RESPONSE TO THE PRODUCTION OF TWO VARIETIES OF OKRA PLANT (*Abelmoschus esculentus* L. Moench) DUE TO THE COMBINATION TREATMENT OF DRY ORGANIC FERTILIZER FROM COW MANURE AND LIQUID ORGANIC FERTILIZER FROM FRUITS WASTE

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ABSTRACT

The application of organic fertilizers in agricultural systems has many benefits in increasing soil fertility. The okra plant is a type of vegetable crop that has started to be widely consumed and can compete in the export market. The purpose of this study was to analyze the production and the interaction of two varieties of okra (*Abelmoschus esculentus* L. Moench) due to the combined treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste. The research method used was a factorial randomized block design consisting of 2 factors. The first factor was the variety treatment which was divided into 2 levels, namely V1 = green okra of Lucky Five 473 F1 variety, and V2 = red okra of Zahira IPB variety. The second factor was the combination treatment of the application of dry organic fretilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste which was divided into 4 levels, namely P0 = 0.0 kg DOF + 0 ml LOF, P1 = 1.5 kg DOF + 50 ml LOF, P2 = 3.0 kg DOF + 50 ml LOF, P3 = 4.5 kg DOF + 50 ml LOF. Parameters observed were number of fruit per sample, number of fruit per plot, the weight of fruit per sample, and weight of fruit per plot. The results showed that the two types varieties of okra plant did affect the parameters of the number of fruits per sample, the number of fruits per plot, weight of fruits per sample, and weight of fruits per plot, where the best variety treatment was the green okra plants (V1). The combination treatment of the application of dry organic fertilizer (DOF) from cow manure with liquid organic fertilizer (LOF) from fruit waste did affect the parameters of the number of fruits per sample, the number of fruits per plot, weight of fruits per sample, and weight of fruits per plot, where the best treatment was P3 (4.5 kg DOF + 50 ml LOF).

Keywords: Production, Okra Plant, Fertilizer, Cow Manure, Fruit Waste

INTRODUCTION

Okra plants are included in many types of vegetable plants and are also cultivated as medicinal and herbal ingredients. The demand for okra in Indonesia is still relatively low, but domestic demand for okra is increasing every year and national production has not been able to meet the needs of the domestic community. Okra production is currently still fluctuating and has not been able to meet national needs. Domestic okra production was recorded at 1,317 tons in 2013 and 1,360 tons in 2015. Demand for okra in 2015 was around 1,500 tons. Based on okra producer PT. Mitra Tani Dua Tujuh, the demand for okra on an export scale is relatively high but domestic production still does not meet the target of market demand (Budi *et al*, 2020). Okra is an agricultural product that can grow and develop well in Indonesia so that it can enter the export market. In 2016, it was recorded that 500 tons of green okra had entered the export market to Japan (Alfandi, 2016).

Based on climatological factors, okra plants have good prospect value if these plants are planted and developed in Indonesia. The tropical climate is perfect for growing okra plants in Indonesia. Thus the Okra plants have good prospect value because they can grow well when cultivated in Indonesia. There are two varieties of okra plants developed in Indonesia, namely red okra and green okra.

The organic farming system that has been implemented in Indonesia produces plant products such as organic vegetables and fruit which are in great demand and profitable because they get high prices in the market. This has made many vegetable and fruit farmers start implementing organic farming systems. Organic farming which is applied to the cultivation of vegetables and fruits makes farmers get a lot of benefits because the prices offered are quite high by the market. The application of organic fertilizer from cow manure is a basic form of organic farming that can improve soil conditions that have decreased fertility. The use of fertilizer from cow manure in the application of organic farming can be done because of its abundant availability and has many benefits that can increase soil fertility. The use of fertilizer from cow manure can have a significant effect on plant height and root length on plant growth. In Indonesia, cow manure is available in large quantities, if this cow manure is not used in properly it will become waste that can pollute the environment (Alfira and Nuraini, 2021).

According to Purnomo *et al* (2013), one way to increase vegetable production is to improve cultivation techniques, including the tendency to use more organic fertilizers than inorganic fertilizers. Plant fertilization is one of the determining factors to increase crop yields. One effort that can be done to reduce the use of inorganic fertilizers is to restore the physical, chemical, and biological conditions of the soil through the use of organic fertilizers. Organic fertilizers are fertilizers that contain the main ingredients of the remains of living organisms such as blood, bones, animal waste, hair, plant residues, or domestic waste that has undergone a decomposition process. Besides being in solid form from animal manure or commonly known as manure, organic fertilizer can also be in liquid form from vegetable or fruit waste. Manure contains macro and micronutrients. Solid fertilizer (macro) contains elements of phosphorus, nitrogen, and potassium. Micronutrients in manure include calcium, magnesium, sulfur, sodium, iron, copper, and molybdenum (Kafrawi *et al*, 2018).

Based on the explanation of the background of this research, we conducted a study entitled "Response to the Growth and Production of Two Varieties of Okra Plant (*Abelmoschus Esculentus* L. Moench) due to the Combination of Treatment of Dry Organic Fertilizer of Cow Manure and Liquid Organic Fertilizer of Fruits Waste".

METHODS

Research Material

The materials used in this study were green okra seeds of the Lucky Five 473 F1 variety, red okra seeds of the Zahira variety IPB, dry organic fertilizer from cow manure, and liquid organic fertilizer from fruit waste.

The tools used in this study were a set of agricultural cultivation tools such as hoes, machetes, watering tools, and sprayers. then monitoring devices such as cameras and rulers. The last is a set of writing tools such as pens, markers, paper, books, and additional tools that support this research.

Research Design

This study used a factorial randomized block design consisting of 2 treatment factors with 8 treatment combinations and 4 repetitions, bringing the total treatment plots to 32 plots.

The first factor is the okra plant variety with the symbol "V" which consists of 2 types of treatment, as follows:

1. V1 = Lucky Five Variety Okra Green 473 F1
2. V2 = Red Okra Varieties of Zahira IPB

The second factor is the interaction of dry organic fertilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste with the symbol "P" which consists of 4 levels of treatment concentration, as follows:

1. P0 = 0.0 kg of DOF from cow manure + 0 ml of LOF from fruit waste
2. P1 = 1.5 kg of DOF from cow manure + 50 ml of LOF from fruit waste
3. P2 = 3.0 kg of DOF from cow manure + 50 ml of LOF from fruit waste
4. P3 = 4.5 kg of DOF from cow manure + 50 ml of LOF from fruit waste

The 8 forms of treatment combinations designed in this study are: 1) V1P0, 2) V1P1, 3) V1P2, 4) V1P3, 5) V2P0, 6) V2P1, 7) V2P2 and 8) V2P3.

The results of the study were analyzed by ANOVA analysis and continued with the DUNCAN mean difference test (DMRT).

Research Procedure

This research was conducted within 4 months, starting from the preparation stage to the stage of analyzing the results. The stages carried out in this study were divided into 3 groups of stages. The first stage is called the preparation stage, the second stage is called the cultivation stage and the third stage is called the analysis stage.

The procedure for implementing the stages carried out in this study in detail are:

1. The preparation stage, including:
   a. Making the organic fertilizer from cow manure
   b. Producting the liquid organic fertilizer from fruit waste
   c. Preparation the cultivation land
   d. Making the plots on cultivation land
   e. Applicating the organic fertilizer from cow manure to the plots of cultivation land
2. The cultivation stage, including:
   a. Seeding the experimental plants on the tray.
   b. Planting the experimental plants on cultivation land
   c. Selecting the sample of experimental plants
   d. Watering the experimental plants
   e. Giving liquid organic fertilizer from fruit waste to experimental plants
   f. Spraying the experimental plants
   g. Weeding the weeds on crop plots
   h. Harvesting the products of the experimental plant
3. The analysis stage, including:
   a. Calculating the average value of research parameters on research results
   b. Analyzing the parameters of the research results with statistical analysis

RESULTS AND DISCUSSION

Research Parameters

1. Number of Fruit Per Sample

Statistical analysis on the observation of the average number of fruits per sample to the response of two varieties of okra plants (V) to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste (P) to the parameter of the number of fruits per sample is presented in Table 1.

Table 1. The average number of fruits per sample in the response of two varieties of okra plants to the combined treatment of dry organic fertilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste

Treatment	The average number of fruits per sample
V = Varieties of okra plants	
V1 = Green okra plant	5,98 aA
V2 = Red okra plant	5,02 bA
P = DOF + LOF	
P0 = 0,0 kg DOF + 0 ml LOF	4,88 bB
P1 = 1,5 kg DOF + 50 ml LOF	5,00 bB
P2 = 3,0 kg DOF + 50 ml LOF	5,50 abAB
P3 = 4,5 kg DOF + 50 ml LOF	6,63 aA
Note : Numbers in the same column followed by the same letter are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).	

The data in Table 1 shows that the response of the two varieties of okra plants has an effect on the parameter number of fruits per sample. The same thing happened to the response of the combination treatment of giving organic dry fertilizer from cow manure and liquid organic fertilizer from fruit waste which had an effect on the parameter of the number of fruits per sample.

Based on Table 1, it can be seen that the response of two varieties of okra plants has an effect on the parameter number of fruits per sample. The highest average number of fruits per sample can be found in treatment V1 (green okra), which was 5.98 fruit, this result was significantly different from treatment V2 (red okra), which was 5.02 fruit. The response of okra plants to the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste also had an effect on the parameter of the number of fruits per sample. The highest average number of fruits per sample can be found in the P3 treatment, which wa 6.63 fruits. These results were significantly different from the P2 treatment, which was 5.50 fruit, but very significantly different from the P1 treatment, which was 5.00 fruit, and P0, which was 4.88 fruit.

The effect of the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste on the rate parameter of the number of fruits per sample in okra plants is presented in a graph which can be seen in Figure 1.

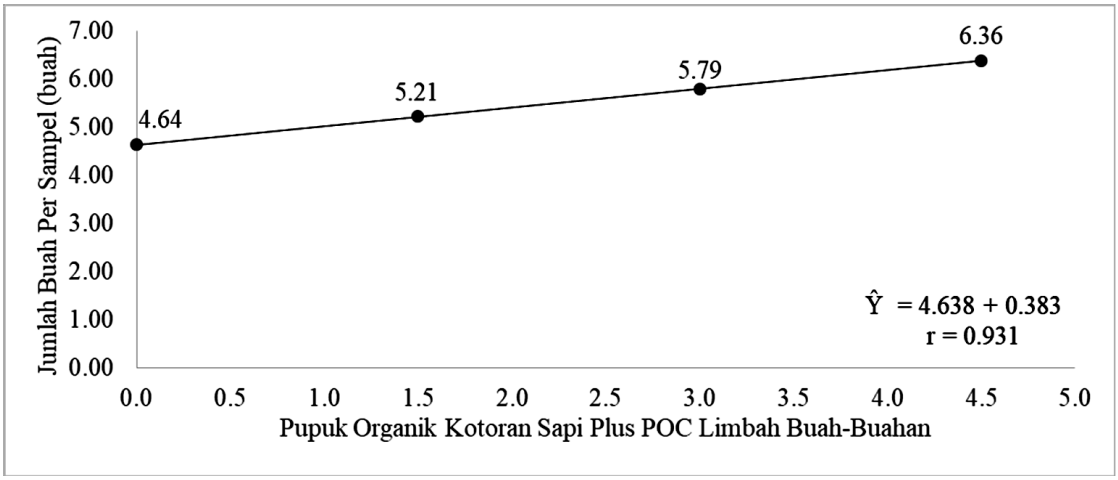

Figure 1. Relationship of the number of fruits per sample to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste

Figure 1 above explains that the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste gave a positive response to the parameter rate of the number of fruits per sample of okra plants which produced a linear graph and formed a linear equation $\hat{Y} = 4.638 + 0.383$ (P) with a coefficient of determination (r^2) of 0.931. This means that if the dose of organic fertilizer is increased, the number of fruits per sample of okra plants will also increase in each treatment.

2. Number of Fruit Per Plot

Statistical analysis on the observation of the average number of fruits per plot to the response of two varieties of okra plants (V) to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste (P) to the parameter of the number of fruits per plot is presented in Table 2.

Table 2. The average number of fruits per sample in the response of two varieties of okra plants to the combined treatment of dry organic fertilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste

Treatment	The average number of fruits per plot
V = Varieties of okra plants	
V1 = Green okra plant	26,69 aA
V2 = Red okra plant	22,75 bA
P = DOF + LOF	
P0 = 0,0 kg DOF + 0 ml LOF	20,25 bA
P1 = 1,5 kg DOF + 50 ml LOF	23,13 bA
P2 = 3,0 kg DOF + 50 ml LOF	26,25 abA
P3 = 4,5 kg DOF + 50 ml LOF	29,25 aA
Note : Numbers in the same column followed by the same letter are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).	

The data in Table 2 shows that the response of the two varieties of okra plants has an effect on the parameter number of fruits per plot. The same thing happened to the response of the combination treatment of giving organic dry fertilizer from cow manure and liquid organic fertilizer from fruit waste which had an effect on the parameter of the number of fruits per plot.

Based on Table 2, it can be seen that the response of two varieties of okra plants has an effect on the parameter number of fruits per plot. The highest average number of fruits per plot can be found in treatment V1 (green okra), which was 26.69 fruit, this result was significantly different from treatment V2 (red okra), which was 22.75 fruit. The response of okra plants to the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste also had an effect on the parameter of the number of fruits per plot. The highest average number of fruits per plot can be found in the P3 treatment, which wa 29.25 fruits. These results were not significantly different from the P2 treatment, which was 26.25 fruit, but significantly different from the P1 treatment, which was 23.13 fruit, and P0, which was 20.25 fruit.

The effect of the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste on the rate parameter of the number of fruits per plot in okra plants is presented in a graph which can be seen in Figure 2.

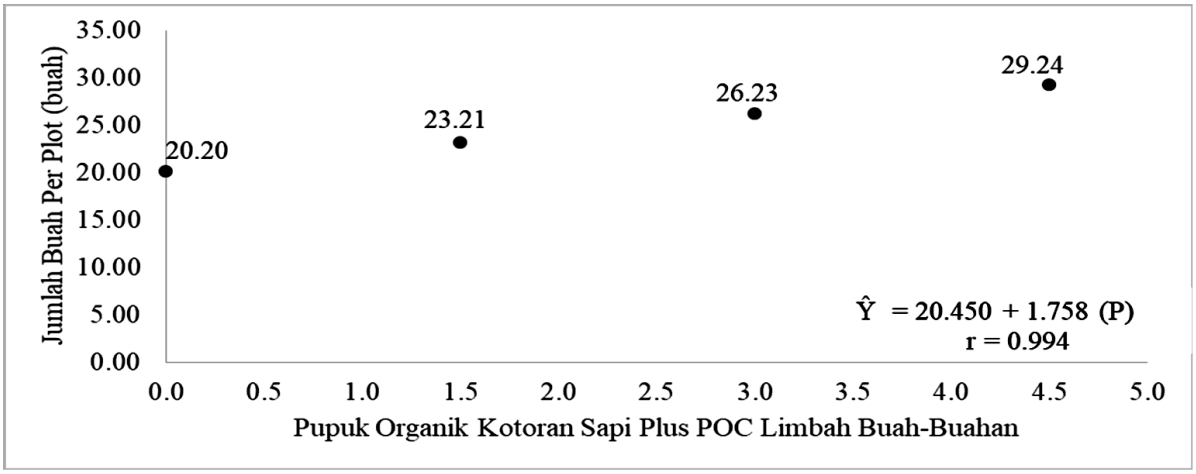

Figure 2. Relationship of the number of fruits per plot to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste

Figure 2 above explains that the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste gave a positive response to the parameter rate of the number of fruits per plot of okra plants which produced a linear graph and formed a linear equation $\hat{Y}$ = 20.450 + 1.758 (P) with a coefficient of determination (r^2) of 0.994. This means that if the dose of organic fertilizer is increased, the number of fruits per plot of okra plants will also increase in each treatment.

3. Weight of Fruit Per Sample

Statistical analysis on the observation of the average weight of fruits per sample to the response of two varieties of okra plants (V) to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste (P) to the parameter of the weight of fruits per sample is presented in Table 3.

Table 3. The average weight of fruits per sample in the response of two varieties of okra plants to the combined treatment of dry organic fertilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste

Treatment	The average weight of fruits per sample
V = Varieties of okra plants	
V1 = Green okra plant	136,92 aA
V2 = Red okra plant	115,69 bA

P = DOF + LOF	
P0 = 0,0 kg DOF + 0 ml LOF	102,42 bB
P1 = 1,5 kg DOF + 50 ml LOF	117,75 bAB
P2 = 3,0 kg DOF + 50 ml LOF	130,88 abA
P3 = 4,5 kg DOF + 50 ml LOF	154,17 aA
Note : Numbers in the same column followed by the same letter are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).	

The data in Table 3 shows that the response of the two varieties of okra plants has an effect on the parameter weight of fruits per sample. The same thing happened to the response of the combination treatment of giving organic dry fertilizer from cow manure and liquid organic fertilizer from fruit waste which had an effect on the parameter of the weight of fruits per sample.

Based on Table 3, it can be seen that the response of two varieties of okra plants has an effect on the parameter weight of fruits per sample. The highest average weight of fruits per sample can be found in treatment V1 (green okra), which was 136.92 gram, this result was significantly different from treatment V2 (red okra), which was 115.69 gram. The response of okra plants to the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste also had an effect on the parameter of the weight of fruits per sample. The highest average weight of fruits per sample can be found in the P3 treatment, which wa 154.17 gram. These results were not significantly different from the P2 treatment, which was 130.88 grams, but significantly different from the P1 treatment, which was 117.75 grams, and very significantly different from the P1 treatment, which was 102.42 grams.

The effect of the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste on the rate parameter of the weight of fruits per sample in okra plants is presented in a graph which can be seen in Figure 3.

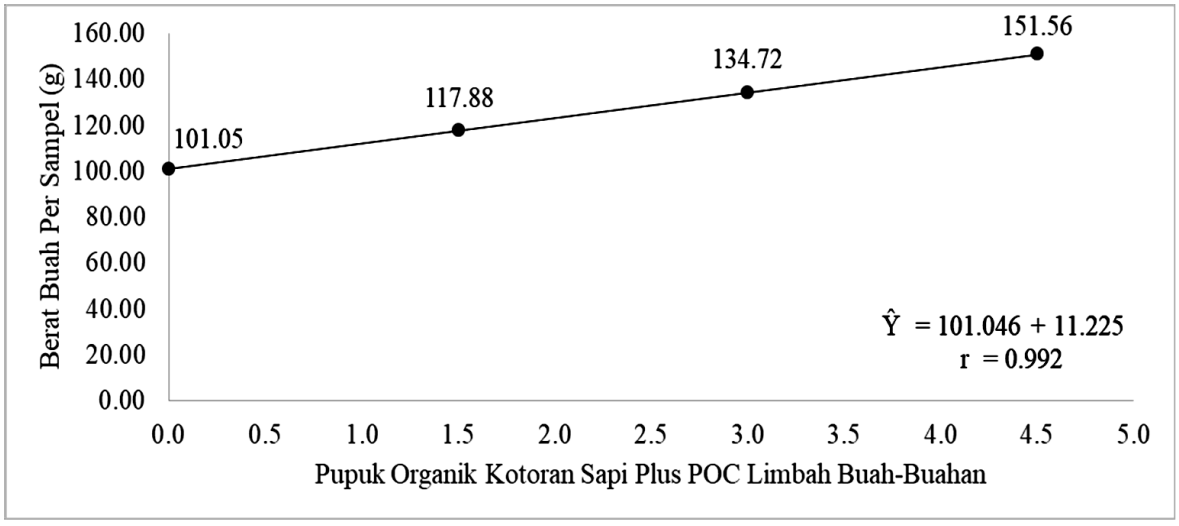

Figure 3. Relationship of the weight of fruits per sample to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste

Figure 3 above explains that the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste gave a positive response to the parameter rate of the weight of fruits per sample of okra plants which produced a linear

graph and formed a linear equation $\hat{Y}$ = 101.046 + 11.225 (P) with a coefficient of determination (r^2) of 0.992. This means that if the dose of organic fertilizer is increased, the weight of fruits per sample of okra plants will also increase in each treatment.

4. Weight of Fruit Per Plot

Statistical analysis on the observation of the average weight of fruits per plot to the response of two varieties of okra plants (V) to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste (P) to the parameter of the weight of fruits per plot is presented in Table 4.

Table 4. The average weight of fruits per plot in the response of two varieties of okra plants to the combined treatment of dry organic fertilizer (DOF) from cow manure and liquid organic fertilizer (LOF) from fruit waste

Treatment	The average weight of fruits per plot
V = Varieties of okra plants	
V1 = Green okra plant	527,69 aA
V2 = Red okra plant	427,50 bA
P = DOF + LOF	
P0 = 0,0 kg DOF + 0 ml LOF	386,88 bB
P1 = 1,5 kg DOF + 50 ml LOF	423,00 bAB
P2 = 3,0 kg DOF + 50 ml LOF	481,50 bA
P3 = 4,5 kg DOF + 50 ml LOF	619,00 aA
Note : Numbers in the same column followed by the same letter are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).	

The data in Table 4 shows that the response of the two varieties of okra plants has an effect on the parameter weight of fruits per plot. The same thing happened to the response of the combination treatment of giving organic dry fertilizer from cow manure and liquid organic fertilizer from fruit waste which had an effect on the parameter of the weight of fruits per plot.

Based on Table 4, it can be seen that the response of two varieties of okra plants has an effect on the parameter weight of fruits per plot. The highest average weight of fruits per plot can be found in treatment V1 (green okra), which was 527.69 gram, this result was significantly different from treatment V2 (red okra), which was 427.50 gram. The response of okra plants to the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste also had an effect on the parameter of the weight of fruits per sample. The highest average weight of fruits per sample can be found in the P3 treatment, which wa 619.00 gram. These results were significantly different from the P2 treatment, which was 481.50 grams, and the P1 treatment, which was 423.00 grams, but very significantly different from the P0 treatment, which was 386.88 grams.

The effect of the combination treatment of the application of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste on the rate parameter of the weight of fruits per plot in okra plants is presented in a graph which can be seen in Figure 3.

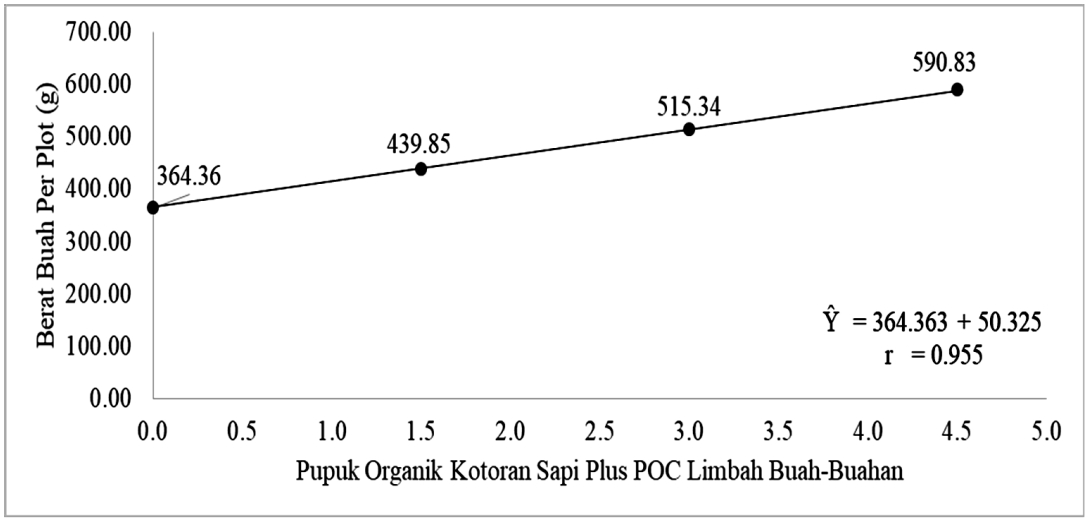

Figure 4. Relationship of the weight of fruits per plot to the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste

Figure 4 above explains that the combination treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste gave a positive response to the parameter rate of the weight of fruits per sample of okra plants which produced a linear graph and formed a linear equation $\hat{Y}$ = 364.363 + 50.325 (P) with a coefficient of determination (r^2) of 0.955. This means that if the dose of organic fertilizer is increased, the weight of fruits per plot of okra plants will also increase in each treatment.

Analysis of Research Results

Based on the results of variance, it is also known that the combination of treatment with dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste has an effect on the parameters of the number of fruits per sample, the number of fruits per plot, fruit weight per sample, and fruit weight per plot. This is because organic fertilizers contain a very high element of phosphorus. The role of phosphorus in the soil is to store and transmit energy in all plant metabolic activities so that with the presence of Phosphorus, plants can stimulate the formation of flowers and increase the formation of flowers into fruit. Thus it will speed up harvest time and increase the amount of crop production.

Meylia and Koesriharti (2018) state that the nutrient content contained in dry organic fertilizer from cow manure is 0.40% Nitrogen, 0.20% Phosphorus, and 0.10% Potassium. Then the nutrient content in liquid organic fertilizer from fruit waste is 1.7% nitrogen, 2.86% phosphorus, and 2.00% potassium. This shows that the treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste can meet the nutritional needs of plants, especially nutrients Nitrogen , Phosphorus, and Potassium. And if the dose of organic fertilizer is increased, it will increase the quantity of yield cultivated plant production.

According to Muhammad and Noor (2014), organic cow manure that has lost its gas can decompose quickly so that it can provide nutrients that are important for plants to stimulate vegetative and generative growth of plants. Applying a dose of dry organic fertilizer from cow manure can increase the availability of nutrients for plant growth and production which in turn can also accelerate the flowering and fruit ripening processes in plants so as to increase maximum crop production.

Nutrients can affect the growth and yield of a plant, especially when plant growth enters the generative phase during the flowering period. During the flowering stage, the plant needs more of the nutrient phosphorus and potassium. Phosphorus plays an important role in accelerating flowering, fruit ripening, and increasing the percentage of fruit formation, while

Potassium plays an important role in photosynthesis, which helps the formation of carbohydrates and improves the quality of the results in the form of flowers and fruit, taste and color. In addition, the nutrients phosphorus and potassium contained in dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste can improve soil fertility.

CONCLUSION

Based on the results of the research and the results of statistical analysis in the results and discussion section, it can be concluded that:

1. Two types varieties of okra plant did affect the parameters of the number of fruits per sample, the number of fruits per plot, the weight of fruits per sample, and the weight of fruits per plot, where the best variety of okra plant was the green okra plants (V1).
2. The combination treatment of the application of dry organic fertilizer (DOF) from cow manure with liquid organic fertilizer (LOF) from fruit waste did affect the parameters of the number of fruits per sample, the number of fruits per plot, weight of fruits per sample, and weight of fruits per plot, where the best treatment was P3 (4.5 kg DOF + 50 ml LOF).
3. Increasing the dose of the combined treatment of dry organic fertilizer from cow manure and liquid organic fertilizer from fruit waste will further increase the parameters of the number of fruits per sample, the number of fruits per plot, the weight of fruits per sample, and the weight of fruits per plot.

REFERENCES

Alfandi, A. L. 2016. Pengaruh Pemberian Dosis Pupuk Urea pada Beberapa Galur terhadap Pertumbuhan, Hasil, dan Kualitas Okra (*Abelmoschus esculentus* L. Moench). Skripsi. Fakultas Pertanian. Universitas Jember. Jember.

Alfira, P. Z., dan Nuraini, Y. 2021. Pengaruh Aplikasi Kompos Kotoran Sapi dan Paitan terhadap Sifat Kimia Tanah dan Pertumbuhan Tanaman Kedelai. Jurnal Tanah Dan Sumberdaya Lahan. 8 (1), 123-133.

Budi, N. A., Soeparjono S., dan Avivi, S. 2020. Peningkatan Produksi dan Kualitas Benih Okra (*Abelmoschus esculentus* L. Moench) Mengunnakan Aplikasi Fosfor dan GA3. Journal Agricultural Sciences. 4 (1), 154-163.

Kafrawi, Asmawati, dan Kumalawati, Z. 2018. Pemanfaatan Kompos Berbagai Kotoran Ternak dan Aplikasinya pada Media Tanam Bibit Kakao (*Theobroma cacao* L.). Jurnal Agroplantae. 7 (2), 20-27.

Meylia, R. D. dan Koesriharti. 2018. Pengaruh Pemberian Pupuk Fosfor dan Sumber Kalium yang Berbeda Terhadap Pertumbuhan dan Hasil Tanaman Tomat (*Lycoperscon esculentum* Mill.). Jurnal Produksi Tanaman. 6 (8), 1934-1941.

Muhammad, S. A., dan Noor, R. J. 2014. Pengaruh Jenis dan Dosis Pupuk Organik Kompos Olahan Biogas Terhadap Pertumbuhan dan Hasil Tanaman Terung (*Solanum melongena* L.) Varietas Mustang F-1. J. Agrifor. 13 (1), 59-66.

Purnomo, R., Santoso, M., dan Heddy, S. 2013. Pengaruh Berbagai Macam Pupuk Organik Dan Anorganik Terhadap Pertumbuhan Dan Hasil Tanaman Mentimun (*Cucumis sativus* L). Jurnal Produksi Tanaman. 1 (3).