



Analysis of Purple Eggplant Growth After Vermicompost and NPK Fertilizer Treatment

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Abstract: Eggplant growth rate is determined by genetic and environmental factors. Environmental factors that affect eggplant growth include the availability of nutrients on agricultural land. Research on analysis of purple eggplant growth after vermicompost and NPK fertilizer treatment was carried out from March to July 2023. This study aims to analyze the effect of the application of vermicompost on the growth of purple eggplant. The application of NPK fertilizer on the growth of purple eggplant. The interaction effect of vermicompost and NPK fertilizer treatment on purple eggplant growth. Growth parameter data were analyzed using the F test. The results showed that: Vermicompost application increased stem height, total leaves and leaf length but did not increase leaf width and stem diameter of purple eggplant. The application of NPK fertilizer was effective in increasing stem height, total leaves, leaf length, leaf width and stem diameter of purple eggplant. The interaction of vermicompost treatment and NPK fertilizer was not effective in increasing all measured growth parameters.

Keywords: NPK fertilizer; Purple eggplant growth; Vermicompost

Introduction

Eggplant is a group of Dicotyledonae, taproots with a main root that penetrates the soil that reaches 80 cm in length (Aidah, 2020). Eggplant fruit has a good taste, can be harvested when the plants are 3.5 months after planting. Eggplant fruit should be harvested after the fruit is of maximum size and still young. If the harvest is done late, the fruit will become tough (Mashudi, 2017). Eggplant fruit contains nutrients in the form of protein, fat, vitamin A, vitamin B, vitamin C, calcium, phosphorus and iron (Anggraeni, 2023).

Eggplant growth rate is determined by genetic and environmental factors. Environmental factors that affect eggplant growth include the availability of nutrients on agricultural land. Efforts to increase nutrients in agricultural land can be done by applying fertilizers, both organic and inorganic fertilizers. Inorganic fertilizers contain various kinds of nutrients so that they can increase plant growth and yields (Alkhadi, 2022). However, Astuti et al. (2016) explained that currently farmers in Indonesia often use chemical fertilizers

excessively and burn rice straw after harvest. Excessive use of chemical fertilizers and burning rice straw has a negative impact on decreasing soil organic matter. and decreased soil ability to store and release nutrients for plants. Likewise, Mulyani (2014) explained that the application of inorganic fertilizers continuously and in doses that exceed the recommendations will cause adverse effects such as environmental pollution, damage to soil structure and reduce soil fertility.

To reduce the unwanted effects of excessive use of chemical fertilizers, the use of chemical fertilizers needs to be combined with organic fertilizers. One of the organic fertilizers that can be used is vermicompost. Manahan et al. (2016) explained that vermicompost provides benefits for plants including fertilizing and loosening the soil so that it is suitable as a planting medium because it can stimulate the growth of roots, stems and leaves, stimulate flower growth, accelerate harvests and increase productivity. Furthermore, Sinda et al. (2015) explained that the use of vermicompost can increase the quantity of microorganisms, pH of soil, soil nitrogen and phosphorus content.

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Vermicompost and bioactivator treatments had a significant impact on the growth parameters of mustard plants with better results compared to controls (Wahyudin et al., 2019). The application of vermicompost had a significant effect on increasing the number of fruits and stem height of okra and shallots grown using the intercropping system (Hidayatullah et al., 2020). Application of vermicompost on agricultural land can increase plant growth. Raksun et al. (2022b) reported that the application of vermicompost could increase the stem height and number of long bean leaves. Vermicompost treatment can increase the number of leaves and fresh weight of pakcoy. The best dose of vermicompost for pakcoy is 700 g (Lokha et al., 2021). The application of vermicompost significantly affected the increase in plant height, number of leaves, leaf area, fresh weight and dry weight of mustard greens (Artha et al., 2018).

Based on the above background, a study was conducted on measuring the growth rate of purple eggplant treated with vermicompost and NPK fertilizer. The purpose of this study was to analyze the effect of: (1) the application of vermicompost on the growth of purple eggplant, (2) the application of NPK fertilizer on the growth of purple eggplant, (3) the interaction effect of vermicompost and NPK fertilizer treatment on purple eggplant growth

Method

The materials needed in the research included: purple eggplant seeds, well water, transparent paper, paranet nets, Arashi brand fungicide, Kasumin brand bactericidal, bamboo, nail iron, rapia rope, Amexda 336SC insecticide, vermicompost, bamboo woven fence and NPK fertilizer. Furthermore, the tools used were hoes, machetes, sickles, hammers, Akapro brand hand sprayers and shark brand water pump machines.

The stages of conducting the research were: Clearing weeds and trash at the research location. Purple eggplant nurseries. Cultivating the land at the research location. At the experimental site making beds with a length of 14 meters and a width of 90 cm. Apply vermicompost at the research location and mix the vermicompost with the soil evenly. Irrigating the experimental land with well water. Planting purple eggplant seedlings. Irrigating the plants regularly. Doing weeding. Controlling pests and plant diseases. Measuring purple eggplant growth parameters.

In this study used a completely randomized design with 2 factors. The first factor was the dose of vermicompost which consisted of 4 levels, namely: B0 = 0 kg vermicompost (control), B1 = 0.4 kg vermicompost, B2 = 0.8 kg vermicompost, B3 = 1.2 kg vermicompost.

The second factor was the application of NPK fertilizer which consisted of 4 levels, namely: A0 = application of 0 g of NPK fertilizer, A1 = application of 0.5 g of NPK fertilizer, A2 = application of 1 g of NPK fertilizer and A3 = application of 1.5 g of NPK fertilizer. Vermicompost treatment was carried out 12 days before planting, while NPK fertilizer was applied 14 and 26 days after planting. Parameters observed were number of leaves, plant height, stem diameter, leaf length and leaf width. Measurement of growth parameters was carried out when the purple eggplant was 36 and 38 days after planting. Data analysis used the F test at a significance level of 5% (Teutenburg et al., 2009).

Result and Discussion

Leaf Length of the Purple Eggplant

The results of measuring the length of purple eggplant leaves 36 days after planting showed variations due to vermicompost and NPK fertilizer treatment. The mean length measurement results for purple eggplant leaves can be seen in table 1.

Table 1. Mean Length of Purple Eggplant Leaves Measured 36 Days after Planting

Treatment	Leaf length (cm)	Treatment	Leaf length (cm)
A0B0	25	A0B2	28
A1B0	26	A1B2	29
A2B0	27	A2B2	29
A3B0	28	A3B2	30
A0B1	27	A0B3	27
A1B1	27	A1B3	28
A2B1	28	A2B3	28
A3B1	29	A3B3	29

The smallest purple eggplant leaf length was 12 cm which was observed in plants treated with 0 g of vermicompost and 0 g of NPK fertilizer. The highest leaf length was 17 cm which was found in the treatment of 800 g of vermicompost and 1.5 g of NPK fertilizer. The results of the analysis of variance showed that the difference in vermicompost doses had a significant effect on the length of purple eggplant leaves. NPK fertilizer treatment significantly increased the length of purple eggplant leaves. The interaction of vermicompost and NPK fertilizer treatments had no significant effect on purple eggplant leaf length. The increase in purple eggplant leaf length due to the application of vermicompost, occurs because vermicompost contains nutrients that are important for plant growth. The results of the analysis of the nutrient content of vermicompost produced from worms fed spinach stems and leaves contained N = 0.52%, while those fed kale stems and leaves contained P = 0.35% (Elfayetti et al., 2017). Furthermore Afsyah et al. (2021) reported that

vermicompost met the Indonesian National Standard as compost, containing 1.07% nitrogen, 10.55% C-organic, 0.22% phosphorus, 0.30% potassium, 9.85 C ratio/N and a pH of 6.5.

The application of NPK fertilizer can increase the length of purple eggplant leaves, due to the presence of nitrogen in NPK fertilizer. Warisno and Dahana (2018) explained that nitrogen plays a role in increasing plant growth, healthy leaf growth with a wider size and green color. Lack of nitrogen nutrients causes chlorosis in the leaves where young leaves that should be green will show a yellow color. Furthermore, Rahmat (2015) explained that nitrogen function to support plant vegetative growth, namely enlarging, tallening and greening leaves. In addition, nitrogen nutrients also play a role in the formation of chlorophyll in leaves.

Number of Purple Eggplant Plant Leaves

Vermicompost doses applied to plants can affect plant vegetative growth. The different doses of NPK fertilizer applied also cause variations in the growth and production of purple eggplant. The average total purple eggplant leaves due to vermicompost and NPK fertilizer treatment can be seen in table 2.

Table 2. Average Total Leaves of Purple Eggplant due to Vermicompost and NPK Fertilizer Treatment

Treatment	Number of leaves	Treatment	Number of leaves
A0B0	8	A0B2	9
A1B0	8	A1B2	10
A2B0	9	A2B2	10
A3B0	9	A3B2	11
A0B1	9	A0B3	9
A1B1	9	A1B3	9
A2B1	10	A2B3	10
A3B1	10	A3B3	10

Table 2 shows that the smallest total purple eggplant leaves were 8 leaves which were observed in the P0R0 treatment, namely the application of 0 kg of vermicompost and 0 g of NPK fertilizer. The highest number of leaves was 14 leaves found in purple eggplant treated with 800 g of vermicompost and 1.5 g of NPK fertilizer. Next is the number of leaves eggplant was observed to increase according to the increase in the dose of vermicompost and NPK fertilizer applied. Analysis of variance gave the result that vermicompost treatment increased the number of purple eggplant leaves, the different doses of NPK fertilizer had a significant effect on the number of purple eggplant leaves. The interaction of vermicompost and NPK fertilizer treatments had no significant effect on the number of purple eggplant leaves. The increase in total purple eggplant leaves due to vermicompost treatment was made possible because vermicompost met the

minimum standards for organic fertilizer quality in accordance with Regulation of the Minister of Agriculture of the Republic of Indonesia No. 1 in 2019 (Lokha et al., 2021). Furthermore, Hanafi et al. (2023) reported that the application of vermicompost can increase total nitrogen, available nitrogen, C-organic, cation exchange capacity, plant height, wet weight, dry weight, N-tissue and nitrogen uptake.

In other studies it was also found that the application of vermicompost had a significant effect on plant growth. Vermicompost application was able to increase leaf length, leaf width, number of tillers, rhizome length and rhizome weight of red ginger. Treatment of 150 g per polybag resulted in better growth than other treatments (Lidar et al., 2021). Raksun et al. (2021) found that the use of vermicompost could significantly increase the number of leaves, stem height, leaf length, leaf width and stem diameter of green eggplant plants. The best dose of vermicompost for green eggplant is 18 tons per hectare. The use of vermicompost fertilizer can stimulate and increase the number of leaves, plant height and fresh weight of mustard greens. Apart from that, vermicompost treatment also increased C-organic, N-total, C/N ratio and soil pH (Lokha et al., 2021).

NPK fertilizer treatment was able to increase the total purple eggplant leaves. The results of this study are in line with the results of studies on other plants. In spinach, the vermicompost treatment had a significant effect on increasing the number of leaves, stem diameter, stem height, leaf length and leaf width (Raksun et al., 2022a). The application of N, P and K fertilizers had a significant effect on increasing the number of leaves, leaf area index, plant height, yield, number of productive branches and stem diameter of eggplant plants (Firmansyah et al., 2017). The application of NPK fertilizer had a significant effect on sprout height, shoot dry weight and root dry weight of oil palm seedlings (Sinaga et al., 2020).

Purple Eggplant Stem Height

The vermicompost treatment caused variations in purple eggplant stem height measured 36 days after planting. Likewise the application of NPK fertilizer causes variations in purple eggplant stem length. The results of measuring the height of purple eggplant stems after the application of vermicompost and NPK fertilizer are presented in table 3.

In table 3 it is observed that the length of the purple eggplant stems varies due to vermicompost and NPK fertilizer treatment. The highest average stem height was 54 cm, observed in the combination treatment of 800 g of vermicompost and 1.5 g of NPK fertilizer. The smallest average stem height was 47 cm which was found in the

application of 0 g of vermicompost and 0 g of NPK fertilizer. The results of the F test for the effect of vermicompost on purple eggplant stem height showed that differences in vermicompost doses had a significant effect on purple eggplant stem height. A significant effect is possible because vermicompost is an organic fertilizer that contains various kinds of nutrients that are important to support plant growth. Mulat (2003) explained that vermicompost contains various kinds of nutrients. Vermicompost generally contains 0.63% nitrogen, 0.35% phosphorus, 0.2% potassium, 0.23% calcium, 0.003% manganese, 0.26% magnesium, 17.56% copper, 0.007% zinc, 0.79% iron, 14.48% molybdenum. Furthermore, Andriawan et al. (Andriawan et al., 2022) reported that vermicompost produced by earthworms fed various kinds of organic matter can be found 2.72% nitrogen and 0.80% phosphorus.

Table 3. Average Height of Purple Eggplant Stems After Application of Vermicompost and NPK Fertilizer

Treatment	Stem Height (cm)	Treatment	Stem Height (cm)
A0B0	47	A0B2	48
A1B0	48	A1B2	50
A2B0	48	A2B2	51
A3B0	50	A3B2	54
A0B1	48	A0B3	48
A1B1	48	A1B3	49
A2B1	49	A2B3	49
A3B1	50	A3B3	50

The results of research on other plants found that the application of vermicompost significantly increased plant height. Vermicompost treatment significantly increased plant height, fresh weight and dry weight of kale land (Oka, 2012). Vermicompost application at a rate of 10 tonnes ha⁻¹ produced the best plant height of 46.04 cm, the fastest flowering age of 31.14 days, the most productive branches = 2.30, the fruit weight was 1.47 per plant, the fruit production per plot was 5.38 kg and fruit production per hectare of 35.88 tonnes (Sanda et al., 2018). The application of vermicompost produced by the earthworm species *E. fetida* can support the growth of vegetable plants under controlled conditions (Illanjiam et al., 2021). In chickpeas, the application of vermicompost significantly increased plant height and number of leaves which were measured 28 days after planting (Raksun et al., 2023). Vermicompost application has a significant effect on lettuce plant height. Vermicompost application can increase the total leaves and volume of lettuce crowns. The best level of vermicompost for lettuce growth is 50 grams for each polybag (Dosem et al., 2018). Vermicompost treatment of 50% significantly increased shoot length and segments of *Capsicum annum* (Rekha et al., 2018). The application of vermicompost has a significant effect on

the height of the mustard stems. Besides that, the application of vermicompost is also able to increase the fresh weight and dry weight of plant stems and roots (Pratama et al., 2018).

Diameter of the Purple Eggplant Plant Stem

The diameter of purple eggplant stems varies according to the dose of vermicompost and NPK fertilizer applied. The diameter of the purple eggplant stems is measured at the stem segment between the 2nd and 3rd leaves. The average diameter of the purple eggplant stems can be seen in table 4.

Table 4. Average Purple Eggplant Stem Diameter Measured 38 Days After Planting

Treatment	Stem Diameter (cm)	Treatment	Stem Diameter (cm)
A0B0	11	A0B2	11
A1B0	11	A1B2	11
A2B0	11	A2B2	11
A3B0	12	A3B2	13
A0B1	10	A0B3	10
A1B1	10	A1B3	11
A2B1	11	A2B3	12
A3B1	11	A3B3	12

In table 4 it can be observed that the lowest purple eggplant stem diameter was 11 mm observed in the treatment combinations A0B0, A1B0, A2B0, A2B1, A3B1, A0B2, A1B2, A2B2, and A1B3. The highest stem diameter was 13 mm which was found in plants treated with A3B2. The results of the F test showed that the application of vermicompost could not increase the stem diameter of purple eggplant. The application of NPK fertilizer significantly increased the stem diameter of the purple eggplant. The interaction of vermicompost and NPK fertilizers had no significant effect on purple eggplant stem diameter. The increase in plant stem diameter due to the application of NPK fertilizer was also found in other plants. The application of NPK fertilizer with different doses has a significant effect on stem diameter, number of leaves, leaf length and stem height of green eggplant plants. The optimum dose of NPK fertilizer is 2 g for 1 plant which produces stem diameter, number of leaves, leaf length and stem height. green eggplant which is better than treatment at other doses (Raksun et al., 2021). The diameter of the oil palm seedlings increased significantly due to NPK fertilizer treatment (Sinaga et al., 2020). The use of NPK fertilizer can increase the diameter of corn stalks, with the optimum dose of 22.5 grams per plot giving the results of the largest stem diameter and significantly different from the control (Irawan et al., 2019). The diameter of the melon stem has increased due to the application of NPK fertilizer. Application of 5 grams of pearl NPK fertilizer

for 1 plant gives the best results (Ayu et al., 2017). NPK fertilizer application can increase the growth of corn which is given at 28 days to 35 days after planting (Hitijahubessy et al., 2016).

Purple Eggplant Leaf Width

The results of measuring the width of the leaves show that the width of the purple eggplant leaves varies according to the dose of vermicompost and NPK fertilizer applied. Table 5 presents data on the average leaf width of the purple eggplant plant which was measured when the plant was 38 days after planting.

Table 5. Average Purple Eggplant Leaf Width Measured 38 Days After Planting

Treatment	Leaf Width (cm)	Treatment	Leaf Width (cm)
A0B0	17	A0B2	17
A1B0	17	A1B2	18
A2B0	18	A2B2	19
A3B0	18	A3B2	19
A0B1	16	A0B3	17
A1B1	16	A1B3	17
A2B1	17	A2B3	18
A3B1	17	A3B3	18

In table 5 it can be observed that the lowest purple eggplant leaf width was 16 cm observed in the combination of treatments A0B1 and A1B1. The highest leaf width was 19 cm which was observed in the A2B2 and A3B2 treatments. The results of the F test showed that the vermicompost treatment did not increase the width of the purple eggplant leaves. NPK fertilizer treatment significantly increased the width of purple eggplant leaves. The interaction of vermicompost and NPK fertilizer applications had no significant effect on purple eggplant leaf width. An increase in the width of purple eggplant leaves due to the application of NPK fertilizer is possible because NPK fertilizer contains elements of N which can support plant growth (Sutedjo, 2008). Metabolic processes in the vegetative organs of plants are influenced by the elements N, P and K, especially during the vegetative growth stage (Lingga, 2002). Therefore, the abundance of nitrogen, phosphorus and potassium nutrients in NPK fertilizer can stimulate the growth of purple eggplant leaf width.

Conclusion

In accordance with the results of research and data analysis in this study it can be concluded: (1) application of vermicompost can increase stem height, total leaves and leaf length but cannot increase leaf width and stem diameter of purple eggplant, (2) application of NPK fertilizer is effective in increasing stem height, total leaves, leaf length, leaf width and stem diameter of

purple eggplant. (3) The interaction of vermicompost treatment and NPK fertilizer was not effective in increasing all measured growth parameters.

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Authors Contribution

This research was carried out by I Wayan Merta and Ahmad Raksun. The two researchers jointly carried out field experiments by planting purple eggplants treated with vermicompost and NPK fertilizer. Next, carry out data collection and data analysis. Finally, together we compose the article.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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