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Increasing the growth and yield of tomato plants (*Lycopersicum Esculentum* Mill) by Applying Palm Oil Compost

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ABSTRACT

Tomato (*Lycopersicum esculentum* Mill) is a horticultural commodity classified as a vegetable plant and has high economic value in the local and international markets. This research was conducted to determine the effect of applying oil palm frond compost on the growth and yield of tomato plants and to determine the best dosage of oil palm frond compost to increase the yield and growth of tomato plants. This research was conducted at the Screen House of the Faculty of Agriculture, University of Pasir Pengaraian, from July 2022 to October 2022. The design used in this study was a Completely Randomized Design (CRD) with 5 treatments, namely P0 = Without adding oil palm. frond compost, P1 = 25 g/polybag of palm frond compost, P2 = 50 g/polybag of palm frond compost, P3 = 75 g/polybag of palm frond compost, P4 = 100 g/polybag of palm frond compost. The results showed that the application of various doses of palm frond compost significantly affected the parameters of the number of fruits per tomato plant. Still, they had no significant effect on the parameters of plant height, number of leaves, and flowering time. The P4 treatment, namely applying palm frond compost at a dose of 100 g/polybag, tended to produce the best observation parameter: the number of fruits per plant. In contrast, the plant height parameter tended to be better with applying palm fronds. frond compost.

Keywords: *Compost, growth, palm fronds, production, Lycopersicum Esculentum Mill*.

1. INTRODUCTION

Tomato (Lycopersicum esculentum Mill) is a horticultural product classified as a vegetable plant with a high economic value on the market, both domestically and internationally. The market demand for tomatoes continues to rise from one year to the next; in 2018, the market demand for tomatoes in Indonesia was 976,772 tonnes, with a 4.46% increase to 1,020,333 tonnes in 2019. In addition, the area of tomato cultivation in Indonesia has increased by 1.15 percent from 54,158 Ha in 2018 to 54,780 Ha in 2019 (Directorate General of Horticulture, 2020).

Tomato producers experience constraints. Fertilizing with composted palm oil fronds is one method for overcoming one of the challenges farmers encounter: ensuring the availability of nutrients in the soil. Fertilization is crucial for promoting healthy plant growth and optimal yield. Fertilization is one of the methods used to add nutrients to the soil and can enhance its chemical, physical, and biological properties.

Fertilization directly impacts soil maintenance, which seeks to restore nutrient conditions so that the soil can support plant growth and increase land productivity. Continuous intake of nutrients through crop yields without a corresponding return of nutrients through organic fertilization will cause the soil to become nutrient-depleted, nutrient-deficient, and unproductive (Rahmi and Juadati, 2003).

Increasing soil fertility with organic fertilizers is one strategy for increasing tomato production. Compost made from palm fronds is an example of an organic material that can be used to combat soil fertility. Palm frond waste has the potential to be converted into fertility-enhancing materials. Naturally decomposing soil as compost. Nitrogen 2.6-2.9%, Phosphorus 0.16-0.19%, Potassium 1.1-1.3%, Calcium 0.5-0.7%, Magnesium 0.3-0.45%, Sulfur 0.25-0.40%, and Chlorine 0.5-0.7% are found in the fronds of the oil palm (Syahfitri, 2008). According to Jeki 2021, the maximum values for plant height, frond length, hump diameter, and leaf width were observed in oil palm plants treated with 100 g of palm frond compost per polybag.

2. MATERIAL AND METHODS

This investigation was conducted between July and October of 2022 at the Screen House of the Faculty of Agriculture, Pasir Pengaraian University, Rambah Hilir Village, Rokan Hulu Regency.

Mutiara Tomato Seeds, polybags measuring 35x40 cm and 10x15 cm, oil palm fronds, poultry manure, bran, brown sugar, and Effective Microorganisms (EM4) soil were used in this investigation.

Hoes, drums, cutters, machetes, sprinkler, measuring tape, a stake, a hoe, a bucket, a sieve, a machete, a tarpaulin, a shovel, a scale, a rope, a ruler, and stationery are the instruments used.

This study was carried out using a completely randomized design (CRD) with 5 treatments and 3 replications to obtain 15 experimental units. The treatment in the study was as follows: Without adding oil palm frond compost, 25 g/polybag of palm frond compost, 50 g/polybag of oil palm frond compost, 75 g/polybag of oil palm frond compost, 100 g/polybag of oil palm frond compost.

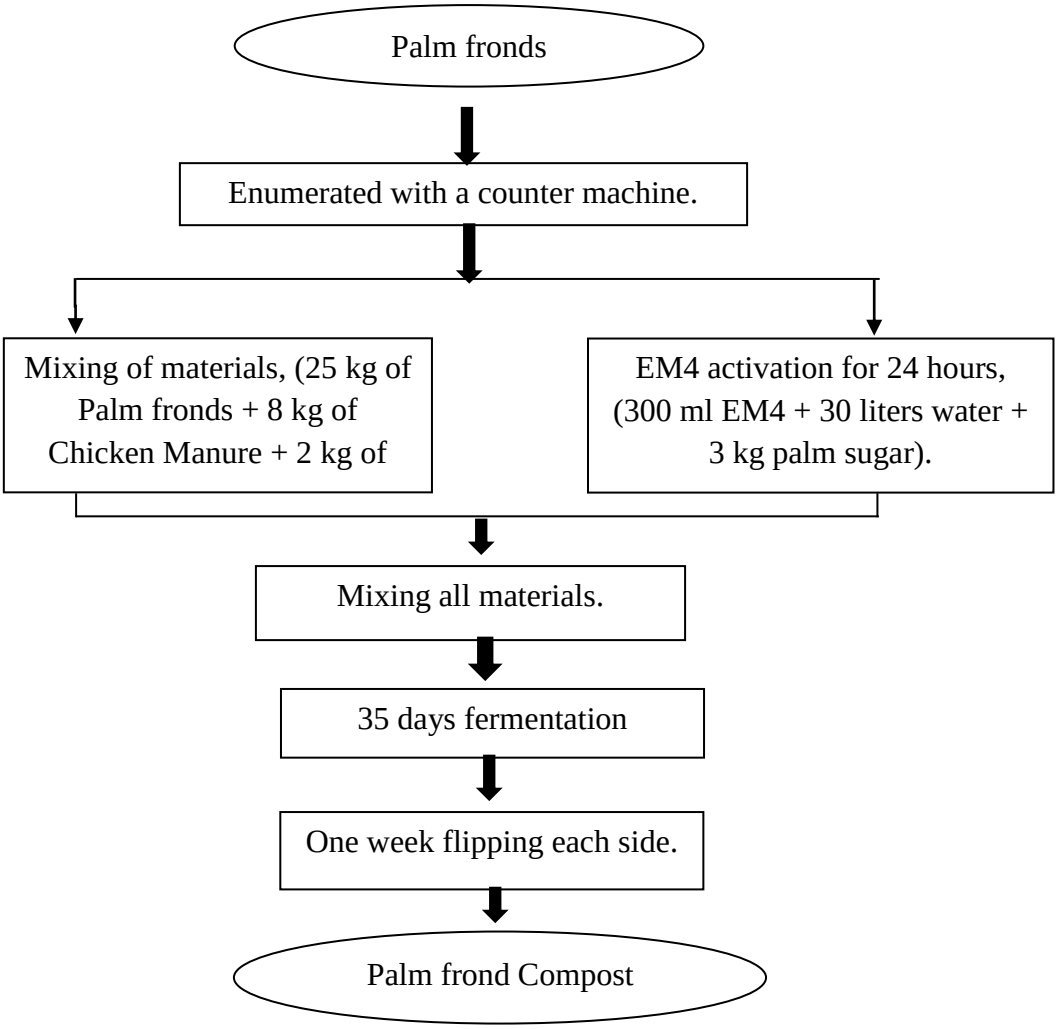

Figure 1. Research floe chart

Preparation of Planting Media

1. Seeding Seeds

The initial step in planting is to prepare the seedbed. In polybags measuring 10 by 15 centimeters, a mixture of soil, husk charcoal, and manure is used to cultivate seedlings. One by one, seeds are deposited in the tray. First, the seeds are soaked in tepid water for five to six hours. The soil is then drained and only then are seedlings planted.

2. Planting

After one month from sowing, tomato seedlings can be transplanted. The plants are planted in the afternoon so they do not wilt and can acclimate to the soil. When planting the seeds, attempt to prevent the tomato leaves from directly touching the soil to prevent rot and disease.

Administering Treatment

During the course of the experiment, palm frond compost was applied once with the following treatments: P0 = 0 g/polybag, P1 = 25 g/polybag, P2 = 50 g/polybag, P3 = 75 g/polybag, and P4 = 100 g/polybag. Compost made from palm fronds is applied by combining it with topsoil. Then it is agitated until thoroughly combined, placed in a poly bag, and left for one week.

Maintenance

Among the maintenance tasks that can be performed are embroidery, weeding, irrigation, and pest and disease control. As soon as it is observed that plants have died or been consumed by vermin, stitching is performed. The plants are stitched until 15 HST (days after sowing). Additionally, weeding must be performed so that the tomato plants are not bothered by weeds and weeds. To prevent plants

from drying out, it is necessary to water them in accordance with the climatic conditions. Pest and disease control is accomplished by eliminating pests and diseased plants. When pest and disease infestations reach the economic threshold, Metindo 25 WP and Antracol 70 WP are used for chemical control. Fruit caterpillars and aphids are the parasites that attack plants, while fruit rot is the disease that attacks plants.

Harvest

Tomatoes are harvested when the tomato plants reach 72 hours of daylight saving time. The harvesting criteria are green fruit epidermis that turns reddish yellow, the edges of old leaves drying out, and the stems turning yellow. Fruit is twisted individually, and only ripe fruit is chosen for harvesting so that it will last longer. not easy to rot and not easy to bruise.

Observation Parameters

1. Analysis of Compost from Palm Oil Leaves

The chemical content of the palm frond compost was analyzed in the UR laboratory. The chemical constituents to be analyzed are the elements N, P, K, Organic C, water content, and C/N.

1. Plant Height

Using a measuring tape, the height of the tomato plants is determined from the stem's base to the developing point. The measurement is performed with a marker marked with a boundary five centimeters above the ground's surface so that the measurement standard does not alter. The plant's height is measured weekly until the generative phase, characterized by the appearance of the first flower. Observations are made when the plant reaches 21 HSPT..

2. Leaves Quantity

The number of leaves was counted once a week until entering the generative phase which was marked by the appearance of the first flower, the leaves counted were fresh and fully opened leaves, observations were made when the plants were 21 HSPT, then data on the number of leaves of tomato plants were processed statistically, namely data from the last week of observation of the vegetative phase.

3. Flowering Age

Observation of the first flower from planting until the plant produces the first flower. Observations were made by counting on what day the flowers appeared and observing the plants.

4. Number of Fruits Per Plant

The number of fruit is observed by counting the number of tomatoes planted.

3. RESULT AND DISCUSSION

1. Results of Compost Analysis of Palm Leaf Compost

The nutrient content analyzed in this study was water content, C/N ratio, C – Organic, pH, N–Total, P2O5, and K2O. A comparison of the results of the analysis of compost nutrient content with the Indonesian National Standard (SNI) is presented in Table 4.

Table 4.1 Nutrient Analysis Results for Palm Oil Compost

Nutrient	Nutrient Content of Palm Leaf Compost	Compost quality standards (SNI 19-7030-2004)	
		Min	Max
Compost water content	74.23 %	-	50 %
Rasio C/N	5.75	10	20
C-Organik	23.92 %	9.80 %	32 %
Ph	7.69	6.80	7.49
N-Total	4.16 %	0.40 %	-
P2O5	3.77 %	0.1 %	-
K2O	4.96 %	0.2 %	-

Source: Laboratory of Soil Science, Faculty of Agriculture, University of Riau.

The results of the analysis of the palm frond compost showed that the water content of the compost was 74.23% which was very high, which is an important key in the composting process. This happens when the water content is too low or high, reducing the composting process's efficiency (Chen, 2007). Optimal water content is 45% - 55% (Hoitink, 2008).

According to the analysis of the compost, the C/N ratio of the palm frond compost was 5.75, which is still relatively low. According to Novizan (2005), good compost possesses a C/N12-15 ratio. If the C/N ratio is high, then the nutrient content is not readily available to plants, whereas if the C/N ratio is low, then the nutrient content is readily available.

The C-Organic yield of the palm frond compost was 23.92 percent. The C-Organic content of palm frond compost indicates the presence of decomposition during composting and the compost's maturity. C-Organic is carbon that microorganisms use as an energy source to build cells by exhaling CO2 and other substances (Mirwan, 2015).

The pH of the composted palm fronds is 7.69, which is within the acceptable range. Isroi (2008) reports that the pH of mature compost is typically close to neutral. According to SNI 19-7030-2004 compost quality standards, the optimal pH range for compost is between 6.8 and 7.49. Nitrogen is a source of energy for soil microorganisms, and the palm frond decomposition contains 4.16 percent total nitrogen. Because microorganisms that decompose compost materials require nitrogen for their growth (Sriharti and Salim, 2010), organic matter's nitrogen content affects the decomposition rate.

The P2O5 yield of palm frond compost is a high 3.77 percent. Phosphorus is a macronutrient that aids in developing plant roots and cell division and increasing production yields in the form of seed and produce weight. According to Widarti et al. (2015), P2O5 plays a crucial function in soil fertility, the photosynthesis process, and the chemical physiology of plants. Phosphorus is required for cell division, tissue development, and plant growth point formation.

The K2O result of 4.96 percent is a significant number. Potassium is abundant in the compost because a significant amount of potassium is derived from organic matter. Potassium plays an essential role in photosynthesis in the formation of protein and cellulose, which strengthen the stems of plants (Ekawandani and Kusuma, 2018). Plants with a potassium deficiency will exhibit brown leaf margins. Potassium binder is produced by decomposing organic matter in compost stockpiles by microorganisms (Trivana and Pradhana, 2017).

2. Plant Height (cm)

The results of the analysis of variance showed that the administration of several doses of palm frond compost had no significant effect on the parameters of tomato plant height. The average height of tomato plants can be seen in Figure 4.1..

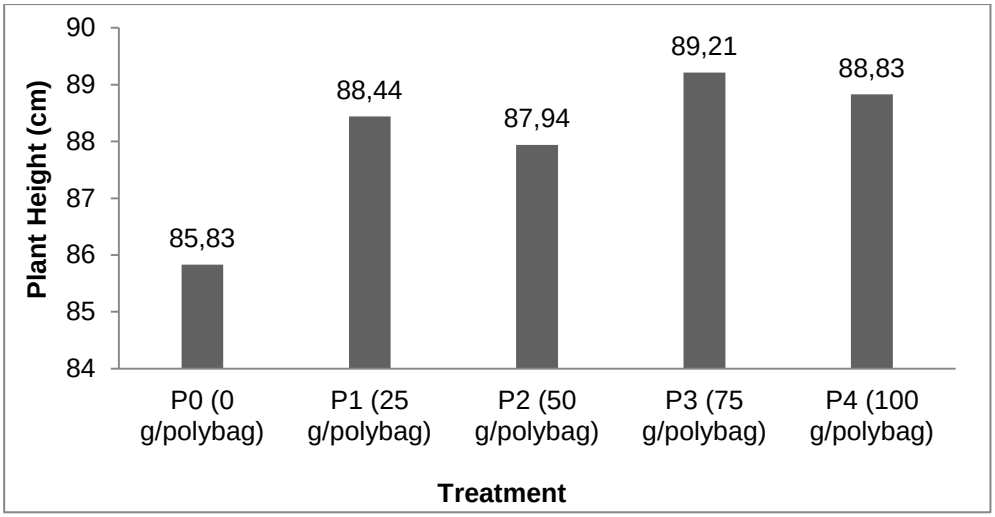

Figure 2. Average Height of Tomato Plants at Observational Age with Oil Palm Leaf Compost Treatment.

Figure 4.1 shows that the application of oil palm frond compost gave a non-significantly different plant height yield, but the P3 treatment of the application of oil palm frond compost (75 g/polybag) tended to produce the best plant height compared to P4 providing oil palm frond compost (100 g/polybag) polybag), P1 (25 g/polybag), P2 (50 g/polybag), and P0 (0 g/polybag).

Applying compost will help increase soil fertility through the release of nutrients slowly through the process of mineralization. Based on Musnawar (2003), manure, compost and green manure are slow-release fertilizers, namely the nutrients in the fertilizer are released slowly and continuously over a certain time so that the nutrients are not immediately available to plants. This study's results align with Sundari (2011), which stated that applying palm frond compost with various decomposers gave significantly different results on the parameters of pakcoy plant height.

3. Number of Leaves (strands)

The results of the analysis of variance showed that the application of palm frond compost had no significant effect on the number of leaves of tomato plants. The average number of tomato leaves can be seen in Figure 4.3

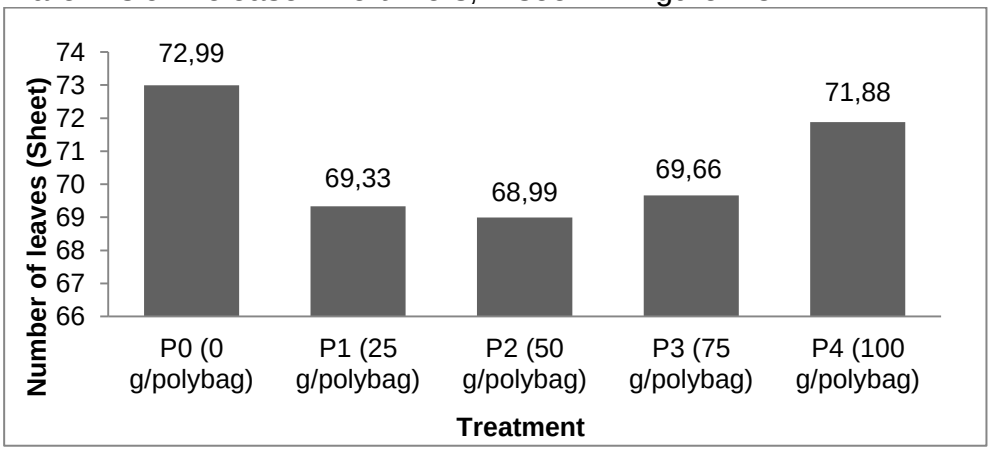

Figure 4.3. Reirata Total Number of Tomato Plant Leaves at Various Ages Observations on the Treatment of Oil Palm Leaf Compost.

Figure 4.3 shows that the application of palm frond compost gave the results of the number of leaves that were not significantly different. Still, the P0 treatment of the application of palm frond compost (0 g/polybag) tended to produce the best number of leaves compared to P4 giving the palm frond compost (100

g/polybag)), P3 (75 g/polybag), P1 (25 g/polybag) and P2 (50 g/polybag).

Compost made from oil palm fronds is extremely nutrient-dense, particularly in nitrogen. Still, tomato plants have not been able to assimilate the nutrients contained in oil palm frond compost optimally. This is consistent with Jumin (2010), who stated that N is an essential element for the vegetative growth of plants, particularly their leaves. N is one of the macroelements that plays a crucial role in promoting plant growth.

Sudrajat (2014) also stated that the availability of elemental nitrogen could influence the morphology and quantity of fronds. According to Gani et al., (2022), the administration of coconut water and manure did not significantly affect the number of leaves. Tomato crop.

4. Flowering Age

The results of the analysis of variance showed that the dosage of palm frond compost had no significant effect on the flowering age of tomato plants. The average yield of the number of flowers of tomato plants can be seen in Figure 4.4.

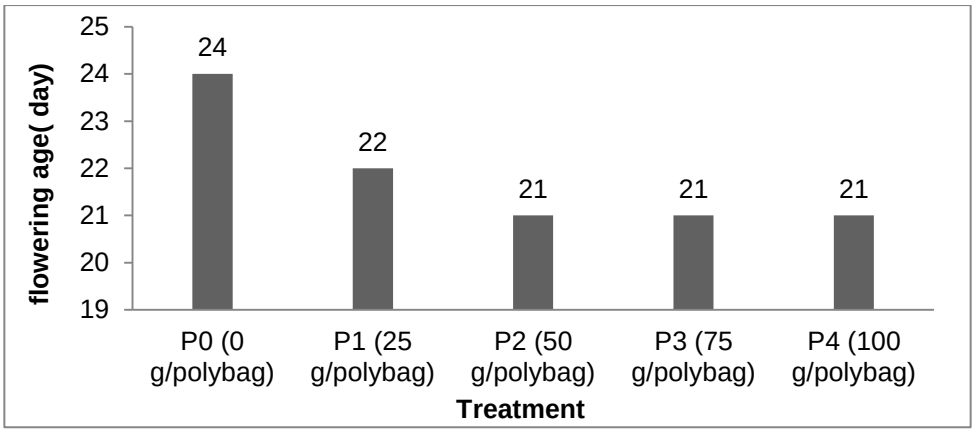

Figure 4.4. The average flowering age of tomato plants at the age of observation with the treatment of palm oil frond compost.

Figure 4.4 shows that applying palm frond compost gave significantly different results. Treatments P4, P3, P2 tended to flower faster, namely P4 (100 g/polybag), P3 (75 g/polybag), P2 (50 g/polybag), compared to P1 (25 g/polybag), and P0 (0 g/polybag).

The genetic nature of the plant influences the process of the emergence of flowers on tomato plants. Differences in flowering and harvesting ages of each genotype are caused by genetic factors that play a role in them. Hartati (2000) stated that tomato plants began to flower when they entered the age of 18-25 days after planting, but in this study, tomato plants flowered faster, namely 21 days after planting. Ruchjaningsih et al. (2000) also stated that a genotype will respond differently to the same environment and different environments..

The variety of tomato plants grown also influences the age at which flowers appear. According to Mariani et al. (2017), plant flowering is a transition from the vegetative to the reproductive phase, which both internal and external factors can influence. Plant genetic factors are believed to be more dominant than environmental factors, such as using organic fertilizer varieties and doses of rice husk mulch. This is consistent with Istianingrum and Damanhuri's (2016) assertion that plant characteristics are controlled by DNA, suggesting that the environment does not significantly affect plant characteristics.

5. Number of Fruits Per Plant

The results of the analysis of variance showed that the application of palm frond compost was significantly different from the number of fruits per tomato plant at the age of observation. The average

number of fruits per tomato plant can be seen in Figure 4.5.

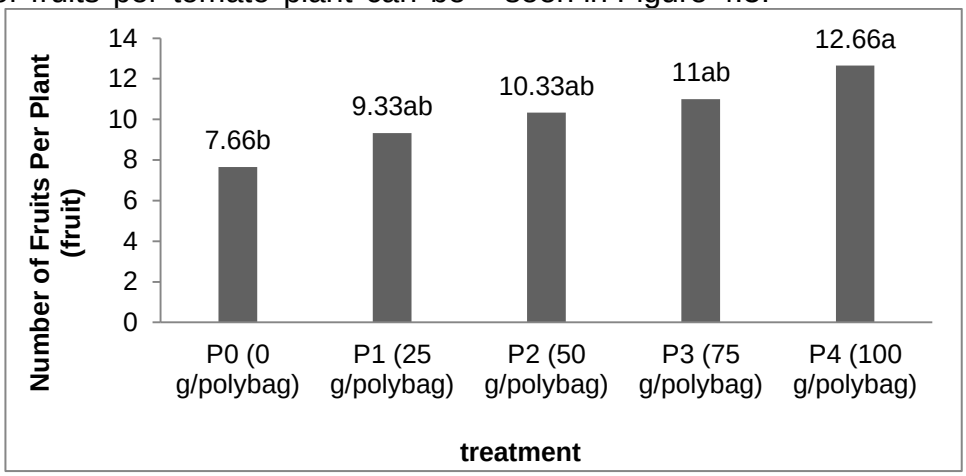

Figure 4.5. The Average Number of Fruits of Tomato Plants at Various Ages Observations on the Treatment of Oil Palm Leaf Compost.

Figure 4.5 shows that the application of Oil Palm Frond Compost yielded a significantly different number of fruits per plant, namely P4 (100 g/polybag) with a value of 12.66 pieces, P3 (75 g/polybag) with a value of 11 pieces, P2 (50 g/ polybag) with a value of 10.33 pieces, P1 (25 g/polybag) with a value of 9.33 pieces, and P0 (0 g/polybag) with a value of 7.66 pieces.

The higher the dose of palm frond compost, the more nutrients are available and absorbed by plants, especially P and K nutrients, affecting tomato plants' generative/fruiting phase. In line with Soleh's research (2009), organic matter in the soil for plants can also improve generative growth, especially the flower formation phase and the fertilization process. High phosphorus stimulates plant flowering, while potassium strengthens flower tissue so it doesn't fall off easily. According to Sainju et al. (2003), the additional doses of compost make the availability of P and K nutrients for plants sufficient to support and maintain the number of the fruit of tomato plants. Sutedjo (2002) states that the need for nutrients for each plant growth and development phase is different.

4. CONCLUSION

The application of various doses of palm frond compost significantly affected the parameters of the number of fruits per tomato plant but not on the parameters of plant height, stem diameter, number of leaves, flowering age, number of flowers, harvest age, and fruit weight. Palm frond compost with a dose of 100 g/polybag tends to produce the best results for the parameter of observing the number of fruits per plant. In contrast, oil palm frond compost tends to produce better results for the parameters of plant height, stem diameter, harvesting age, and number of flowers.

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