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Effect of Providing Compost and NPK Fertilizer 16:16:16 on the Growth and Production of Cucumber Plants (*Cucumis sativus*)

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Abstract

The research aims to determine the Effect of Providing Compost and NPK fertilizer 16:16:16 on the Growth and Production of Cucumber Plants (Cucumiss sativus). This research used a factorial Randomized Group Design (RAK) using 2 treatment factors. The first factor is dose treatment, which consists of 3 levels, namely K1: No compost, K2: Compost dose 10 t/ha or 1 kg/plot, and K3: Compost dose 20 t/ha or 2 kg/plot. The second factor is the dose of NPK 16:16:16 fertilizer, namely:N1: NPK fertilizer dose 250 kg/ha or equivalent to 25g/plot, N2: NPK fertilizer dose 350 kg/ha or equivalent to 35g/plot, N3: NPK fertilizer dose 450 kg/ha or equivalent to 45g/plot. The results showed that the dose of compost had a significant effect on fruit weight; a dose of 2kg/lot of chicken coop compost produced the heaviest fruit weight but had no significant effect on plant height, number of leaves, flowering time, fruit length, fruit diameter and number of fruit on cucumber plants. The dose of NPK 16:16:16 fertilizer had no significant effect on all observed parameters. The interaction between the chicken coop compost dose and the NPK 16:16:16 fertilizer had no significant effect on all observed parameters.
Keywords: Compost, NPK 16:16:16 fertilizer, Cucumber

Introduction

The cucumber (Cucumis sativus) is a fruit-vegetable plant from the gourd family (Cucurbitaceae) that spreads or propagates through a spiral-shaped holder (Bolly and Jeksen 2021; Padang et al. 2023). The cucumber plant originates from northern India, namely the slopes of the Himalayas, which then expanded to the Mediterranean region. Cucumbers can

grow from the lowlands to the highlands ± 1,000 meters above sea level (ASL). Cucumbers are one of the choices of horticultural commodities for farming activities (Bolly and Jeksen 2021). Cucumber production in Indonesia has increased over the past 4 years; namely, in 2018, it was 433 931.00t in the one-year harvest period; in 2019, it was 435 975.00t in the one year harvest period; in 2020, it was 441 286.00t in the one-year harvest period, and in 2021 it will be 471 941.00t within one year's harvest period (Indonesia 2021; Mustafa 2023; Setiawan 2019).

Mutiara NPK Fertilizer 16-16-16 is a compound fertilizer containing the nutrient Nitrogen, which is available in the form of Amnonia ($NH_3$16%), Phosphate (P_2O_5) 16%, Potassium (K_2O) l6% and contains other macro elements, namely 0.5% MgO (Magnesium), and 10 6% CaO (Calcium). NPK Mutiara 16-16-16 fertilizer can provide nutrients quickly and directly, help fertilize the soil, especially those with acidic soil, and can increase root growth (Asnur and Kurniasih 2018; Santos, Fonseca, and Ramadhan 2023; Setiadi, Wahyudi, and Marlina 2021)

The cucumber cultivation business has bright prospects in Indonesia because apart from being popular with the public, cucumbers also contain many vitamins and benefits. One of the benefits of consuming cucumbers is that apart from adding to the taste of food, they also contain high levels of nutrition for body health (Amin 2015; Husna 2017). The prospects for developing cucumbers are getting brighter along with increasing market demand due to the expanding pace of the cosmetics industry. Cucumber production is also sought after by foreign markets. Some export target countries are Malaysia, Singapore, Japan, England, France and the Netherlands. To meet the increasing demand for cucumbers, land productivity and the use of cucumber varieties are increased (Liu et al. 2021; Rahman, Nasrudin, and Saleh 2022; Sofyadi, Lestariningsih, and Gustyanto 2021; Yuniar 2023).

One effort to increase the growth and production of cucumber plants can also be made by providing compost. According to (Abri 2023; Dahliana et al. 2022; Hadi 2019; Indasah and Fitriani 2021; Yulianandа, Utomo, and Golddin 2019), compost is an organic fertilizer that benefits soil fertility. Compost results from partial/incomplete decomposition of organic materials, which can be accelerated artificially by populations of various microbes in warm, moist, and aerobic or anaerobic conditions. The benefits of compost include Increasing soil fertility, improving soil structure and characteristics, increasing soil water absorption capacity, increasing soil microbial activity, improving the quality of harvests, and increasing nutrient availability in the soil. Chicken manure has the potential to be used as compost. Chicken manure contains nutrients including N (1.72%), P (1.82%), K (2.18%), Ca (9.23%), and Mg (0.86%). Therefore, chicken manure can be used as an ingredient in making compost (Hasibuan 2015). This research aims to determine the effect of giving NPK 16:16:16 and compost on the growth and production of cucumber plants (Cucumis sativus).

Research Method

This research was carried out on Jalan Bunga Sedap Malam V Jalan, Ngumban Surbakti, Sempakata Village, Medan Selayang District, Medan City, with an altitude of ± 30 meters above sea level. The research location is at an altitude of ± 30 meters above sea level. This research used a factorial Randomized Group Design (RAK) using 2 treatment factors. The first factor is dose treatment, which consists of 3 levels, namely K1: No compost, K2: Compost dose 10 t/ha or 1 kg/plot, and K3: Compost dose 20 t/ha or 2 kg/plot. The second factor is the dose of NPK 16:16:16 fertilizer, namely:N1: NPK fertilizer dose 250 kg/ha or equivalent to

25g/plot, N2: NPK fertilizer dose 350 kg/ha or equivalent to 35g/plot, N3: NPK fertilizer dose 450 kg/ha or equivalent to 45g/plot. The parameters observed were plant height (cm), number of leaves (strands), flowering time (days), fruit length (cm), fruit diameter (cm), number of fruits per plant (fruit), and fruit weight per plant (grams). Analysis of variance was used to test the effect of treatment and mean differences between treatments; honest significant difference tests, regression, and correlation were carried out at a test level of 5%.

Result/Findings

Research result

1. Cucumber Plant Height (cm)

Data on cucumber plant height at 2, 3, and 4 weeks after planting (WAP) due to doses of 16:16:16 NPK fertilizer and compost. The variance list shows that the treatment dose of compost and NPK fertilizer 16:16:16 and the interaction between the two treatments had no significant effect on cucumber plant height at all ages of observation. In Table 1, the average height of cucumber plants at the ages of 2, 3, and 4 WAP is presented as a result of treatment with doses of 16:16:16 NPK fertilizer and compost.

In Table 1, it can be seen that the compost dosage treatment had no significant effect on cucumber plant height. The highest plants at 4 WAP were in the K3 treatment, and the lowest were in the K1 treatment. In Table 1, it can also be seen that the NPK 16:16:16 fertilizer treatment had no significant effect on cucumber plant height. The highest plants at 4 WAP were in the N2 treatment, and the lowest were in the N3 treatment.

In Table 1, it can also be seen that the interaction between treatments of compost and NPK 16:16:16 fertilizer had no significant effect on cucumber plant height. The highest plants at 4 WAP were in the K3N3 treatment, and the lowest were in the K1N3 treatment.

Table 1. High Average Cucumber Plants (cm) When Treated with Compost and NPK Fertilizer Doses 16:16:16 at the Age of 2, 3, and 4 Weeks After Planting.

Treatment	Plant height (cm)		
	2 WAP	3 WAP	4 WAP
K1	31.12	95.57	175.99
K2	31.28	95.86	176.72
K3	32.59	95.59	178.13
N1	30.94	95.33	176.99
N2	31.45	95.89	177.59
N3	32.60	94.79	176.26
K1N1	30.30	94.65	176.65
K1N2	31.13	97.48	177.32
K1N3	31.92	94.58	174.00
K2N1	31.13	96.53	176.38
K2N2	31.17	95.27	177.47
K2N3	31.55	95.77	176.30

K3N1	31.40	94.82	177.93
K3N2	32.05	94.92	177.98
K3N3	34.33	94.03	178.47

2. Number of Cucumber Plant Leaves (strands)

Data on the number of leaves on cucumber plants at 2, 3, and 4 weeks after planting (WAP) due to the dose of NPK 16:16:16 fertilizer and compost. The variance list shows that the treatment doses of compost and NPK fertilizer 16:16:16 and the interaction between the two treatments have no significant effect on the number of leaves on cucumber plants at all ages of observation. Table 2 presents the average number of leaves of cucumber plants at the ages of 2, 3, and 4 WAP as a result of treatment with doses of 16:16:16 NPK fertilizer and compost.

Table 2. Average Number of Cucumber Plant Leaves (strands) When Treated with Compost and NPK Fertilizer Doses 16:16:16 at the Age of 2, 3, 4 Weeks After Planting.

Treatment	Number of Leaves (Strands)		
	2 WAP	3 WAP	4 WAP
K1	4.67	12.28	23.06
K2	5.11	12.56	22.67
K3	5.17	14.06	24.00
N1	4.78	12.00	22.33
N2	5.00	13.89	23.67
N3	5.17	13.00	23.72
K1N1	4.50	11.17	22.33
K1N2	4.67	14.00	23.67
K1N3	4.83	11.67	23.11
K2N1	5.00	12.50	23.00
K2N2	5.17	12.50	22.67
K2N3	5.17	12.67	22.33
K3N1	4.83	12.33	21.67
K3N2	5.17	15.17	24.67
K3N3	5.50	14.67	25.67

Table 2 shows that the compost dose treatment had no significant effect on the number of leaves of cucumber plants. The highest number of leaves at 4 WAP was in the K3 treatment, and the lowest was in the K2 treatment. In Table 2, it can also be seen that the NPK 16:16:16 Fertilizer treatment had no significant effect on the number of leaves of cucumber plants. The highest number of leaves at 4 WAP was in treatment N3, and the lowest was in treatment N1. In Table 2, it can also be seen that the interaction between treatments of compost and NPK 16:16:16 fertilizer had no significant effect on the number of leaves on cucumber plants. The highest number of leaves at 4 WAP was in the K3N3 treatment, and the lowest was in the K3N1 treatment.

3. Flowering Time (days)

Data on the flowering time of cucumber plants due to the dose of compost and NPK fertilizer 16:16:16. The variance list shows that the treatment dose of compost and NPK fertilizer was 16:16:16, as well as the interaction between the two treatments had no significant effect on the flowering time of cucumber plants. Table 3 presents the average flowering time of cucumber plants as a result of treatment with compost and NPK fertilizer doses of 16:16:16.

Table 3 shows that the compost dosage treatment had no significant effect on the flowering time of cucumber plants. The highest flowering time for cucumber plants was in the K2 treatment, and the lowest was in the K3 treatment. In Table 3, it can also be seen that the NPK 16:16:16 fertilizer treatment had no significant effect on the flowering time of cucumber plants. The highest flowering time for cucumber plants was in treatment N1, and the lowest was in treatment N2.

Table 3. AverageFlowering Time of Cucumber Plants (days) When Treated with Compost and NPK Fertilizer Doses 16:16:16.

K Factor	N factor			Average
	N1	N2	N3	
K1	28.17	28.00	29.00	28.39a
K2	32.17	28.17	28.33	29.56a
K3	27.83	27.67	27.50	27.67a
Average	29.39a	27.95a	28.28a	28.54

4. Length of Cucumber Fruit (cm)

Data on fruit length of cucumber plants due to doses of compost and NPK fertilizer 16:16:16. The variance list shows that the treatment dose of compost and NPK fertilizer was 16:16:16, as well as the interaction between the two treatments had no significant effect on the fruit length of cucumber plants. Table 4 presents the average fruit length of cucumber plants as a result of treatment with compost and NPK fertilizer doses of 16:16:16.

Table 4 shows that the compost dosage treatment had no significant effect on the fruit length of cucumber plants. The highest fruit length of cucumber plants was in the K3 treatment, and the lowest was in the K1 treatment. In Table 4, it can also be seen that the NPK 16:16:16 fertilizer treatment had no significant effect on the fruit length of cucumber plants. The highest fruit length of cucumber plants was in the N1 treatment, and the lowest was in the N2 treatment.

Table 4. AverageCucumber Plant Fruit Length (cm) When Treatment with Compost and NPK Fertilizer Doses 16:16:16.

K Factor	N factor			Average
	N1	N2	N3	
K1	22.42	21.67	22.52	22.20a

K2	22.78	22.7	21.53	22.34a
K3	22.28	22.05	23.38	22.57a
Average	22.49a	22.14a	22.48a	22.37

5. Cucumber Plant Fruit Diameter

Data on fruit diameter of cucumber plants due to the dose of compost and NPK fertilizer 16:16:16. The variance list shows that the treatment dose of compost and NPK fertilizer was 16:16:16, as well as the interaction between the two treatments had no significant effect on the fruit diameter of cucumber plants. Table 5 presents the average fruit diameter of cucumber plants as a result of treatment with compost and NPK fertilizer doses of 16:16:16.

Table 5. Average Cucumber Plant Fruit Diameter (cm) When Treated with Compost and NPK Fertilizer Doses 16:16:16.

K Factor	N factor			Average
	N1	N2	N3	
K1	4.67	4.30	3.97	4.31a
K2	4.97	4.53	4.23	4.58a
K3	5.30	4.73	5.33	5.12a
Average	4.98a	4.52a	4.51a	4.67

Table 5 shows that the compost dose treatment had no significant effect on the fruit diameter of cucumber plants. The highest fruit diameter of cucumber plants was in treatment K1, and the lowest was in treatment K2. In Table 5, it can also be seen that the NPK 16:16:16 fertilizer treatment had no significant effect on the fruit diameter of cucumber plants. The highest fruit diameter of cucumber plants was in the N2 treatment, and the lowest was in the N1 treatment.

6. Number of Cucumber Plant Fruits

Data on the number of cucumber plants due to the dose of compost and NPK fertilizer 16:16:16. The variance list shows that the treatment dose of compost and NPK fertilizer was 16:16:16, as well as the interaction between the two treatments had no significant effect on the number of fruit on cucumber plants. Table 6 presents the average number of cucumber plants resulting from treatment with compost and NPK fertilizer doses of 16:16:16.

Table 6. Average Number of Cucumber Plant Fruits in the Treatment of Compost and NPK Fertilizer Doses 16:16:16.

K Factor	N factor			Average
	N1	N2	N3	
K1	4.33	4.00	4.00	4.11a
K2	4.83	4.67	4.33	4.61a
K3	3.83	4.50	4.33	4.22a

Average	4.33a	4.39a	4.22a	4.31

In Table 6, it can be seen that the compost dose treatment had no significant effect on the number of cucumber plants. The highest number of fruits on cucumber plants was in the K2 treatment, and the lowest was in the K1 treatment. In Table 6, it can also be seen that the NPK 16:16:16 fertilizer treatment had no significant effect on the number of cucumber plants. The highest number of fruits on cucumber plants was in the N2 treatment, and the lowest was in the N3 treatment.

7. Weight of Cucumber Plant Fruit (grams)

Data on fruit weight of cucumber plants due to doses of compost and NPK fertilizer 16:16:16. The variance list shows that the compost fertilizer treatment has a significant effect on fruit weight and NPK 16:16:16, and the interaction between the two treatments has no significant effect on fruit weight of cucumber plants. Table 7 presents the average fruit weight of cucumber plants as a result of treatment with compost and NPK fertilizer doses of 16:16:16.

Table 7. Average Fruit Weight of Cucumber Plants (grams) When Treated with Compost and NPK Fertilizer Doses 16:16:16.

K Factor	N factor			Average
	N1	N2	N3	
K1	204.17	203.33	206.33	204.61a
K2	204.17	204.33	209.33	205.94a
K3	212.00	206.90	208.83	209.24b
Average	206.78a	204.85a	208.16a	206.60

Table 7 shows that the compost dosage treatment had no significant effect on the fruit weight of cucumber plants. The highest fruit weight of cucumber plants was in the K3 treatment and significantly differed from K2 and K1. In contrast, the K2 treatment was not significantly different from K1, and the lowest was in the K1 treatment. Table 7 shows that the treatment dose of NPK 16:16:16 had no significant effect on the fruit weight of cucumber plants. The highest fruit weight of cucumber plants was in the N3 treatment, and the lowest was in the N2 treatment. The compost dose-response can be seen in Figure 1.

Figure 1. Histogram of the Effect of Compost Treatment on Fruit Weight of Cucumber Plants

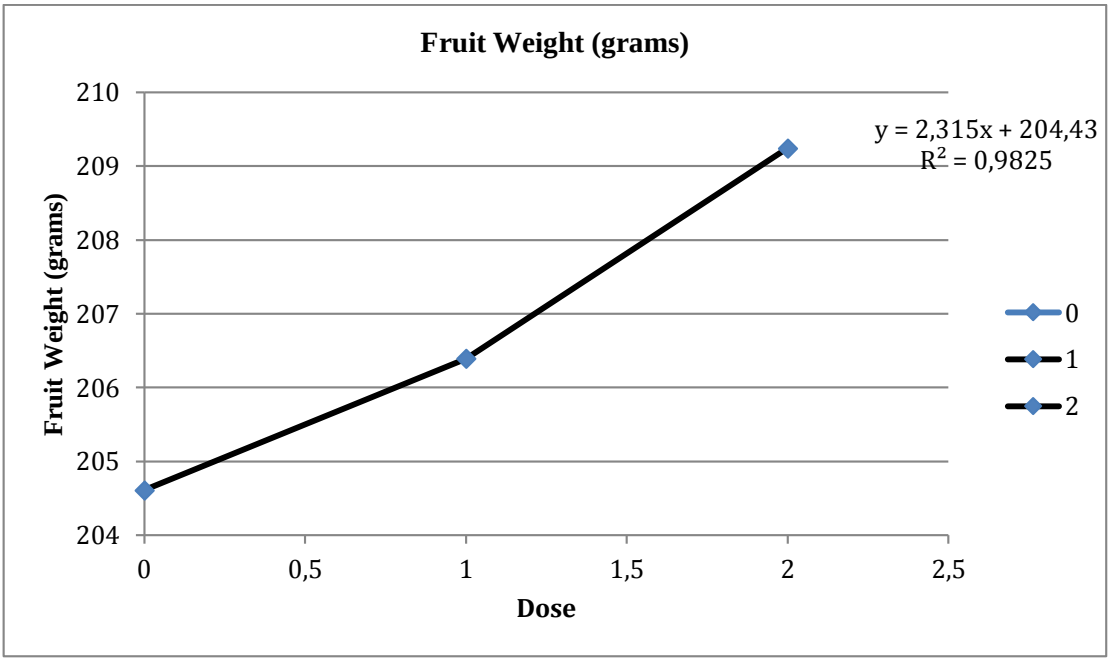

Figure 1 shows that the highest net weight was in treatment N3 (450 kg/ha), followed by N2 (350 kg/ha), while the lowest was in treatment N1 (250 kg/ha).

Discussion

1. Effect of Chicken Coop Compost on Growth and Production of Cucumber Plants (Cucumis sativus)

The variance test results showed that the chicken coop compost treatment dose had a significant effect on fruit weight but no significant effect on plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, and number of fruit. The higher the dose of chicken coop compost given, the higher the pH, organic C, total N, and soil P_2O_5 and K_2O levels tend to be. According to (Tufaila, Laksana, and Alam 2014; Wijaya 2010), compost has many advantages, including its complete content of macro and micronutrients. The increase in organic C is due to sufficient organic material in the soil for plants. This is in line with the opinion of that the addition of organic matter (bokashi) to the soil can increase the content of organic matter and nutrients in the soil, which is a very suitable condition for meeting the needs of cucumbers to achieve maximum yields (Gashua et al. 2023).

According to (Quiroz and Céspedes 2019), bokashi derived from chicken manure contains several nutrients and organic materials that can improve soil's physical, chemical, and biological properties. The availability of nutrients in the soil, soil structure, and good soil air conditioning greatly influence root growth and development, as well as the ability of plant roots to absorb nutrients. The development of a good root system in cucumber plants planted in acidic soil greatly determines the plant's vegetative growth, which ultimately determines the reproductive phase and crop yield. This is in line with the opinion of (Ginting, Wahyudi, and

Zulkifli 2019; Puspasari, Karyawati, and Sitompul 2018) that good vegetative growth will also support a good generative phase.

2. The Effect of NPK 16:16:16 Fertilizer on the Growth and Production of Cucumber (Cucumis sativus) Plants

The variance test results showed that the treatment dose of NPK 16:16:16 fertilizer had no significant effect on plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, number of fruits, and fruit weight. This is thought to be caused by many factors that influence the environment, genetic characteristics, and climate conditions. Apart from that, it can also be caused by excesses and deficiencies of nutrients given to plants, resulting in the photosynthesis process not being effective and the resulting photosynthesis being reduced (de Bang et al. 2021; Sihaloho, Purba, and Siregar 2019). This is in line with the research results of (Sastrawan, Situmeang, and Sunadra 2020) stated that the right dose of NPK fertilizer can increase plant length, number of leaves, number of female flowers, number of harvested fruit per plant, fruit length, fruit weight per plant, and harvest yield as well as speeding up the Age at which flowering begins. Fruit, and the first harvest.

3. The Interaction Effect of Chicken Cage Compost Doses and NPK 16:16:16 Fertilizer on the Growth and Production of Cucumber (Cucumis sativus) Plants

Based on the results of the variance test, it showed that the interaction between treatment doses of chicken coop compost and NPK 16:16:16 fertilizer had no significant effect on plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, number of fruit, and fruit weight. This is expected due to factors that may affect cucumber plants, such as changing weather, pest attacks such as grasshoppers and snails, which damage several parts of the cucumber plant as well as weeds and trees around the cucumber plant, which may affect the cucumber plant's ability to obtain nutrients, water, and light. The sun thus inhibits the growth and production of cucumber plants. (Sastrawan, Situmeang, and Sunadra 2020) stated that good plant growth can be achieved if the factors that influence growth are balanced and profitable and because many factors influence the growth and production of cucumbers, such as genetic factors and climate conditions.

Conclusion

The chicken coop compost dosage treatment significantly affected fruit weight but did not significantly affect plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, and number of fruits. The treatment dose of NPK 16:16:16 fertilizer had no significant effect on plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, number of fruits, and fruit weight. The interaction between the treatment doses of chicken coop compost and NPK 16:16:16 fertilizer had no significant effect on plant height, number of leaves, leaf diameter, flowering time, fruit length, fruit diameter, and fruit weight.

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