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Effect of NPK fertilizer on the growth and yield of eggplant (Solanum melongona) in Yellow Red Podzolic Soil

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ABSTRACT

The eggplant plant (Solanum melongena) is a type of annual vegetable. The need for eggplant is increasing over time along with the increase in human population. SOne of the efforts needed to increase eggplant productivity is an intensification program in the form of regulating the composition of planting media and appropriate fertilization. One type of fertilizer that can be used is NPK compound fertilizer. The aim of this research is to determine the effect of NPK fertilizer on the growth and yield of eggplant plants and to find the dose that can have the best effect on the growth and yield of eggplant plants. This research was conducted on Jalan Keling Kumang, Sekadau district, West Kalimantan. This research design used a Completely Randomized Design (CRD) with one treatment factor, namely the dose of NPK fertilizer with 4 treatment levels and each treatment consisted of 5 replications. The NPK fertilizer dose treatment is, p1: 5 gram dose, p2: 10 gram dose, p3: 15 gram dose, p4: 20 gram dose. The observation variables in this research are plant height (cm), number of leaves (strands), number of fruit and fruit weight (grams). The results showed that the dose of NPK fertilizer had a significant effect on plant height and number of fruit, while the number of leaves and weight of eggplant fruit showed no significant effect.

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1. INTRODUCTION

The eggplant plant (Solanum melongena) is a type of annual vegetable. There are many varieties of eggplant cultivated in Indonesia, ranging from local eggplant such as gelatik eggplant, kopek eggplant, Bogor eggplant, Medan eggplant to imported eggplant such as Japanese eggplant. The shape and color of eggplant fruit itself is quite varied, from white, green to purple. The shapes are round, large oval, or oval with sharp edges (Putri, 2016). Likewise, the texture is hard and not hard. The need for eggplant is increasing over time along with the increase in human population. According to the West Kalimantan Central Statistics Agency (2021), eggplant production in 2020 was recorded at 5420.1 tons with a land area of 1,687 ha.

Meanwhile, Indonesia's eggplant production in 2020 was 182,546 tons with a land area of 45,929 ha, which means eggplant production in West Kalimantan is still very low. One of the efforts needed to increase eggplant productivity is an intensification program in the form of regulating the composition of planting media and appropriate fertilization. To be able to grow plants need a

planting medium as a place for roots to grow and develop, as well as a place for the plants to stand (Wuryaningsih, 2008). Eggplant plants require sufficient nutrients for growth, increasing nutrients can be done by providing organic fertilizer and inorganic fertilizer (Waskito et al., 2018). Efforts to increase eggplant productivity by providing organic fertilizer have not been satisfactory. Therefore, there is a need for additional inorganic fertilizers to overcome nutrient deficiencies and be able to provide them effectivelyfast.

Balanced fertilization between organic fertilizer and inorganic fertilizer can be an effort that can increase the growth and yield of eggplant plants. One type of fertilizer that can be used is NPK compound fertilizer (16:16:16). The appropriate use of NPK fertilizer can have a positive impact on plant productivity (Hakim & Saragih, 2019). Correctly applied NPK fertilizer can also make a positive contribution to soil quality (Dariah et al., 2015). The aim of this research is to determine the effect of NPK fertilizer on the growth and yield of eggplant plants and to find the dose that can have the best effect on the growth and yield of eggplant plants.

2. METHOD

This research was conducted on Jalan Keling Kumang, Sekadau district, West Kalimantan. This research was conducted from 18 April to 24 June 2024. The materials used in this research were eggplant seeds, PMK (Red and Yellow Podzolic) soil, NPK fertilizer, manure, plastic. The tools used were a hoe, gembor, analytical scales, camera, ruler and writing utensils. This research design used a Completely Randomized Design (CRD) (Shieh & Jan, 2004) with one treatment factor, namely the dose of NPK fertilizer with 4 treatment levels and each treatment consisted of 5 replications. The NPK fertilizer dose treatment is, p1: 5 gram dose, p2: 10 gram dose, p3: 15 gram dose, p4: 20 gram dose. The observation variables in this research are plant height (cm), number of leaves (strands), number of fruit and fruit weight (grams). Statistical analysis was carried out on observed variables using analysis of diversity (ANOVA). If the calculated F shows a real effect of each treatment, then proceed with an honest significant difference test at the 5% level.

3. RESULTS AND DISCUSSION

Eggplant plant growth and production variables consist of plant height, number of leaves, number of fruit and fruit weight. The results of the diversity analysis showed that the application of NPK fertilizer had no significant effect on the height of eggplant plants at 1 WAP, however, it had a significant effect at 2 WAP, 3 WAP and 4 WAP. The differences between treatments of N, P, K fertilizer on plant height variables aged 2 WAP, 3 WAP and 4 WAP can be seen in table 1.

Table 1. BNJ Test Variable Observation of Plant Height 2 WAP, 3 WAP, and 4 WAP on Eggplant Plants

	Plant height		
NPK Fertilizer Dosage	2 WAP	3 WAP	4 WAP
5 g/plant	3.7 ab	5.7 b	9.8 b
10 g/plant	4.2 ab	6.4 ab	11.3 ab
15 g/plant	3.3 b	5.6b	8.9 b
20 g/plant	5.0 a	9 a	15.38 a
BNJ 5%	1.31	2.63	5.48

Noted: Numbers followed by the same letter in one column have no significant effect at the 5% BNJ test level

Based on the BNJ test results in Table 1, it shows that the height of plants aged 2 WAP, given 20 g/plant of NPK fertilizer was significantly different from the plant height of 15 g/plant, but was not significantly different from 5 g/plant and 10 g/plant of NPK fertilizer. The variable height of eggplant plants aged 3 WAP and 4 WAP when giving 20 g/plant of NPK fertilizer was significantly different from giving 5 g/plant and 15 g/plant of NPK fertilizer but not significantly different from 10 g/plant of NPK fertilizer. Based on observations of the growth and yield parameters of eggplant plants consisting of plant height, number of leaves, number of fruit and fruit weight when administering doses of NPK fertilizer. The plant height variable at 1 WAP had no significant effect, this was because the growth of the eggplant plants in the first week did not show a response to the application of NPK fertilizer. Plant height in the 2nd week of WAP, 3 WAP and 4 WAP shows that giving a dose of 10 g/plant gives good and effective results compared to a dose of 20 g/plant which both gives the highest plant height, this shows that NPK fertilization provides a nutrient contribution

which is needed by eggplant plants to increase the growth of eggplant plant cells in the vegetative phase. The need for nutrients is very important for plant growth, whether given directly or indirectly, so that it can increase growth, increase production and plant quality. The increase in plant height is thought to be due to the high levels of nitrogen given to plants for cell formation and growth. Apart from that, the presence of micro nutrients also plays a role in increasing nutrient absorption. This is in accordance with the opinion of Napitupulu & Winarto, 2010 who stated that the application of nitrogen can increase plant growth, stimulate the formation of chlorophyll, and cause the color of the leaves to be greener, so that the shoot-to-root ratio increases. Therefore, applying nitrogen can increase the rate of plant growth. Data on analysis of variance in administering NPK fertilizer doses to the variable observing the number of leaves of eggplant plants can be seen in table 2.

Table 2. Analysis of Various Observation Variables Number of Leaves at 1 WAP, 2 WAP, 3 WAP, and 4 WAP on Eggplant Plants

SK	DB	F Hit				F Table
		1 WAP	2 WAP	3 WAP	4 WAP	
NPK dosage	3	2.67tn	0.18tn	0.73tn	2.31tn	3.24
Error	16					
Total	19					
KK%		5.37	8.26	9.27	8.49	

Explanation: * = Real influence
tn = No real effect

The results of the analysis of the diversity of leaf number variables showed that NPK fertilizer had no significant effect at 1 WAP, 2 WAP, 3 WAP and 4 WAP. The average value of the number of leaves of eggplant plants can be seen in Figure 1.

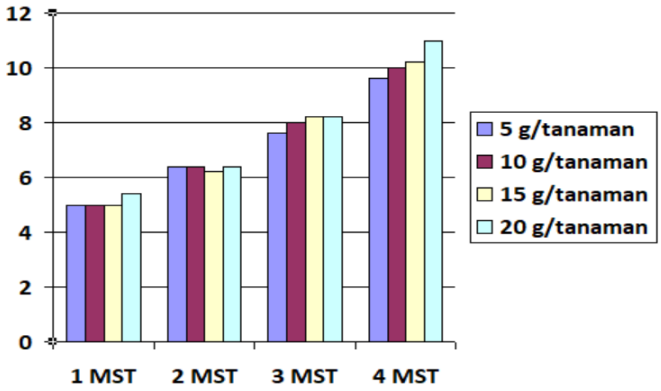

Figure 1. Average Value of Number of Leaves for Eggplant Plants 1 WAP, 2 WAP, 3 WAP and 4 WAP when Dosing NPK Fertilizer

Figure 1 shows the highest average value for the number of leaves of eggplant plants at 1 WAP, namely 5.4 strands, 6.4 at 2 WAP, 8.2 at 3 WAP and 11 strands at 4 WAP, the highest average value was found in the 20 WAP treatment. g/plant NPK fertilizer dose. The number of leaves did not show significant differences between treatments. This is because eggplant plants are still in the early stages of growth and the growth of the leaves of the plant is predominantly determined by the growth characteristics of the leaves of the eggplant plant itself. Plant growth is determined by external growth factors and also by growth factors within the plant itself. Apart from internal factors that influence plant growth, the planting medium also greatly influences plant growth. The type of PMK soil media is acidic, which is deficient in nutrients, the media is too dense so that there is not enough oxygen available for plant root respiration. Sarief et al., 1988 states that dense soil can have a direct effect on root development, as a result it completely inhibits growth processes in other plant parts. If the planting medium is too hard, it will experience obstacles in vegetative growth. This has previously been explained by Punjungsari & Ulfa, 2022, who stated that it is easy to break off young root systems mostly in hard soil media from meristematic cells which are actively undergoing differentiation and growth in their cells. This condition will affect the oxygen supply in the soil so that respiration is hampered and results in stunted leaf growth. As the age of the eggplant plant increases, the plant's needs will increase and the nutrients in the soil will not be able to meet its needs, which will affect growth.

If a plant is deficient in nutrients, it will inhibit the vegetative growth of the plant and will prolong the fruit ripening phase. Nitrogen is a primary macro element which is the main component of various compounds in the plant body (Jovita, 2018). Growing plants must contain nitrogen to form new cells. Photosynthesis produces carbohydrates and O2, but this process cannot occur to produce proteins and nucleic acids if nitrogen is not available. Nitrogen available to plants can influence protein formation, and in addition is also an integral part of chlorophyll (Giginyu & Fagbayide, 2009).

Table 3. Analysis of Various Variables Observing the Number of Fruits on Eggplant Plants

SK	DB	JK	KT	F Hit	F tab
NPK dosage	3	12.95	4.31	5.08*	3.24
Error	16	13.6	0.85		
Total	19	26.55			

Explanation: * = Real influence
tn = No real effect

The results of statistical analysis show that the dose of NPK fertilizer has a significant effect on the number of fruits per plant. The differences between NPK fertilizer dosage treatments can be seen in table 4.

Table 4. BNJ Test Variable Observation of Number of Fruits on Eggplant Plants

NPK Fertilizer Dosage	Number of Fruits
5 g/plant	1.2 b
10 g/plant	2.2 ab
15 g/plant	1 b
20 g/plant	3 a
BNJ 5%	1.67

Explanation: * = Real influence
tn = No real effect

Based on the BNJ test results in Table 4, it shows that giving a dose of 20 g NPK fertilizer/plant is significantly different from a dose of 15 g NPK fertilizer/plant, but is not significantly different from a dose of 5 g/plant and 10 g/plant NPK fertilizer. The number of fruit on eggplant plants shows that giving a dose of 10 g/plant gives good and effective results compared to a dose of 20 g/plant which both gives the highest number of fruit. This is suspected by giving a dose of NPK fertilizer of 10 g/plant which is able to be absorbed by the plant. optimally in the adult plant phase. The number of fruit formed on an eggplant plant is an important component that can influence the size of the yield. Sufficient supply of nutrients supports plant growth and produces a high number of fruit. It is known that the nutrients N, P and K are primary macro nutrients that plants need more than other nutrients to form the important ingredients chlorophyll and carbohydrates in the photosynthesis process, so that they will stop the growth process and increase the number of fruit (Ruhukai, 2011). The function of the macro nutrient primary element N is to support vegetative growth and the formation of chlorophyll. The nutrient P is for plant maturation and root growth, and K is an element that builds cell walls, regulates the opening and closing of guard cells in leaf stomata, and the strength of plant stalks and stems, as well as resistance to disease attacks (Nurtika, 2009).If these three nutrients are not available or are available too slowly, or are not in balance, plant development will be hampered.

Table 5. Analysis of Various Variables for Observing Fruit Weight of Eggplant Plants

SK	DB	JK	KT	F Hit	F tab
NPK Fertilizer Dosage	3	446.54	148.85	0.64 tn	3.24
Error	16	3716.83	232.30		
Total	19	4163.36			

Explanation: * = Real influence
tn = No real effect

The results of the analysis of the diversity of fruit weight variables showed that NPK fertilizer had no significant effect. The average value of the number of fruit for eggplant plants can be seen in Figure 2.

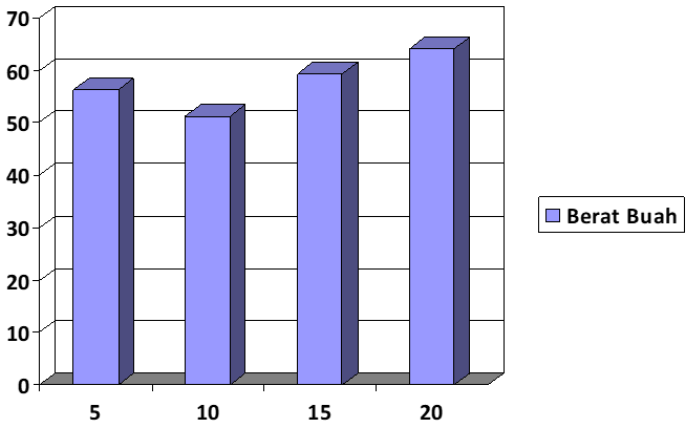

Figure 2. Average Fruit Weight Value of Eggplant Plants when Giving NPK Fertilizer Doses

Fruit weight per plant is the most important component in determining the level of eggplant productivity. The average yield is influenced by the fertilizer dose of N, P, and K because the NPK nutrient is the main nutrient needed by plants which is taken from the soil and they influence each other. The functions of N, P, and K are closely related in supporting the photosynthesis process and the production of photosynthate produced, as well as increasing plant growth through the mechanism of converting NPK nutrients into organic compounds or energy called metabolism, nutrients cannot be replaced with other nutrients so that with nutrients Plants can fulfill their life cycle. NPK compound fertilizer releases nutrient elements gradually so that they can be absorbed by plants according to plant needs (Firmansyah et al., 2017). Vegetable plants require relatively large amounts of nitrogen, phosphorus and potassium, therefore these three nutrients must be available to the plant according to the plant's needs. If these three nutrients are not available or are available too slowly, or are not in balance, plant development will be hampered (Handayanto et al., 2017).

4. CONCLUSION

Providing a dose of NPK fertilizer can increase the growth and yield of eggplant plants. A dose of 10 g/plant is considered more effective because it gives relatively the same results as the treatment that gave the highest results.

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