plants is one way of effort carried out to meet nutrients during plant growth. Both types of fertilizers have their respective advantages and disadvantages. The advantage of organic fertilizers is that they can provide plant nutrients and can improve soil physical, chemical, and biological properties [14,15].

Moreover, there is a lack of organic fertilizers which have a slow effect, and they must be used a lot. Meanwhile, the advantages of inorganic fertilizers are that the nutrient content is made appropriately, its distribution is practical, can be adjusted according to need, and saves time [16]. The drawbacks of this inorganic fertilizer are macro and micro nutrients in several separate products, easily wasted or carried away by water, easily evaporates at high temperatures and can cause damage to the soil structure if high accumulation and cause poisoning in plants [17], this was proven by the use excessive input of pesticides and fertilizers in intensive agriculture has an impact on environmental damage, namely degradation of productivity and soil fertility, as well as pollution of rivers/lakes/reservoirs/groundwater which at a certain level can endanger human health [18,19]. Based on the theory that applying liquid fertilizer to the leaves will be better than applying fertilizer to the soil [20]. However, in this study, in treatment P1 the amount of P-available was more than in treatment P3 or P2. This can be influenced by hot weather resulting in evaporation so that the nutrients given are lost and are not fully absorbed by the plants.

In soil physics, what is seen is the texture of the soil, where to determine the texture of the soil, there are 3 components of the soil fraction that affect it, those are sand, dust and clay (Table 2). On the physical characteristics of the soil when viewed using the USDA soil texture class triangle diagram, it is obtained a sandy loam textured soil [21], because based on the relative proportion (%) ratio between the fraction of sand with a diameter of 2.00 - 0.20 mm or 2000 - 200 μ m (approx. 40–87.5%), dust (silt) with a diameter of 0.20 - 0.002 mm or 200 - 2 μ m (approx. < 50%) and clay (clay) measuring <2 μ m (approx. < 20%) [21]. Based on research that has been done, the texture of sandy soil is a limiting factor for plant growth, so that it has the ability to hold water very low and drainage is excessive, so the availability of water and fertilizers used in plants is very low so it is necessary to improve the physical and chemical

properties of the soil properly [22]. This also affects the soil structure and soil color, where the soil is said to be fertile if it has a soil structure with an aggregate or ped structure, while the soil color has good fertility if the color is blackish brown. This is evident from the triangular soil diagram, that P1 and P2 have the texture of clay sand, while P3 and Control have the texture of sandy clay. The soil texture is describe in table 2 below:

Table 2. Soil Texture

Texture	Treatment			
	P1	P2	P3	C
Sand	77.12	77.12	73.12	69.12
Silty	14.00	16.00	20.00	22.00
Clay	8.88	6.88	6.88	8.88
Land Triangle	clay sand	clay sand	sandy clay	sandy clay

To see plant height, number of leaves, and leaf color can be seen from the One-Way Analysis of Variance (ANOVA) with a significant level of 0.05% and the Least Significant Difference(LSD) test. This test was conducted to see the influence of the treatment on the growth of mustard plants. In the ANOVA test for plant height, from the calculation of the analysis test that has been carried out, it was obtained $F_{\text{count}} (287.528) > F_{\text{table}} (6.59)$, so that if we look at the testing criteria $F_{\text{count}} > F_{\text{table}}$, then H_0 is rejected, meaning that there is an influence between the four treatment groups on plant height growth. mustard greens. In the ANOVA test for the number of leaves, from the calculation of the analysis test that has been carried out, it is obtained $F_{\text{count}} (61.19) > F_{\text{table}} (6.59)$, so that if we look at the testing criteria $F_{\text{count}} > F_{\text{table}}$, then H_0 is rejected, meaning that there is an influence between the four treatment groups on the number of strands mustard leaves. In the ANOVA test for leaf color, the analysis test that has been carried out is obtained $F_{\text{count}} (108.4706) > F_{\text{table}} (6.59)$, so that if we look at the testing criteria $F_{\text{count}} > F_{\text{table}}$, then H_0 is rejected, meaning that there is an influence between the four treatment groups on the color of mustard leaves.

In this study, to see which treatment had a statistically different effect on plant growth, number of leaves and leaf color, the least significant difference (LSD) test was carried out, and the results can be seen in Table 3 below:

Table 3. LSD Test for Plant Height

Treatment	Average Value	Notation
P1	12.85	B
P2	10.765	A
P3	16.4	C
C	6.825	A

Table 3 shows that P3 (16.4) has a very big influence on the growth of mustard greens, P3 is denoted c, as well as treatment P1 (12.85) which is denoted b. Whereas in P2 (10.765) and without treatment (C) (6.825) have the same notation, namely a. This means that statistically P2 and C do not have a significant effect on the growth of mustard greens. The LSD test results for the number of leaves are shown in table 4:

Table 4. LSD test for the number of leaves

Treatment	Average Value	Notation
P1	5	B
P2	5	b
P3	6	c
C	4	a

Based on table 4 that P1 (5) and P2 (5) have the same notation, namely b, so that the treatment of P1 and P2 does not have a big effect. Another case in treatment P3 (6) which is denoted as c, and C (4) which is denoted as a, have different notations, so that P3 and C have a significant effect on each treatment, especially in treatment P3 which shows a very large effect compared with other treatments. The LSD test results for the leaf color are shown in table below:

Tabel 5. LSD Test for Leaf Color

Treatment	Average Value	Notation
P1	5	b
P2	5	b
P3	6	c
C	4	a

From table 5, it shows that without treatment C has a notation (4), while in treatment P1 (b) and P2 (b) have the same notation, so that treatment P1 (5) and P2 (5) statistically does not really have a significant effect. very large. Whereas in P3 (c) it has a different notation from the other treatments. So that P3 (6) is a treatment that greatly influences the change in leaf color on the growth of mustard greens.

Growth of plants that can be said to be optimal growth is by looking at the height of the stem, the number of leaf blades and leaf color found in mustard plants. Leaves are needed as an indicator of plant growth. Because the leaf has a function as a light receiver and photosynthesis tool. Besides, the presence of nutrients that meet will affect plant growth. This is supported by Dwidjoseputro's opinion that plant growth is strongly influenced by nutrients in the soil where the plant grows. Sufficient nutrients will support plant growth properly, so that it can support plants to carry out photosynthesis and produce lots of carbohydrates [23], this is evident from the research of Lilik Tri Indriyati that the results of the treatment of organic and inorganic fertilizers significantly increased plant growth compared to control, but not significantly different compared to standard NPK treatment. Combination treatment of organic fertilizers with an equivalent dose of 4 tons ha⁻¹ and 50% of standard NPK fertilizer showed the highest diameter and yield of broccoli. A single treatment of organic fertilizers with a dose equivalent to 4 tonnes ha⁻¹ showed growth and yield of broccoli that were equivalent to standard NPK treatment [24]. So, based on the explanation above, it is concluded that the results of the treatment of organic and inorganic fertilizers significantly increased the growth of mustard plants.

4. Conclusions

Based on the research results, it can be concluded that the application of organic and inorganic fertilizers affects the growth of mustard greens. The best effect was on P3 treatment using organic 50% + 50% inorganic fertilizers. Treatment P3 has a sandy clay texture which is very influential for the growth process because it provides nutrients and has good drainage and aeration. The fertile soil structure can be seen from the dark brown soil color because it contains many nutrients and organic matter. Meanwhile, the chemical characteristics of the soil, the amount of P-available is more in the P1 treatment. Factors that influence the growth of mustard greens are plant height, number of leaf blades, and leaf color.

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