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THE EFFECT OF ORGANIC AND INORGANIC FERTILIZER DOSES ON THE GROWTH AND DEVELOPMENT OF RED CHILI PLANTS (Capsicum annuum L.)

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ABSTRACT

This study aimed to determine the effect of organic and inorganic fertilizer dosages on the growth and development of red chili plants (Capsicum annuum L.). The experiment was conducted using a factorial Randomized Block Design (RBD) with 9 treatment combinations (3 × 3). The first factor was chicken manure with the following doses: P0 = control, P1 = 2.6 kg, and P2 = 5.2 kg. The second factor was NPK 16:16:16 fertilizer with the following doses: N0 = control, N1 = 100 g, and N2 = 200 g. The experimental procedures included land preparation, mulching, planting, watering, replanting, weeding, and harvesting. The observed parameters were plant height (cm), stem diameter, yield per plot, and descriptions of pests and diseases (OPT) attacking the chili plants. Application of chicken manure did not significantly affect the observed parameters, although it showed an increase in plant height, stem diameter, and yield per plot compared to the control. The application of chicken manure and NPK fertilizer at 2, 4, 6, and 8 weeks after planting (WAP) had no significant effect on chili plant height. However, plants treated with chicken manure and NPK tended to grow taller than those without fertilization. Similarly, the combined application of chicken manure and NPK had no significant effect on stem diameter at 2, 4, 6, and 8 WAP. In contrast, the application of chicken manure and NPK significantly affected fruit weight per plot. The highest fruit weight was obtained in the N2 treatment, which was significantly different from N0 and N1. The interaction between chicken manure and NPK fertilizer had no significant effect on any of the observed parameters.

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INTRODUCTION

Red chili (Capsium annum L.) is a horticultural crop widely cultivated commercially. This is because chili contains nutrients and can add flavor to dishes. The demand for red chili is increasing, in line with the increasing variety of foods that use red chili. Red chili (Capsium annum L.), or commonly called large chili, is one of the important commodities in the world of agriculture. Red chili is a source of vitamins A, B, C, and E, as well as minerals such as molybdenum, manganese, folate, potassium, thiamin, and copper. Red chili is also included in the group of fruit plants in the vegetable category producing B complex vitamins such as niacin, pyridoxine (vitamin B-6), riboflavin, and thiamin (vitamin B-1). In addition to its high nutritional value, red chili is one of the agricultural commodities with high economic value and is very easy to grow in tropical regions such as Indonesia (Wardani and Purwanta (2008). Inorganic NPK fertilizer is one of the fertilizers that is widely available and sold among farmers.

According to Sintaatmadja in Palobo et al. (2013), NPK compound fertilizers have a relatively high nutrient content and are readily available to plants. Their advantages over single fertilizers include easier application, a more complete and balanced nutrient content, greater efficiency in terms of labor and time, and easier procurement and storage. One frequently used brand of NPK compound fertilizer is Mutiara NPK (16:16:16). This compound fertilizer contains the macronutrients N, P, and K, each at 16% of each.

Considering the negative impacts of long-term inorganic fertilizer use, soil fertility efforts should focus on a combination of inorganic and organic fertilizers. Organic fertilizers offer several advantages over inorganic fertilizers. In addition to being a source of nutrients, they can also increase soil humus content, water retention capacity, and contain numerous microorganisms (Pisdon, 2001 in Lamarobak, 2004).

Chicken manure is an excellent organic fertilizer for crop development. Chicken manure is a mixture of solid and liquid waste mixed with food scraps and bedding. According to Knaofmone (2013), the nutrient content of chicken manure is 0.5% N, 0.25% P2O5, and 0.5% K2O. This varies greatly depending on environmental conditions and the feed provided.

Several studies have consistently shown positive plant responses to chicken manure applications. This is because chicken manure decomposes relatively quickly and has sufficient nutrient content compared to the same amount of other manures (Sutejo, 2002). Research by Haramburu (2017) indicates that the application of chicken manure fertilizer is 40 tons/ha.

RESEARCH METHODS

This research was conducted on local farmers' land in Tanjung Selamat Village, Medan, North Sumatra Province. The research was conducted from April to September 2024. The materials used in this study were local variety red chili seeds, organic (compost), and inorganic fertilizers (NPK 16:16:16). The tools used in this study were a hoe, a watering can, a ruler, a pestle, and a name plate.

The tools used in this study were a hoe for land preparation, a hoe for land preparation, a measuring tape, and a hand sprayer.

This study used a factorial Randomized Block Design (RBD) with 3x3 = 9 combinations: the first factor was chicken manure with doses: P_0 = control, P_1 = 2.6 kg, P_2 = 5.2 kg, and the second factor was NPK 16:16:16 fertilizer with doses: N_0 = control, N_1 = 100 grams, N_2 = 200 grams.

RESULTS AND DISCUSSION

Plant Height

The results of the analysis of variance showed that the provision of chicken manure had no significant effect on the height of red chili plants, the provision of NPK fertilizer had no significant effect on the height of red chili plants, while the interaction had no significant effect on the height of chili plants so that the data analysis was not continued with a mean difference test. Observation data on the provision of chicken manure and NPK fertilizer on the height of red chili plants can be seen in Table 1.

Table 1. Effect of Chicken Manure and NPK Fertilizer on Red Chili Plant Height at 2, 4, 6 and 8 Weeks After Planting.

Treatment	Plant Height (cm)			
	2 MST	4 MST	6 MST	8 MST
P0	33,43	40,77	44,40	56,50
P1	36,00	44,67	54,03	65,53
P2	37,73	45,50	58,53	72,93
BNJ	-	-	-	-

N0	33,93	41,17	44,77	54,90
N1	37,53	45,27	55,03	62,27
N2	35,70	44,50	57,17	77,80
BNJ	-	-	-	-

From Table 1, it can be seen that the application of chicken manure and NPK fertilizer at the age of 2, 4, 6, and 8 Weeks After Planting (WAP) had no significant effect on the height of red chili plants, but the application of chicken manure and NPK fertilizer was higher than without the application of chicken manure and NPK fertilizer. This occurs because plants that are given fertilizer will have a nutrient content that can help accelerate plant growth. It is suspected that NPK fertilizer can balance the lack of nutrients from the soil. The increase in plant height can be optimal because of the appropriate application of Mutiara NPK fertilizer. This is in accordance with the opinion of Tarigan (2009) that plants will grow optimally if planted in a place that meets the growing requirements such as environmental factors, namely climate factors such as soil properties and nutrient availability.

Stem Diameter

The results of the analysis of variance showed that the provision of chicken manure had no significant effect on the diameter of the red chili stem, the provision of NPK fertilizer had no significant effect on the diameter of the red chili stem, while the interaction had no significant effect on the diameter of the chili stem so that the data analysis was not continued with the mean difference test. Observation data on the provision of chicken manure and NPK fertilizer on the diameter of the red chili stem can be seen in Table 2. Analysis of variance showed that the provision of ecoenzyme concentration did not affect the diameter of the red chili stem at the age of 2, 4 and 6 WAP, but had a significant effect at the age of 8 WAP. Observation data on the provision of ecoenzyme concentration on the diameter of the red chili stem can be seen in Table 2.

Table 2. Effect of chicken manure and NPK fertilizer on the diameter of red chili stems at ages 2, 4, 6 and 8 MST.

Treatment	Stem Diameter (cm)			
	2 MST	4 MST	6 MST	8 MST
P0	3,51	4,54	5,63	7,93
P1	3,86	4,79	6,40	9,00
P2	3,67	4,47	6,97	9,70
BNJ	-	-	-	-
N0	3,50	4,50	6,27	8,67
N1	3,71	4,57	6,10	8,70
N2	3,83	4,73	6,63	9,27
BNJ	-	-	-	-

Table 2 shows that chicken manure and NPK fertilizer had no significant effect on red chili pepper stem diameter at 2, 4, 6, and 8 weeks after planting.

According to Gardner, Pearce, and Mitchell (1991) in Sufianto 2014, plant growth is influenced not only by internal growth but also by external factors. It is also clear that plant growth is determined by two main factors: genetics and the environment. Several environmental factors that influence plant growth and development are nutrients, water and humidity, soil, temperature, and light.

Fruit Weight per Plot

The results of the analysis of variance showed that the application of ecoenzyme concentration significantly affected the weight per plot of red chili peppers. Observational data on the effect of chicken manure and NPK fertilizer on the weight per plot of red chili peppers can be seen in Table 3.

Table 3. Effect of Chicken Manure and NPK Fertilizer on the Weight per Plot of Red Chili.

Treatment	N0	N1	N2	Average
P1	370,00	400,00	1890,00	886,67
P2	350,00	580,00	1860,00	930,00
P3	350,00	920,00	1910,00	1060,00
Average	356,67a	633,33a	1886,67b	
BNJ (N) 0,05			419,36	

Note: Numbers followed by the same letter in the same column indicate no significant difference at the 5% level.

Table 3 shows that the application of chicken manure and NPK fertilizer significantly affected the weight of red chili peppers per plot. The highest weight of red chili peppers per plot was found in the N2 treatment, significantly different from the N0 and N1 treatments. NPK fertilizer is well absorbed by plants because it dissolves in water, making it easier for plants to absorb it as it is no longer a solid. This is consistent with Agromedia (2007) which states that inorganic fertilizers have several advantages, including high nutrient content, high water absorption capacity, and high solubility, which is readily absorbed by plant roots.

The higher the NPK fertilizer application, the higher the fruit weight per plot. This suggests that high fertilizer doses can supply the soil's nutrient needs. According to Sutanto (2002) in Yanto (2012), balanced fertilizer application can increase soil nutrients. NPK fertilizers generally contain complete nutrients in sufficient quantities, essential for plant growth and development, enabling optimal plant growth and increased yields.

The relationship between NPK fertilizer application and the weight of red chili plants per plot can be seen in Figure 1.

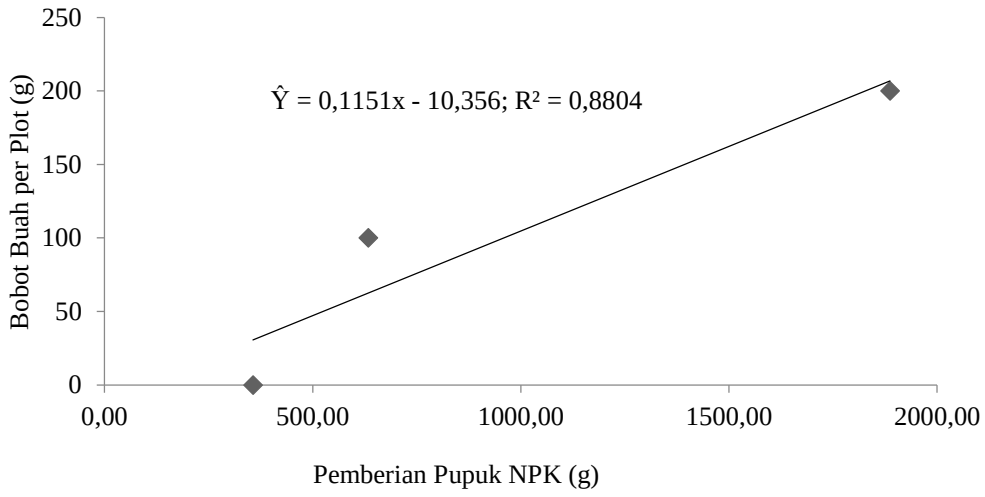

Figure 1. Relationship between NPK fertilizer application and weight per plot of red chili plants.

Types of Chili Plant Diseases

Types of diseases found in red chili plants include:

1. Fusarium Wilt (Fusarium oxysporum F.sp)
   Symptoms of Attack:
   Infected leaves wilt starting from the bottom, turning yellow and spreading upward to young branches. As the infection progresses, the plant wilts. The root and stem tissue turns brown. The infected wound site is covered with white, cotton-like hyphae.
2. Ralstonia Bacterial Wilt (Ralstonia solanacearum)
   Symptoms of Attack:
   In older plants, wilting usually first occurs in the lower leaves. In young plants, wilting symptoms begin to appear on the upper leaves. After a few days, the wilting symptoms are followed by sudden wilting, and the entire plant wilts permanently, while the leaves remain green, sometimes with a slight yellowish tinge. The vascular tissue of the lower stem and roots becomes brownish.
3. Anthracnose Fruit Rot (Collectrotichum gloeospoiroides)
   The initial symptoms of this disease are characterized by the appearance of shiny, slightly sunken, water-soaked spots, black, orange, and brown in color. The black color is the fungal structure (microsclerotia and acervulus). When conditions are humid, the fruit body will turn orange or pink. The resulting lesions will widen and form concentric circles with a diameter of approximately 30 mm or more.
4. Yellowing Virus Disease (Gemini Virus)
   Symptoms:
   Leaf blades experience vein clearing, starting at the top of the leaf, developing a bright yellow color, the leaf veins thicken, and the leaves curl upward. Advanced infection with the gemini virus causes the leaves to shrink and turn bright yellow, stunting the plant, and fruiting is not possible. This disease is very detrimental because it can affect fruit production.
5. Leaf Spot Disease (Cercospora sp.)
   Symptoms:
   This disease causes damage to leaves, stems, and roots. Symptoms of this disease begin with the appearance of round, dry brown spots on the leaves, which can reach about 1 inch in size. The center of the spots is pale to white with darker edges. Older spots can cause holes. Leaf spot can cause significant economic losses in chili cultivation, causing infected leaves to wilt and fall off. This leaf spot disease can attack young plants in the nursery and tends to affect older plants more.

Conclusion

Based on this study, it can be concluded that the application of chicken manure did not significantly affect the observed parameters, but did show an increase in height, stem diameter, and weight per plot compared to control plants. The application of NPK fertilizer significantly affected the fruit weight per plot of red chili plants. The interaction between chicken manure and NPK fertilizer did not significantly affect the observed parameters.

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