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The Effect of Cow State Fertilizer and Mutiara NPK to Plant Growth and Production of Purple Eggplant (*Solanum melongena* L.) on Alluvial Soil in Polybag

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ABSTRACT
This study aims to determine the effect of the interaction of cow state fertilizer and Mutiara NPK to plant growth and production of purple eggplant on alluvial soil in polybags. This research was conducted on Karet Street, West Pontianak District, West Kalimantan Province with an altitude of ± 1 meter above sea level. This research was conducted from March 25 to July 2, 2021. This study used a completely randomized design (CRD) with a factorial pattern consisting of 2 factors. The first factor is cow state fertilizer (S) with 3 levels, namely s_1 = 40 grams/polybag, s_2 = 60 grams/polybag and s_3 = 80 grams/polybag. The second factor is Mutiara NPK fertilizer (N) with 3 levels, namely n_1 = 1,2 grams/polybag, n_2 = 1,6 grams/polybag and n_3 = 2 grams/polybag. The number of treatments in this study was 9 treatment combinations and each treatment consisted of 3 times. Each replication consisted of 3 plant samples, so the total number of plant samples was 81 plants. The variables observed in this study were plant height (cm), number of leaves per plant (strands), number of fruits per plant (fruit), and fruit weight per plant (grams). The results showed that cow state fertilizer treatment had a significant effect on the number of leaves per plant, a very significant effect on fruit weight per plant, and no significant effect on the number of plants and fruit per plant. Mutiara NPK fertilizer treatment had a significant effect on fruit weight per plant and had no significant effect on plant height, number of leaves per plant, and number of fruit per plant. The interaction of cow state fertilizer and Mutiara NPK had a significant effect on fruit weight per plant and had no significant effect on plant height, number of leaves per plant, and number of fruit per plant.

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INTRODUCTION

Eggplant or eggplant (*Solanum melongena* L.) is a food plant grown for its fruit. The domestic market is a potential market for vegetable marketing. Vegetable commodities are indeed directed to stimulate the domestic market. But the market, of course, requires a supply of the necessary goods, both in terms of quantity and quality. For this reason, a good and correct cultivation pattern is needed so that the inventory meets the expectations of many related parties. Both farmers, middlemen, traders, to consumers in general (Eriyandi, 2008). Eggplant contains many vitamins and high nutrients, such as B-complex vitamins, thiamin, pyridoxine, riboflavin, iron, phosphorus. Eggplant is one source of food that is very well known by all levels of society. Eggplant is one of the menus that are of interest to various circles, to buy it is not difficult because it is available in the markets. Apart from being delicious, eggplant can also be processed into a variety of cooking menus, and how to process it is fairly easy and simple.

According to the Central Bureau of Statistics (2019), eggplant production in West Kalimantan in 2018 was 3,635 tons with a harvested area of 1,782 hectares and a productivity of 2.04 tons per hectare. One of the soils that can be used to cultivate eggplant is alluvial soil. Alluvial soil in West Kalimantan has an area of 1,793,771 hectares or 12.22% of the total area in West Kalimantan (Central Bureau of Statistics, 2018). In general, the growth of a plant is strongly influenced by environmental conditions, especially the conditions of the growing media of the plant itself. If soil conditions do not provide a suitable environment such as good soil structure, high organic matter available, and complete availability of nutrients, then the growth of plants cultivated on the soil will be stunted or the plants will grow stunted. Planting media consists of two types, namely a mixture of soil containing natural soil and a mixture without soil that does not contain soil (Harjadi, 1989).

The problem of alluvial soil, in general, is the availability of elements of N, P, K in small and large quantities depending on the parent material. In addition, many low pHs are found. In conditions of low soil pH, it can be an obstacle for plants to absorb nutrients, because some of the nutrients are in the form of cations that will not be available to plants, besides that alluvial soil has a sandy clay texture with a sand content of less than 50% (Hardjowigeno, 2003). Alluvial soil is considered marginal soil because it has physical, chemical, and biological properties that do not support eggplant plant growth. One of the efforts to overcome the problem of alluvial soil is fertilization.

Cow state fertilizer has a very important role, especially in improving the physical properties of the soil, which can increase the ability of the soil to hold water, improve drainage and soil air conditioning. The role of improving soil chemical properties can increase nutrients and improvement of biological properties can increase the number and activity of microorganisms in the soil. Agree with Gole, Sukerta, and Udiyana (2019) stated that cow state fertilizer contains several nutrients and organic matter that can improve the physical, chemical, and biological properties of the soil. Sarief (1998) stated that livestock manure is an organic material with a low C/N value. Mutiara NPK fertilizer is carried out as an effort to meet the nutrient needs of plants so that production goals can be achieved. This is because eggplant plants need an adequate supply of nutrients. Fertilization is very supportive of efforts to preserve land productivity and maintain the availability of nutrients in the soil.

According to Sriyanto, Astuti, and Sujalu (2015), the best dose for using cow state fertilizer is 15 tons/ha which gives the highest production of fruit weight, which is 7.26 gr. Meanwhile, according to Ayuningtyas, Koesriharti, and Murdiono (2020), the treatment of giving 400 kg/ha resulted in a higher number of harvested fruits per plant. This study aimed to determine the effect of the interaction of cow state fertilizer and Mutiara NPK to the growth and production of purple eggplant (*Solanum melongena* L.) on alluvial soil in polybags.

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METHOD

This research was conducted on Karet Street, West Pontianak District, West Kalimantan Province with an altitude of ± 1 meter above sea level. This research was conducted from March 25 to July 2, 2021. The research materials used were eggplant seeds, alluvial soil, polybags measuring 40 cm x 40 cm, cow state fertilizer, Mutiara NPK fertilizer, dolomite lime. The tools used in this study were: soil sieve, hoe, machete, camera, writing utensil, ordinary scale, ruler, measuring cup, bucket, pH meter, and thermohygrometer.

This study used a completely randomized design (CRD) with a factorial pattern consisting of 2 factors. The first factor is the dose of cow state fertilizer (S) with 3 levels, namely s_1 = 40 grams/polybag, s_2 = 60 grams/polybag and s_3 = 80 grams/polybag. The second factor is the dose of Mutiara NPK fertilizer (N) with 3 levels, namely n_1 = 1.2 grams/polybag, n_2 = 1.6 grams/polybag and n_3 = 2 grams/polybag, in order to obtain 9 treatment combinations. The treatment combinations are as follows: s_1n_1, s_1n_2, s_1n_3, s_2n_1, s_2n_2, s_2n_3, s_3n_1, s_3n_2, s_3n_3. Each treatment was repeated 3 times. Each replication consisted of 3 plant samples so that the total number of plant samples was 81 plants.

The implementation of this research includes preparation of planting media, seed sowing, liming, application of cow state fertilizer, planting, application of Mutiara NPK, maintenance, harvesting. Observation variables include plant height (cm), number of leaves per plant (strands), fruit weight per plant (g), number of fruit per plant (fruit). Control variables include pH, air temperature (°C), and humidity (%). Statistical analysis used analysis of diversity to see the effect of the treatment.

RESULTS AND DISCUSSION

Plant Height (cm)

Based on the results of the analysis of diversity showed that there was no interaction between the treatment of cow state fertilizer and Mutiara NPK fertilizer to plant height of purple eggplant. The treatment of cow state fertilizer and Mutiara NPK individually had no significant effect on to plant height of purple eggplant. This is presumably because cow state fertilizer and Mutiara NPK have not been able to increase eggplant plant height. This is following the results of research by Muhammad, Abdul, and Noor (2014) who reported that with the increasing age of eggplant plants, the need for nutrients, especially Nitrogen (N) is also higher. Furthermore, Djunaedy (2009) reported that young plants will be able to absorb nutrients in small amounts in line with the age of the plant, the rate of absorption of plant nutrients will increase if the age increases according to their life cycle. The quality of plant life is also very dependent on the adequacy of nutrients from the environment and the ability of roots to absorb nutrients to support the vegetative phase of plants. Find out the average plant height in the treatment of cow state fertilizer and Mutiara NPK fertilizer can be seen in Fig. 1.

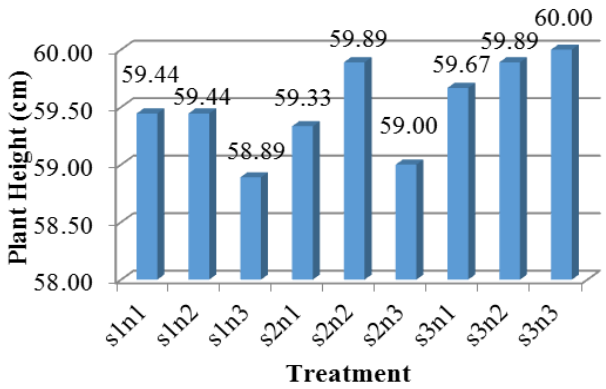

Fig. 1 *The average plant height in the treatment of cow state fertilizer and Mutiara NPK fertilizer*

International Journal of Multi Discipline Science (IJ-MDS)
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e-ISSN: 2615-1707. Page: 44-50

Fig. 1 showed that the s_3n_3 treatment produced the highest average plant height of 60.00 cm, while the s_1n_3 treatment produced the lowest plant height of 58.89 cm. The s_3n_3 treatment with a dose of 80 grams of cow state fertilizer and 2 grams of Mutiara NPK fertilizer per polybag gave an increase in the average height of eggplant plants.

Number of Leaves (Strands)

Based on the results of the analysis diversity showed that there is no interaction between cow state fertilizer and Mutiara NPK treatment to the number of leaves per purple eggplant plant. The cow state fertilizer treatment had a very significant effect on the number of leaves per purple eggplant plant, while the Mutiara NPK fertilizer treatment had no significant effect on the number of leaves per purple eggplant plant. To find out the difference between each dose of cow state fertilizer, a 5% Honest Significant Difference test was carried out which can be seen in Table 1.

Table 1
Results of Honestly Significant Difference Test (BNJ) the Effect of Cow State Fertilizer Treatment to Average Number of Leaves per Plant

Treatment	Average Number of Leaves per Plant (Strands)	Different
s_1	59.85	a
s_2	69.04	b
s_3	67.78	b
BNJ 5% = 5.88		

Note: The numbers followed by the same letter are not significantly different according to the BNJ test at the 5% level

Table 1 showed that the treatment of s_2 and s_3 was significantly different from the s_1 treatment. The treatment of s_2 and s_3 with a dose of cow state fertilizer each as much as 60 grams and 80 grams per polybag give the results of average the highest number of leaves per plant was 69.04 strands and 67.78 strands. This is presumably because cow state fertilizer is a good organic fertilizer as basic fertilizer, so it can improve soil fertility and increase water absorption so that the water needed by plants is adequate. According to Gonggo, Hermawan, and Anggraeni (2005), the nutrient content in state fertilizer is not too high but has other features that can improve soil physical properties such as soil permeability, soil porosity, soil structure, water-holding capacity, and soil cations.

Number of Fruits per Plant

Based on the results of the analysis of diversity showed that the treatment interaction of cow state fertilizer and Mutiara NPK had no significant effect on the number of fruits per purple eggplant plant. Treatment of cow state fertilizer and Mutiara NPK each had no significant effect on the number of fruits per purple eggplant plant. It is suspected because the application of cow state fertilizer and Mutiara NPK has not been able to provide an increase in eggplant plant height. Good plant growth requires complete nutrients, the use of incomplete nutrients affects the balance of nutrients that can be absorbed and reduces the effectiveness of nutrient uptake. Complete fertilizers can improve physiological processes increasing the product produced which in eggplant plants is expressed in the generative part, namely fruit, both in the number of fruits that can be formed and in size. To find out the average number of fruits per plant in various treatment combinations of cow state fertilizer and Mutiara NPK fertilizer can be seen in Fig. 2.

Fig. 2 showed that the s_3n_3 treatment produced the highest average number of fruits per plant, namely 9.56 fruits, while the s_3n_2 treatment produced the lowest number of fruits per plant, namely 8.56 fruits. The s_3n_3 treatment with a cow state fertilizer dose of 80 grams and Mutiara NPK fertilizer as much as 2 grams per polybag gave an increase in the average number of fruits per eggplant plant. In general, the appearance of the fruit is influenced by the time the plant flowers appear. Faster flower age will

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result in faster fruiting age, as long as the seeds used are in good condition, which has high adaptation to the environment. Poor quality seeds can cause a decrease in the percentage of fruit. Not all flowers that are formed can undergo fertilization and not all fruits that are formed can continue to grow until they become ripe fruit (Lakitan, 2012).

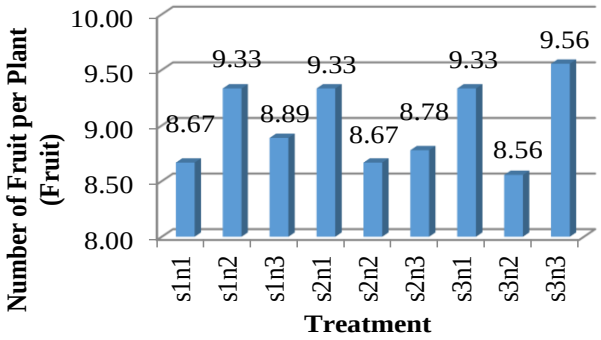

Fig. 2 *The average number of fruits per plant in various treatment combinations of cow state fertilizer and Mutiara NPK fertilizer*

Fruit Weight per Plant

Based on the results of the analysis of diversity showed that the interaction of cow state fertilizer and Mutiara NPK treatment had a significant effect on fruit weight per purple eggplant plant. The cow state fertilizer treatment had a very significant effect on fruit weight per purple eggplant plant, while the Mutiara NPK fertilizer treatment had a significant effect on fruit weight per purple eggplant plant. To find out the difference at each level of treatment of cow state fertilizer and Mutiara NPK, then proceed with the 5% BNJ test which can be seen in Table 2-4.

Table 2
Honestly Significant Difference Test Results (BNJ) the Effect of Cow State Fertilizer Treatment to Average of Fruit Weight per Plant

Treatment	Average Fruit Weight per Plant (grams)	Different
s_1	890.12	b
s_2	885.38	a
s_3	972.03	b
BNJ 5% = 54.37		

Note: The numbers followed by the same letter are not significantly different according to the BNJ test at the 5% level

Table 2 showed that the treatment of s_1 and s_3 was significantly different from the s_2 treatment. The treatment of s_1 and s_3 with a dose of cow state fertilizer each as much as 40 grams and 80 grams per polybag give the results of average the highest fruit weight per plant was 890.12 grams and 972.03 grams.

Table 3 showed that the treatment of n_1 and n_3 was significantly different from the treatment of n_2. The treatment of n_1 and n_3 with a dose of Mutiara NPK fertilizer of 1.2 grams and 2 grams per polybag, respectively give the results of average the highest fruit weight per plant was 932.96 grams and 939.12 grams.

International Journal of Multi Discipline Science (IJ-MDS)
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Table 4 showed that the interaction of treatment with various doses of cow state fertilizer and Mutiara NPK obtained the best fruit weight per eggplant plant in the s_3n_3 treatment, which was 1043 grams which were not significantly different from the tuber weight in the s_2n_1 and s_3n_1 treatments, but significantly different from the weight of the tubers in the treatment of s_1n_1, s_1n_2, s_1n_3, s_2n_2, s_2n_3, and s_3n_2. The lowest fruit weight per plant was obtained in the s_2n_2 treatment with an average of 827.30 grams not significantly different from the fruit weight per plant in the s_1n_1, s_1n_2, s_1n_3, s_2n_1, s_2n_3, and s_3n_2 treatments, but significantly different from the weight of the tubers in the treatment of s_3n_1 and s_3n_3.

Table 3
Results of Honestly Significant Difference Test (BNJ) the Effect of Mutiara NPK Fertilizer Treatment to Average of Fruit Weight per Plant

Treatment	Average Fruit Weight per Plant (grams)	Different
n_1	932.96	b
n_2	875.46	a
n_3	939.12	b
BNJ 5% = 54.37		

Note: The numbers followed by the same letter are not significantly different according to the BNJ test at the 5% level

Table 4
Results of Honestly Significant Difference Test (BNJ) the Effect of Cow State Fertilizer and Mutiara NPK Treatment to Average of Fruit Weight per Plant

s Treatment	n Treatment		
	n_1	n_2	n_3
s_1	888.68 ab	899.11 ab	882.58 ab
s_2	937.06 abc	827.30 a	891.79 ab
s_3	973.13 bc	899.96 ab	1043.00 c
BNJ 5%		129.39	

Note: The numbers followed by the same letter are not significantly different according to the BNJ test at the 5% level

The enhancement of fruit weight per plant in the treatment of s_3n_3 with dose 80 grams of cow state fertilizer and 2 grams of Mutiara NPK fertilizer per polybag that can produce the highest mean value is the influence of the nutrient content of the fertilizer and is available so that it can be absorbed by plants for metabolic processes and the fruit that is formed has grown in size to become larger. Meanwhile, the lighter fruit weight is caused by the lack of nutrient K. If there is a lack of potassium, the fruit will remain small (Rismunandar, 2000), thereby reducing fruit weight. According to Damanik et al. (2010), potassium functions to maintain a balance, both in nitrogen and phosphorus.

Potassium is needed in helping the formation of nitrogen and carbohydrates, plays a role in strengthening the plant body, woody parts of plants, so that leaves, flowers, and fruit do not fall easily, increasing plant resistance to drought and disease. While the element N plays an important role in the formation of green leaves that are useful in the process of photosynthesis, the formation of the leaf is a place for the formation of starch for plants. High starch or food formation can increase fruit weight per plant.

CONCLUSIONS

Based on the results of the study, it can be concluded that (1) cow state fertilizer treatment had a significant effect on the number of leaves per plant, a very significant effect on fruit weight per plant, and an insignificant effect on plant height and number of fruits per plant; (2) Mutiara NPK fertilizer treatment had a significant effect on fruit weight per plant and no significant effect on plant height, number of leaves per plant, and number of fruit per plant; (3) the interaction of cow state fertilizer and Mutiara NPK had a significant effect on fruit weight per plant and no significant effect on plant height, number of leaves per plant, and number of fruit per plant.

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