

The Influence of Solid Palm Oil Waste and Npk Fertilizer on the Growth and the Production of Green Eggplant (*Solanum Melongena*L.)

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Abstract

The purpose of this research was to discover the effect of solid and NPK fertilizer, as well as the interaction of solid and NPK fertilizer on the growth and production of green eggplant. This research used a factorial randomized block design with two treatment factors, namely the first factor: Administration of oil palm solid which consisted of 4 levels of treatment, namely: S0 = No palm oil waste solid; S1 = Administration of palm oil waste solid at 0.5 kg/m²; S2 = Administration of palm oil waste solid at 1 kg/m²; S3 = Administration of palm oil waste solid at 1.5 kg/m². The second factor is the addition of NPK fertilizer per plant (J) consisting of 3 levels of treatment, namely: J0 = 0 g/plant; J1 = 5 g/plant; J2 = 10 g/plant. The results showed that solid treatment significantly affected the plants height at ages 2, 4, and 6 MST, flowering age, production per plant, and production per plot. The treatment of Solid S3 produced the highest plants aged 2, 4, and 6 MST, respectively (21.78 cm), (53.45 cm), and (77.78 cm), the fastest flowering age (32.89 days), highest production per plant (1748.77 g), and highest production per plot (21.89 kg). The NPK treatment significantly affected the plants height at ages 4 and 6 WAP, flowering age, production per plant, and production per plot. The NPK J2 fertilizer dosage treatment produced the highest plants aged 4 and 6 WAP, respectively (47.83 cm), and (75.84 cm), the fastest flowering age (32.91 days), the highest production per plant (1562.91 g), and the highest production per plot (19.86 kg). The interaction treatment of the NPK fertilizer and solid administration did not significantly affect all parameters. The combination of S3J2 produced the highest plants aged 2 and 6 WAP, respectively (22.33 cm) and (79.67 cm), the fastest flowering age (32.33 days), the highest production per plant (1816.67 g), the and highest production per plot (22.49 kg).

Keywords: Green Eggplant, Solid, NPK Fertilizer.

Introduction

Eggplant (*Solanum melongena* L.) is one of the horticultural plant products that are widely distributed in Indonesia. Eggplant comes from Sri Lanka and India. Eggplant is an important agricultural commodity needed in Indonesia because it has quite complete nutritional content and has high economic value; usually used as food ingredients, therapeutic ingredients, and natural cosmetic ingredients. Eggplant contains a lot of potassium and Vitamin A which is useful for the body. The chemical composition of eggplant per 100 grams, namely: 92.70 grams of water; 0.60 gram of ash (mineral); 0.60 mg of iron; 5.70 grams of carbohydrate; 0.20 gram of fat; 0.80 gram of fiber; 24.00 cal (calories); 27.00 mg of phosphorus; 223.00 mg of potassium; 30.00 mg of calcium; 1.10 grams of protein; 4.00 mg of sodium; 0.60 mg of Vitamin B3; 0.05 mg of Vitamin B2; 10.00 mg of Vitamin B1; 130.00 SI of Vitamin A; and 5.00 mg of Vitamin C (Budiman, 2008)

Green eggplant is one of the vegetables that is quite famous and is popular with all levels of society. Young eggplants, in addition to being good for to cook as Indonesian *Lalapan*, also contain high levels of nutrition; and their composition is complete so that the green eggplant commodity has the potential to be developed intensively on an agribusiness scale, as well as contributing substantially to nutritious food diversity for the population (Rukmana, 2009).

The eggplant market potential can also be seen in terms of prices that are affordable by all levels of society so as to open up greater opportunities for market and farmers uptake. Therefore, the demand for eggplant commodities will continue to increase along with the population growth and increasing the public awareness of health.

Eggplants contain active substances that function for counterparts. In addition, eggplant can prevent diabetes and increase passion at work. However, for patients with inflammatory bowel disease or inflammation of the anus, and women with uterine enlargement, are not allowed to eat eggplant because it can cause things that are not good. The type of eggplant *solanumsanitwongsei* is very good for the diabetes medicine (Sunarjono, 2008).

Efforts to increase eggplant productivity can be done in many ways. The eggplant crop production is strongly influenced by cultivation techniques, pest control, and fertilization which can be done through roots and leaves.

Fertilizer is the key to soil fertility. By fertilizing, the nutrients that are transported during harvest can be returned. Fertilizing means adding nutrients to the soil (root fertilizer) and plants (leaf fertilizer). Fertilization aims to provide nutrients needed by plants for their growth and their quality fruit production. In addition, the basic fertilizer is given at the time of tillage. Plants are also given supplementary fertilizers, carried out periodically to provide adequate nutrition for them for optimal production. Supplementary fertilizers are given in the form of a solution and poured into the planting holes (Hadisuwito, 2007).

Solid is the solid waste from the by-product of the processing of fresh fruit bunches (FFB) in a palm oil mill into crude palm oil or CPO. Raw solid has the shape and consistency of tofu pulp, brown and sweet sour, and still contain CPO around 1.5% (Ruswendi, 2008).

NPK fertilizer is called a complete compound fertilizer. Compound fertilizer is a mixed fertilizer that is deliberately made by the factory by mixing two or more nutrients. NPK fertilizer contains three elements, namely N, P, and K (Lingga and Marsono, 2013).

Based on the description above, the authors are interested in conducting research, "The influence of solid palm oil waste and NPK fertilizer on the growth and the production of green eggplant."

Research Method

This research was conducted from January to March 2019 in Purwodadi Village, Pematang Bandar District, Simalungun Regency, at an altitude of 200 meters above sea level. The materials used were: NPK fertilizer, palm oil waste solid, mulch plastic, insecticide, fungicide, eggplant seeds Royal Variety F1, and water. The tools used were: hoes, watering cans, tape measure, pruning shears, scales, and other stationery.

This research used the 2-factor Randomized Block Design (RCBD). The first factor was the oil palm solid treatment (S), consisting of 4 levels of treatment, namely: S_0 = No palm oil waste solid; S_1 = Administration of 0.5 kg/m^2 of palm oil waste solid; S_2 = Administration of 1 kg/m^2 palm oil waste solid; S_3 = Administration of 1.5 kg/m^2 of palm oil waste solid. The second factor was the dose of NPK fertilizer per plant (J) which consisted of 3 levels of treatment: $J_0 = 0 \text{ g/plant}$; $J_1 = 5 \text{ g/plant}$; $J_2 = 10 \text{ g/plant}$.

Observed Parameter

a. Plant Height (cm), b. Flowering Speed (Day), c. Fruit Weight per Plant (g), d. Fruit Weight per Plot (Kg).

Results and Discussion

1. Plant Height (cm)

The Test Results of the Plant Height Average Difference aged 2, 4, and 6 WAP, can be seen in Table 1.

Treatment	Plant Height (cm)			Flowering age (day)
	2 WAP	4 WAP	6 WAP	
S ₀	17,89 c	37,78 d	69,45 b	34,33 c
S ₁	19,89 b	45,45 c	70,89 b	33,22 b
S ₂	21,56 a	50,22 b	72,11 b	32,89 a
S ₃	21,78 a	53,45 a	77,78 a	32,89 a
J ₀	20,08	44,64 b	69,17 b	33,83 b
J ₁	20,50	47,50 a	72,67 ab	33,25 ab
J ₂	20,25	47,83 a	75,84 a	32,91 a
S ₀ J ₀	17,33	37,67	67,67	34,67
S ₀ J ₁	18,33	37,67	68,00	34,33
S ₀ J ₂	18,00	38,00	72,67	34,00
S ₁ J ₀	19,67	42,67	67,00	33,33
S ₁ J ₁	20,00	46,67	70,67	33,33
S ₁ J ₂	20,00	47,00	75,00	33,00
S ₂ J ₀	22,00	46,33	66,00	33,67
S ₂ J ₁	22,00	51,00	74,33	32,67
S ₂ J ₂	20,67	53,33	76,00	32,33
S ₃ J ₀	21,33	52,67	76,00	33,67
S ₃ J ₁	21,67	54,67	77,67	32,67
S ₃ J ₂	22,33	53,00	79,67	32,33

Information: The numbers followed by the unequal notations in the same column represent significant differences at the 5% level.

From Table 1 it can be seen that the treatment of solid S₃ shows the highest plants at ages 2, 4, and 6 WAP, namely (21.78 cm), (53.45 cm), and (77.78cm), which are different significantly with the treatment of S₂, S₁, and S₀; however, the one at the age 2 WAP was not significantly different from the S₂.

This is because the S₃ treatment can improve the physical properties of the soil; in addition, the dose given was more sufficient for the plant growth compared to the lower dose. Thabrani (2011) states that the organic matter contained in solids will increase the soil biological activity in assisting the decomposition process. A good decomposition process will increase the availability of nutrients for the plants so that the metabolic activity, especially the process of photosynthesis, increases, and the photosynthate produced will be transplanted for the plant growth.

The treatment of NPK J₂ showed the highest plants at ages 2, 4, and 6 WAP respectively (20.50 cm), (47.83 cm), and (75.84 cm) which were significantly different from the J₀ treatment, but not significantly different with J₁; whereas at age 2 the WAP was not significantly different from other treatments. This was because the higher the dose of fertilizer given, the more the plant growth can increase.

According to Purwa (2007), Nitrogen content contained in NPK is a constituent of all proteins and nucleic acids. Plants that are adequately supplied with N will form broad leaf strands with high chlorophyll content so that they can produce assimilates in sufficient quantities to support their vegetative growth. Sutedjo (2000) states, the addition of sufficient nutrients in plants will accelerate the rate of division and elongation of the roots, stems, and leaves.

The interaction of the administration of the solid and the S₃J₂ NPK fertilizer showed the highest plant height aged 2 and 6 MST, respectively (22.33 cm) and (79.67 cm), but the age of 4 WAP contained in S₃J₁ (54.67 cm) showed no difference real with other treatments. This was because solid was one of the organic materials that worked to improve the physical properties of the soil so that the solid and the NPK fertilizer had not synergized with each other to influence the plant growth.

For more details about the influence of administering the Solid and the NPK fertilizer, and the interaction on the height of the green eggplant, can be seen in Figure 1.2.

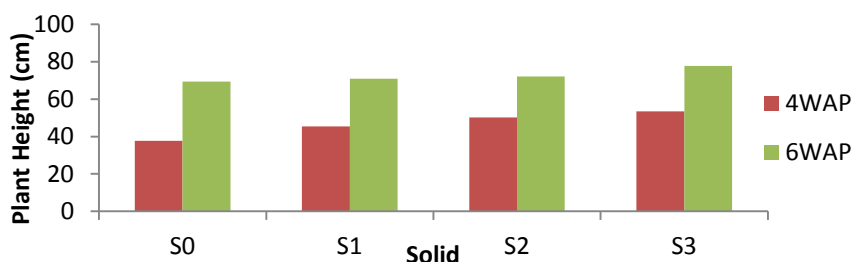


Figure 1: Histogram The effect of Solid toward the height growth of green eggplant (*Solanum melongena* L.) the age of 4 WAP, 6 WAP.

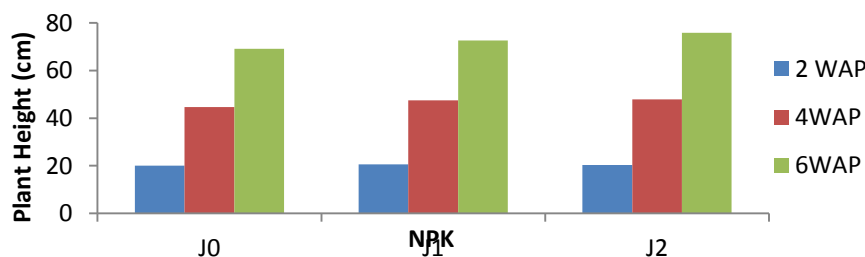


Figure 1: Histogram The effect of NPK Manure toward the height growth of green eggplant (*Solanum melongena* L.) the age of 4 WAP, 6 WAP.

2. Flowering Age (day)

The data on the average plants flowering age in Table 2 shows that the treatment of S₂ and S₃ showed the fastest flowering age (32.89 days) which was significantly different from S₀ and S₁. The NPK fertilizer treatment of J₂ (32.92 days) was not significantly different from J₁, but it was significantly different from J₀. This was because the administration of solid with the right dosage was able to provide the availability of nutrients for the plants as well as being useful for increasing the productivity and speeding up the harvest. Based on Karterine’s opinion (2015), the plant growth is largely determined by the nutrients available in the optimum and balanced conditions.

The J₂NPK fertilizer treatment showed the fastest flowering time, i.e., (32.91 days) which was not significantly different from the J₁ treatment yet significantly different from the J₀ treatment. This was because the J₂ treatment was more sufficient for the plant growth. In accordance with the opinion of Lingga and Marsono (2013) which states that the plant growth with satisfactory results will be obtained if the growing media has an adequate supply of nutrients, which includes the amount, frequency, and is balanced according to the plant needs; but if the amount is insufficient or excessive, it will cause the growth and production of the plants disturbed, including the flowering.

The interaction of the administration of solid and NPK fertilizer for the S₃ J₂ showed the fastest flowering age which was not significantly different from other treatments. This was because the same nutrient content in the NPK fertilizer and solid fertilizer had not synergized so that it had not given the real impact on the flowering.

For more details, the influence of administering the solid and NPK fertilizer on the flowering time can be seen in Figures 3, 4.

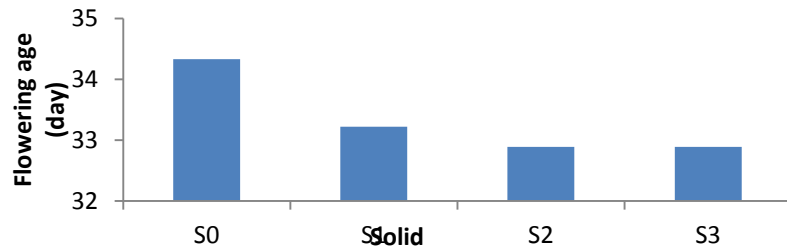


Figure 3: Histogram The effect of Solid toward the Flowering age of green eggplant (*Solanum melongena* L.) the age of 4 WAP, 6 WAP.

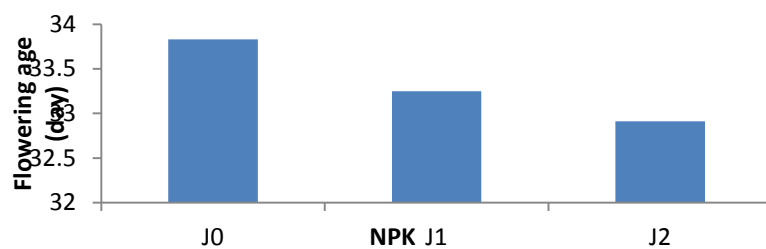


Figure 4: Histogram The effect of NPK Manure toward the Flowering age of green eggplant (*Solanum melongena* L.) the age of 4 WAP, 6 WAP.

3. Total Production per Plant (g)

The Test Results of the Average Difference of the production amount per plant can be seen in Table 2.

Table 2: The Test Results of Average Different of the Production amount per plant green eggplant

Treatment	Production Per Plant (g)	Production Per Plot (kg)
	1067,00 c	15,01 c
S ₁	1368,88 b	18,15 b
S ₂	1600,89 a	19,79 ab
S ₃	1748,77 a	21,89 a
J ₀	1338,58 b	17,29 b
J ₁	1428,66 b	18,98 ab
J ₂	1562,91 a	19,86 a
S ₀ J ₀	974,33	13,14
S ₀ J ₁	1045,67	15,88
S ₀ J ₂	1187,00	16,02
S ₁ J ₀	1253,33	16,82
S ₁ J ₁	1331,00	17,93
S ₁ J ₂	1486,33	19,70
S ₂ J ₀	1422,33	18,29
S ₂ J ₁	1612,67	19,85

S ₂ J ₂	1767,67	21,24
S ₃ J ₀	1704,33	20,92
S ₃ J ₁	1725,33	22,26
S ₃ J ₂	1816,67	22,49

Information: The numbers followed by the unequal notations in the same column represent significant differences at the 5% level.

It can be seen from Table 2 that the S₃ solid treatment shows the highest production per plant, namely (1748.77 g) which is significantly different from the S₁ and S₀ treatments; whereas the S₂ treatment was not significantly different from the S₃ treatment. This was due to the administration of solid would increase the plant growth and production so that the storage tissue cells would form more and bigger. Lingga and Marsono (2013): Fertilizer administration with the right dose and rotation will produce the best for the plant growth and production.

The treatment of J₂ NPK fertilizer showed the highest crop production, namely (1562.91 g) which was significantly different from the treatments of J₁ and J₀. This was because the higher the dose of fertilizer given, the more increased the crop production. In accordance with Karterine's opinion (2015), the complete NPK fertilizer content can meet the needs of the crop production so as to ensure the optimal crop production, and producing the production that meets the quality standards.

The administration of solid and NPK fertilizer did not show a real difference for the crop production. This was because the same nutrient content in the solid and NPK fertilizer had not been synergized so that it had not given the real impact on the production per plant.

For more details about the influence of solid, NPK fertilizer, and the interaction of the administration of solid and NPK fertilizer on the production per plant, can be seen in Figures 7, 8, .

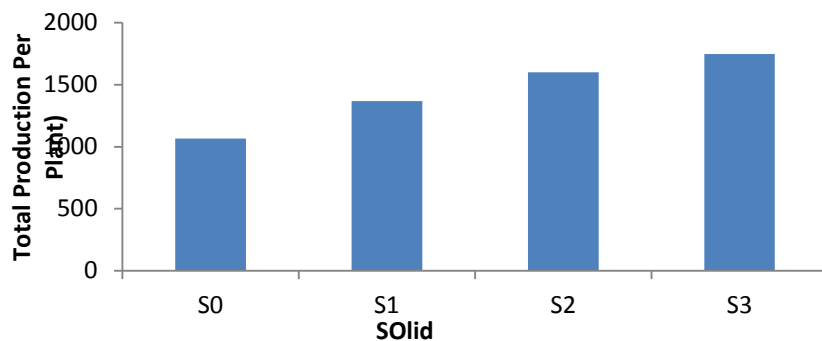


Figure 5: Histogram The effect of Solid toward the Total Production per plant of green eggplant (*Solanum melongena* L.)

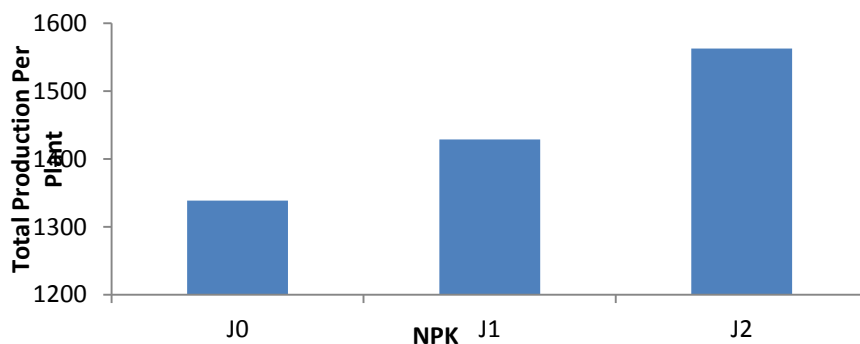


Figure 6: Histogram The effect of NPK Manure toward the Total Production of green eggplant (*Solanum melongena* L.)

4. Production per Plot (kg)

The Test Results of the Average Difference of the production per plot can be seen on Table 2.

It can be seen in Table 2 that the S₃ solid treatment shows the highest production per plot, which is (21.89 kg) and not significantly different from the S₂ treatment but significantly different from the S₁ and S₀ treatments. This was due to the fact that Solid can improve the soil biological properties, including: the soil microbes became active so that the soil fertility was better, so that the nutrients needed by plants can be available. In accordance with the opinion of Murbandon (2005) which states that organic matters can act as sources of plant nutrients after undergoing the process of mineralization, and indirectly can create better environmental conditions for the plant growth by increasing nutrient availability to support the plant growth and production.

The JNPK fertilizer treatment showed the highest production per plot, namely (19.86 kg) which was not significantly different from the J₁ treatment but significantly different from the J₀ treatment. This was because the complete nutrient content of the NPK fertilizer can increase the needs of plants to produce the optimal production. In accordance with Karterine's opinion (2015), the complete NPK fertilizer content can meet the needs of crop production so as to ensure the optimal crop production, and producing the production that meets quality standards. In accordance with the opinion of Lingga and Marsono (2013), the addition of NPK fertilizer will increase the plant growth so that the storage tissue cells will form more and bigger.

The treatment of the administration of the solid and the NPK fertilizer showed no real difference for production per plot. This was because the same nutrient content in the solid and NPK fertilizer had not been synergized so that it had not given the real impact on the production per plant.

For more details about the influence of administering the Solid and NPK fertilizers as well as the interactions on the Production per plant, can be seen in Figures 7 and 8.

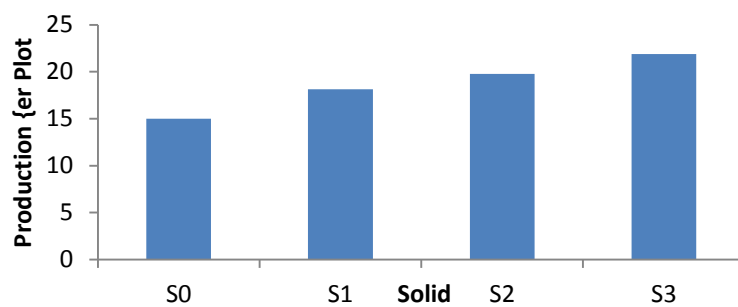


Figure 7: Histogram The effect of Solid Manure toward the Total Production Per Plot of green eggplant (*Solanum melongena* L.)

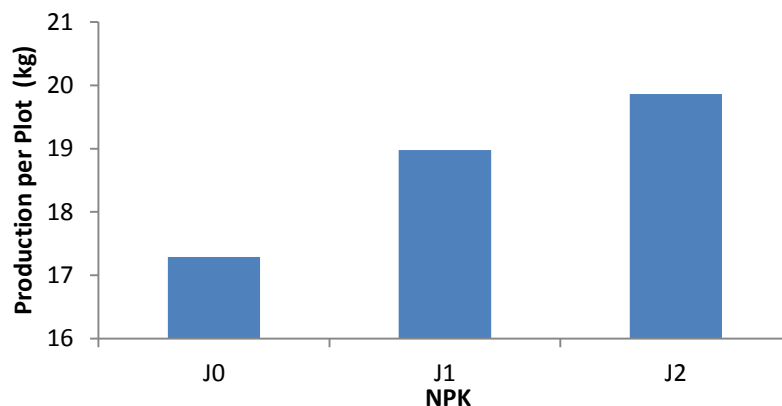


Figure 8: Histogram The effect of NPK Manure toward the Total Production Per Plot of green eggplant (*Solanum melongena* L.)

It can be seen from Figure 6 that the J₂ treatment shows the highest production per plant, followed by the treatments of J₁ and J₀.

Conclusion

- a. The treatment of administering the solid significantly affected the plant height aged 2, 4, and 6 MST, the flowering age, the production per plant, and the production per plot. The solid treatment of 1.5

- kg/m² produced the highest plants aged 2, 4, and 6 WAP respectively were (21.78 cm), (53.45 cm), and (77.78 cm), the fastest flowering age was (32.89 days), the highest production per plant was (1748.77 g), and the highest production per plot was (21.89 kg).
- b. The NPK fertilizer treatment significantly affected the plant height aged 2, 4, and 6 WAP, the flowering age, and the production per plot. The NPK fertilizer dosage treatment of 10 g/plant produced the highest plants aged 4 and 6 MST respectively were (47.83 cm) and (75.84 cm), the fastest flowering age was (32.91 days), the highest production per plant was (1562.91 g), and the highest production per plot was (19.86 kg).
- c. The treatment of administering the solid and the NPK fertilizer did not significantly affect all treatments. The Solid interaction of 1.5 kg/m² and the NPK fertilizer interaction of 10 g/plant produced the highest plants aged 2 and 6 WAP respectively were (22.33 cm) and (79.67 cm), the fastest flowering age was (32.33 days), the highest production per plant was (1816.67 g), and the highest production per plot was (22.49 kg).

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