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THE GROWTH RESPONSE AND YIELD OF WHITE EGGPLANT (*Solanum melongena* L.) TO THE APPLICATION OF CORN COB BOKASHI AND LIQUID ORGANIC FERTILIZER OF TEMPEH WASTE

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ABSTRACT

White eggplant is a horticultural commodity that is widely distributed and consumed in Indonesia. It is included in hybrid varieties that have nutrients such as vitamins, calcium, phosphorus and fat. This study aims to obtain the maximum dose of corn cob bokashi and concentration of tempeh waste Liquid Organic Fertilizer (LOF) to increase the growth and yield of white eggplant (Solanum melongena L.). This study used a Randomized Block Design consisting of two factors, namely corn cob bokashi and LOF tempeh waste. Corn cob bokashi consists of levels: 0, 60, 90 and 120 g/plant. While for LOF tempeh waste consists of levels: 0, 250, 500 and 750 ml/polybag. The parameters observed were plant height, stem diameter, fruit diameter, number of fruits per plot, and fruit weight per plot. Observational data were analyzed using an analysis of variance and followed by a difference of means test according to Duncan's Multiple Range Test at $p<0.05$. The interaction of corn cob bokashi and tempeh waste LOF had no significant effect on all parameters. The recommended application of corn cob bokashi is 60 g/plant and LOF tempeh waste as much as 300 ml/polybag to obtain the optimum weight of eggplant fruit.

Keywords: Corn cob bokashi, LOF waste tempe response, white eggplant

INTRODUCTION

White eggplant has many ingredients such as vitamins A, B, and C, calcium, protein, fat, and phosphorus, with a high calcium content of about 217 mg/100g. This makes white eggplant has an important role in nerve and muscle contraction. White eggplant has a low sodium content of about 3 mg/100g and fiber content of about 2.5 g/100g (Vonnisye et al., 2022). In Indonesia, the average eggplant production is 3,200-3,400 kg/ha whereas 1 hectare can produce 30,000 kg of eggplant. Based on the Central Bureau of Statistics of Kabupaten Labuhan Batu in 2021, the area of eggplant plants is 13.5 ha with a production of 22,300 kg, with a yield per hectare of 1,600 kg (Walida, 2018).

The purpose of fertilization is an effort to find the nutrient needs of plants so that production goals can be achieved. Fertilization needs to be done because the content of nutrients in the soil varies and changes due to the loss of nutrients through leaching (Manurung, 2021). Composting is sought to restore soil organic matter that affects soil fertility, one of which is processing corn cob waste.

The use of organic materials like this can increase the availability of soil nutrients and reduce the use of inorganic fertilizers which are expected to benefit in the long run by preserving soil fertility and increasing agricultural productivity (Haitami & Wahyudi, 2019). Organic fertilizers are divided into two, namely solid organic fertilizers and liquid organic fertilizers. There are two types of organic fertilizer: solid organic fertilizer and liquid organic fertilizer. Organic fertilizers have an important role in improving the physical, chemical, and biological properties of soil. Although the nutrient levels contained in organic fertilizers are relatively low, the role of soil chemical properties far exceeds artificial chemical fertilizers (Lubis et al., 2022).

Liquid organic fertilizer can be made using materials that are around us, be it animal manure, vegetable waste or even liquid waste. The advantages of liquid organic fertilizers are that they can improve product quality, are environmentally friendly, can be absorbed quickly by leaves and photosynthesis, increase cation exchange capacity and increase soil fertility and binding between particles. The use of organic fertilizers can reduce inorganic fertilizers (Barus et al., 2020).

The research aims to obtain the maximum dose of corncob bokashi and the concentration of Liquid Organic Fertilizer from tempeh waste to increase the growth and yield of white eggplant plants.

METHODS

The research was conducted at the Growth Center Jl. Peratun No.1, Kenangan Baru, Kecamatan Percut Sei Tuan, Deli Serdang Regency, North Sumatra Province. The research started in May until August 2023. The location is 25 m above sea level, with an average rainfall of 290 mm/month; temperature of 29.5 °C; air humidity of 85%; and sunlight intensity of 166.5 $W.m^{-2}$.

The materials are white eggplant seeds of Kania F1 variety, corn cob bokashi, LOF tempeh waste, and polybags measuring 35 cm × 40 cm with a volume of 5 kg. The tools used in this research are hoes, meters, analytical scales, push scales, plastic ropes, wood, scissors, paddles, sprayers, plastic shades, polybags, digital scales, and stationery.

Research conducted The research was conducted using a Randomized Group Design (RGD) consisting of 2 treatment factors, namely corn cob Bokashi, consisting of T_0: (control), T_1: 60 (g/plant), T_2: 90 (g/plant) and T_3: 120 (g/plant) and the second-factor LOF tempeh waste, consisting of L_0: (control), L_1: 250 (ml/polybag), L_2: 500 (ml/polybag) and L_3: 750 (ml/polybag), each treatment with 3 replications. The treatment of tempeh waste LOF was given by sprinkling it on the planting media around the eggplant plants.

Fifteen (15) kg of corn cob bokashi will be used, so 50 kg of corn cob waste will be required in manufacturing. Put the chopped cob pieces into a large container of about 20 cm height and then mix it with EM-4 to make composting easier. Add the molasses and stir until evenly distributed over the bokashi material. Molasses liquid serves as a food source for microorganisms. After that, rice bran and rice husks are added as a nutrient adhesive. Then give the chopped corn cobs back and mix them the same as the first layer up to several levels and then cover the composting container tightly with a tarpaulin. Composting is carried out at a temperature of around 35-45 ℃. Composting has been successful, indicated by the characteristics of the compost material being well fermented, there is white mold and a distinctive smell.

Tempeh liquid waste is added with a mixture of EM4 and starter in a ratio of 10 liters: 1ml: 1 ml. Then the mixed solution is put into a plastic jar and left for 48 hours for fermentation. Once completely fermented, marked by a brownish change in water color and a distinctive tapai odor, the LOF has been successful and is ready to be used.

Parameters observed included: plant height, stem diameter, fruit diameter, fruit weight per plant and fruit weight per plot. Data were analyzed using analysis of variance, followed by DMRT test and correlation regression.

RESULTS AND DISCUSSION

Plant Height

The treatment of corn cob bokashi had a significant effect on the height of white eggplant plants, but the treatment of LOF tempeh waste and the interaction of the two treatments had no significant effect on the observations of 2, 4, and 6 WAT (weeks after transplanting). The average height of white eggplant plants can be seen in Table 1.

Providing corn cob bokashi had a significant effect on the height of white eggplant plants at 2 WAT. The application of T_1 (60 g/plant) was significantly different compared to T_0 (control) but not significantly different compared to T_2 (90 g/plant) and T_3 (120 g/plant). At 4 WAT, T_1 (60 g/plant) was significantly different compared to T_0 (control), T_2 (90 g/plant) and T_3 (120 g/plant). At 6 WAT, T_1 (60 g/plant) was significantly different compared to T_0 (control) but not significantly different compared to T_2 (90 g/plant) and T_3 (120 g/plant).

Table 1. Plant Height (cm) 2, 4, and 6 WAT with the Treatment of Corn Cob Bokashi and LOF of Tempeh Waste.

Treatment	Plant Age (WAT)		
	2	4	6
Corn cob bokashi			
T_0 (control)	5.69[b]	18.85[b]	42.85[b]
T_1 (60 g/plant)	7.14[a]	28.75[a]	52.10[a]
T_2 (90 g/ plant)	6.75[a]	23.22[b]	47.58[ab]
T_3 (120 g/ plant)	6.82[a]	23.32[b]	48.96[ab]
LOF of tempeh waste			
L_0 (control)	6.17	22.57	47.92
L_1 (250 ml/polybag)	6.77	23.13	47.69
L_2 (500 ml/polybag)	6.72	23.49	47.32
L_3 (750 ml/polybag)	6.73	24.96	48.57

Note: Numbers followed by different letters indicate significant differences in the 5% DMRT test

The correlation between corn cob bokashi and white eggplant plant height can be seen in Figure 1.

In Figure 1, the response of white eggplant plant height to corn cob bokashi treatment forms a positive quadratic graph with the equation $y = -0.0013x^2 + 0.1921x + 43.178$. The treatment of 73.88 grams of corn cob bokashi per plant produces the maximum height of white eggplant 50.42 cm at 6 WAT. With a value of $R^2 = 0.7351$, the role of corn cob bokashi determines the increase in height of white eggplant plants by 73.51%. Referring to the mathematical equation, it is known that the provision of different corn cob bokashi provides a significant increase in plant height. This is because the corn cob bokashi treatment can increase the availability of nutrients as the dose given to white eggplant plants increases

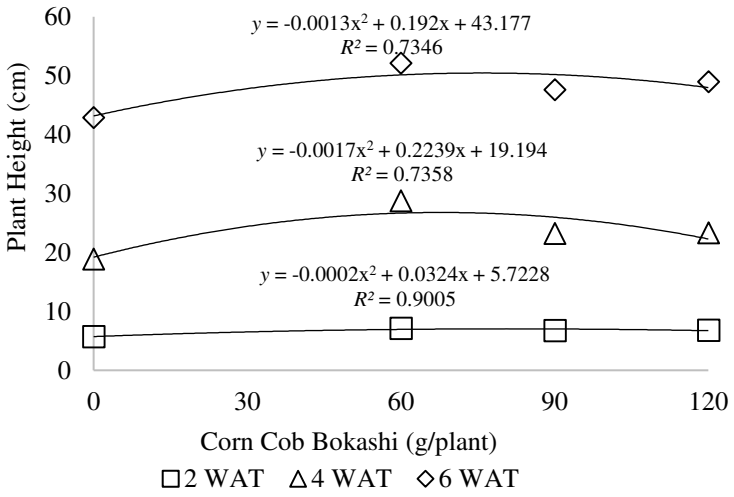

Figure 1. The Correlation of Plant Height (cm) of White Eggplant and Corn Cob Bokashi at the Age of 2, 4 and 6 WAT.

The process of absorption of water and nutrients from the soil to the roots and plants is done by osmosis. Nutrients contained in corn cob bokashi can penetrate the cell walls of eggplant plants due to the availability of nutrients in an available form appropriate to the nutrient needs of plants. This is in line with the research of Marviana & Utami (2014) that the use of corn cob bokashi as much as 1050g bokashi + 2500g soil shows significant plant height in eggplant. The increase in white eggplant plant height is due to the provision of corn cob bokashi which can increase the availability of nitrogen nutrients. This is in line with the research of Raksun & Japa (2019) showing that organic matter is a source of nitrogen in the soil. Organic matter can also act as a binder that greatly helps the mobility of nutrients for plant availability.

Stem Diameter

Referring to the results of the analysis of variance, the treatment of corn cob bokashi on white eggplant plants has a significant effect on stem diameter at the age of 2, 4 and 6 WAT while LOF of tempeh waste and its interaction have no significant effect. The difference in stem diameter due to corn cob bokashi can be seen in Table 2.

At the age of 2 WAT, the stem diameter due to the 90 g/plant corn cob bokashi treatment (T_2) was significantly different compared to the control (T_0), but not significantly different when compared to the application of 60 g/plant (T_1) and 120 g/plant (T_3). Observations at 4 WAT of 90 g/plant corn cob bokashi treatment (T_2) were significantly different compared to the control (T_0), but not significantly different compared to 60 g/plant (T_1) and 120 g/plant (T_3). At the age of 6 WAT, the treatment of 60 g/plant (T_1) corn cob bokashi produced the largest stem diameter and was significantly different from the control (T_0), T_2 and T_3.

Table 2. Stem Diameter (mm) 2, 4 and 6 WAT due to Bokashi Treatment of Corn Cobs and LOF Tempeh Waste.

Treatment	Plant Age (WAT)		
	2	4	6
Corn Cob Bokashi			
T_0 (control)	4.72[b]	6.68[b]	10.00[b]
T_1 (60 g/plant)	5.51[a]	7.93[a]	11.47[a]
T_2 (90 g/ plant)	5.60[a]	8.42[a]	10.38[b]
T_3 (120 g/ plant)	5.30[ab]	7.67[a]	10.00[b]
LOF of Tempeh Waste			
L_0 (control)	5.13	7.63	10.27
L_1 (250 ml/polybag)	5.42	7.85	10.74
L_2 (500 ml/polybag)	5.48	7.58	10.40
L_3 (750 ml/polybag)	5.08	7.65	10.44

Note: Numbers followed by different letters indicate significant differences in the 5% DMRT test

The correlation between corn cob bokashi treatment and the stem diameter of white eggplant can be seen in Figure 2.

In Figure 2, it can be seen that the provision of corn cob bokashi at various levels has a significant effect on the diameter at the age of 6 WAT white eggplant stem by forming a positive quadrative graph with the equation: $y = -0.0003x^2 + 0.0386x + 10.049$. Based on these calculations, 64.33 g/plant of corn cob bokashi gives the maximum stem diameter growth of 11.29 mm at the age of 6 WAT. With a value of $R^2 = 0.791$, it shows that 79.1% of corn cob bokashi plays a role in determining the increase in stem diameter of white eggplant.

The N nutrient content contained in corn cob bokashi can increase nitrogen and phosphorus nutrients in the soil which support plant growth in the preparation of protein and chlorophyll. Chlorophyll plays a role in the photosynthesis process to increase vegetative growth, including stem enlargement. This is in line with the research of Jayantia et al. (2018) which states that N is directly or indirectly involved in cell enlargement and new cell division, tissue production to increase stem diameter, significantly increasing the size of leaf and stem vascularization.

In addition to N nutrients, P and K nutrients in the soil can meet the needs of plants during the process of stem diameter growth. This is in line with the research of Sulistyowati & Yunita (2017) which states that the increase in stem diameter is also influenced by nutrients P and K supporting the formation of eggplant stem diameter increases in size and becomes strong.

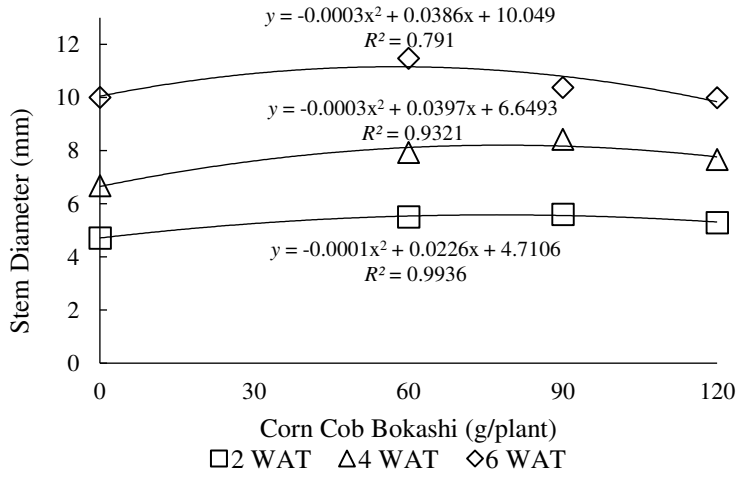

Figure 2. The Correlation of White Eggplant Stem Diameter and Corn Cob Bokashi at the Age of 2, 4 and 6 WAT

Fruit Diameter

The treatment of corn cob bokashi had a significant effect on fruit diameter, but the provision of tempeh waste and the interaction between the two treatments had no significant effect on the diameter of white eggplant fruit. The average diameter of white eggplant fruit can be seen in Table 3.

Table 3. Fruit Diameter (mm) due to the Treatment of Corn Cob Bokashi and LOF of Tempeh Waste.

LOF of Tempeh Waste (ml/polybag)	Corn Cob Bokashi (g/plant)				Average
	T_0 (control)	T_1 (60)	T_2 (90)	T_3 (120)	
L_0 (control)	42.10	40.58	43.44	41.94	42.02
L_1 (250)	39.37	46.20	45.48	41.50	43.14
L_2 (500)	37.71	40.61	42.78	43.19	41.07
L_3 (750)	36.91	47.28	43.17	39.95	41.83
Average	39.02[b]	43.67[a]	43.72[a]	41.65[ab]	

Note: Numbers followed by different letters indicate significant differences in the 5% DMRT test

Based on Table 3, the treatment of corn cob bokashi has a significant effect on fruit diameter. The biggest diameter shown in the 90 g/plant (T_2) treatment with an average value of 43.72 mm, is significantly different from the control (T_0) with an average value of 39.02 mm, but not significantly different from T_1 (60 g/plant) with an average value of 43.67 mm and 120 g/plant (T_3) with an average value of 41.65 mm.

The correlation between the fruit diameter of white eggplant plants and corn cob bokashi at harvest time can be seen in Figure 3.

The correlation between corn cob bokashi and white eggplant fruit diameter forms a quadratic graph with the equation $y = -0.0009x^2 + 0.1362x + 39.007$. Based on the calculation, applying 75.67 g/plant of corn cob bokashi produces the maximum white eggplant fruit diameter of 44.15 mm. With a value of $R^2 = 0.9979$, it shows that the role of corn cob bokashi is 99.79% determining the increase in the diameter of white eggplant fruit. Increasing the dose of bokashi to more than 75.67 g/plant will reduce fruit diameter.

Applying corn cob bokashi shows a significant effect on fruit diameter, this is because fruit filling is strongly influenced by the availability of nutrients in the soil that can be absorbed by plants to support photosynthesis. In line with this opinion, Muldiana & Rosdiana (2017) state that the availability of sufficient nutrients can help the photosynthesis process which produces carbohydrates, fats, and mineral proteins which will be translocated to the storage part of the plant, namely the fruit.

The size of the fruit depends on the availability of nutrients in the soil. The diameter of the white eggplant fruit is significantly different due to the provision of bokashi presumably the level of nutrients contained in it according to the treatment level adds to the availability of nutrients in the planting medium sufficiently (balanced) and even exceeds the needs of plants so that the storage of photosynthetic assimilates is significant. In line with the research of Arisona et al. (2022) nutrients that exist in a balanced state and supported by a good environment will trigger plant growth. The increase in fruit diameter is more influenced by the availability of P and K elements in plant nutrients.

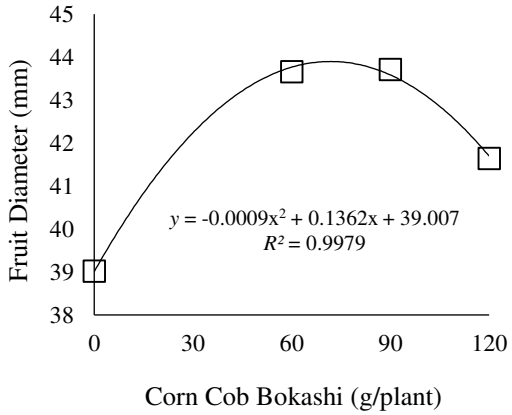

Figure 3. Correlation of White Eggplant Fruit Diameter and Corn Cob Bokashi

Number of Fruits per Plot

The application of LOF tempeh waste had a significant effect on the number of white eggplant fruits per plot. But corn cob bokashi

and the interaction of the two treatments had no significant effect. The average number of fruits per plot of white eggplant can be seen in Table 4.

Table 4. Number of Fruits per plot with the Treatment of Corn Cob Bokashi and LOF of Tempeh Waste

LOF of Tempeh Waste (ml/polybag)	Corn Cob Bokashi (g/plant)				Average
	T_0 (control)	T_1 (60)	T_2 (90)	T_3 (120)	
L_0 (control)	5.00	6.33	5.33	6.33	5.75[b]
L_1 (250)	4.67	5.33	7.33	5.33	5.67[b]
L_2 (500)	6.33	7.67	9.33	6.67	7.50[a]
L_3 (750)	4.67	4.67	3.67	6.33	4.83[b]
Average	5.17	6.00	6.42	6.17	

Note: Numbers followed by different letters indicate significant differences in the 5% DMRT test

Based on Table 4, the application of tempeh waste significantly affects the number of fruits per plot. The highest results were shown in the 500 ml/polybag (L2) treatment with an average number of fruits of 7.50 fruits which was significantly different compared to the control treatment (L0), 250 ml/polybag (L1) and 750 ml/polybag (L3). The correlation between the number of fruits per plot of white eggplant plants and the treatment of tempeh waste can be seen in Figure 4.

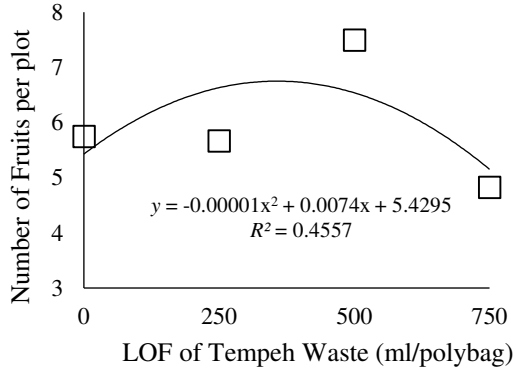

Figure 4. Correlation of the Number of Fruits per Plot of White Eggplant and Treatment of LOF of Tempeh Waste

Based on Figure 4, the correlation of tempeh waste and the number of white eggplant fruits per plot formed a quadratic graph with the equation $y = -0.00001x^2 + 0.0074x + 5.4292$. From this equation, the provision of tempeh waste as much as 370 ml/polybag, produces the maximum number of fruits as much as 6.79 white eggplant fruits per plot. With a value of $R^2 = 0.4538$, the role of tempeh waste is 45.38% to determine the increase in the number of white eggplant fruits per plot. This is because the nutrient content of tempeh waste supports plant physiological processes such as photosynthesis and transpiration so that the utilization of nutrients by plants becomes more efficient.

According to the opinion of Mufriah & Sulistiani (2020), the role of organic fertilizers is to increase the water-holding capacity in the soil so that plants are better at absorbing water and nutrients for physiological and photosynthetic processes, including flower and fruit production. Plant production reflects the ability of plants to absorb nutrients in the soil. In addition, organic fertilizers can improve the development of plant roots, so improvements in soil physical, chemical and biological properties and plant root development are expected to increase the efficiency of inorganic fertilizer absorption (Wahyuni & Nasution, 2019).

Fruit Weight per Plot

The application of corn cob bokashi had a significant effect on fruit weight per plot, but the treatment of tempeh waste and the interaction between the two treatments had no significant effect on fruit weight per plot in white eggplant plants. The average weight of white eggplant fruit per plot can be seen in Table 5.

The application of corn cob bokashi has a significant effect on fruit weight per plot. The heaviest was shown in the 60 gr/plant (T_1) treatment at 578.75 g/plot, significantly different from the control (T_0). However, T1 was not significantly different in fruit weight compared to the application of corn cob bokashi at a dose of 90 gr/plant (T_2) and 120 gr/plant (T_3).

Table 5. Fruit Weight per Plot (g) with Corn Cob Bokashi and Treatment of LOF of Tempeh Waste

LOF of Tempeh Waste (ml/polybag)	Corn Cob Bokashi (g/plant)				Average
	T_0 (control)	T_1 (60)	T_2 (90)	T_3 (120)	
L_0 (control)	455.00	419.67	517.67	521.00	478.33
L_1 (250)	450.33	680.00	641.00	479.67	562.75
L_2 (500)	408.00	475.00	579.67	512.00	493.67
L_3 (750)	363.67	740.33	442.00	513.00	514.75
Average	419.25[b]	578.75[a]	545.08[a]	506.42[ab]	

Note: Numbers followed by different letters indicate significant differences in the 5% DMRT test

The correlation of corn cob bokashi application to fruit weight per plot of white eggplant can be seen in Figure 5.

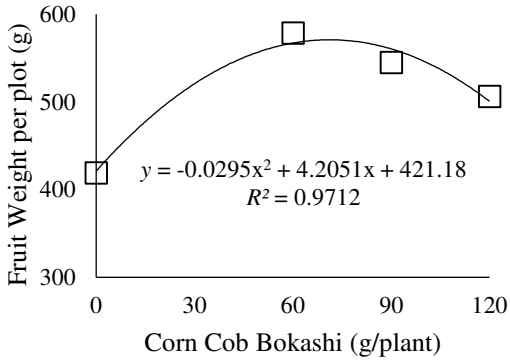

Figure 5. Correlation of Fruit Weight per plot (g) of White Eggplant and Corn Cob Bokashi Treatment

It is seen that the application of corn cob bokashi at various levels has a significant effect on the weight of white eggplant fruit per plot. Showing a quadratic graph $y = -0.0295x^2 + 4.2051x + 421.18$. Based on these results by giving 71.27 g/plant of corn cob bokashi, it produces the maximum value of 571.03 grams on the weight of white eggplant fruit per plot. With a value of $R^2 = 0.9712$, the role of corn cob bokashi is 97.12% determining the increase in white eggplant fruit weight per plot.

The application of corn cob bokashi can increase the weight of white eggplant fruit. Corn cob bokashi can improve the soil media because it contains C-organic (44.16%) and nutrients that can increase the yield of white eggplant. The nutrient element P (2.71%) can accelerate seed formation and fruit ripening. This is in accordance with the research of Fajriyati (2020) which states that plant growth with sufficient nutrients can result in more active plant metabolic activity, which ultimately results in lengthening and increasing the number of cells well which affects the increase in white eggplant fruit weight. According to Andina & Zulkifli (2023), fertilization using organic materials can maintain nutrients so that there is an increase in assimilates that are useful for increasing fruit weight and production yields. This is due to the nature of organic matter that can improve the biological, chemical and physical properties of the soil.

CONCLUSION

The application of corn cob bokashi has a significant effect on the parameters of maximum plant height (dose of 73.88 g/plant), maximum fruit diameter (75.67 g/plant), and maximum fruit weight per plot of white eggplant plants (71.27 g/plant). The application of LOF of tempeh waste has a significant effect on the parameters of the maximum number of fruits per plot of white eggplant plants (370 ml/polybag). It is recommended to use a dose of corn cob bokashi as much as 60 g/plant and LOF of tempeh waste as much as 250 ml/polybag to obtain optimum results.

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