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Application of Nitrogen and Phosphorus Fertilizers to the Vegetative Growth of Red Chilies (Capsicum Year L.)

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ABSTRACT

This study aims to determine the extent of the effect of Nitrogen and phosphorus on the vegetative growth of red chili plants. The research method was carried out at the Experimental Garden of the Faculty of Agriculture, Merdeka University, Surabaya. This study used a factorial Randomized Block Design (RAK) with two factors and three plant replications. The results showed a significant interaction between the combination of Nitrogen and Phosphorus treatments on Plant Height observations. The treatment of the correct (highest) Nitrogen fertilizer dose was shown by the N3 treatment and was significantly different from the N1 and N2 treatments on the parameters of plant height, number of leaves and number of branches. The treatment of the correct (highest) Phosphorus fertilizer dose was shown by the P2 treatment and was significantly different from the P1 treatment on the parameters of plant height, number of leaves and number of branches.

Keywords: Chili, Fertilizer, Growth, Plants, Soil.

1. INTRODUCTION

Red chili peppers (Capsicum annuum L.) are a fruit vegetable commodity categorized as a commercial commodity because they are generally sold fresh or processed (SALEH & ROSNI, 2022). Red chili peppers are known as a flavoring and complement to various Indonesian dishes, making them a staple in almost every day. 100 g of chili peppers contains 1.0 g of protein, 0.3 g of fat, 7.3 g of carbohydrates, 470 mg of vitamin A, 18 mg of vitamin C, and 90.9 g of water (Setyadi et al., 2020). Chili peppers are a horticultural product widely cultivated by farmers. This is because chili peppers are a commodity with economic value and are also a raw material that is continuously needed, as they are a food ingredient consumed daily (Hariyadi et al., 2019).

Chili peppers will continue to be needed in increasing quantities along with population growth and the national economy (Septiadi et al., 2020). Chili peppers, or lombok, are annual shrubs. They can be easily grown in both lowlands and highlands. The requirements for good chili growth are humus-rich (fertile), loose, well-drained soil, and a soil pH between 5-6. Areas where chili peppers are widely grown include Yogyakarta, Wonosobo, Pekalongan, and Cirebon. Chili peppers cannot

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tolerate rain, especially during flowering, as the flowers will easily fall off. If the soil is too waterlogged or muddy, the plants are susceptible to wilt disease (Ampareng, 2021). Therefore, the best time to plant chili peppers is at the beginning of the dry season. In dry climates such as Central Java, chili peppers can also be planted during the rainy season as long as there is good drainage (Sukmawati & Numba, 2018).

One of the determining factors for successful chili cultivation is the application of fertilizer. Fertilizer is the primary source of nutrients for plants during growth and reproductive development. Plants require several nutrients daily, such as minerals and water. These nutrients are absorbed by the roots, stems, and leaves. Plant nutrition is inseparable from three nutrients: nitrogen (N), phosphorus (P), and potassium (K) (Ginting, 2019). These nutrients play a crucial role and have mutually supportive functions in plant growth and production. Like other plants, chili plants can grow healthily if the soil where they grow is sufficiently supplied with macro and micro nutrients. The required macro nutrients can be met with artificial fertilizers, namely N, P, and K (MP, 2021). Nitrogen is found not only in the air but also in artificial fertilizers like ZA and Urea. Nitrogen is unstable in the soil, so plants often show symptoms of this nutrient deficiency. Considering this issue, it is necessary to study the effect of nitrogen and phosphorus fertilizer doses on red chili growth (Rai, 2023).

2. RESEARCH METHODS

The research was conducted at the Experimental Garden of the Faculty of Agriculture, Merdeka University, Surabaya. This research used a factorial Randomized Block Design (RAK) with two factors and three plant replications.

Factor I: Nitrogen Fertilizer Dose consisting of 3 levels:

N1 : 5 grams/plant

N2 : 10 grams/plant

N3 : 15 grams/plant

Factor II: Phosphorus Fertilizer Dose consisting of 2 Levels:

P1 : 10 grams/plant

P2 : 15 grams/plant

From the two factors above, 6 treatment combinations were obtained as follows, then each treatment combination was repeated 3 times:

N1P1	N1P2
N2P1	N2P2

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N3P1 N3P2

Information :

N : Nitrogen Fertilizer Dosage

P : Phosphate Fertilizer Dosage

I,II,III : Ulangan

3. RESULTS AND DISCUSSION

Plant Height

The statistical results on plant height (Appendix 1) show an interaction between the Nitrogen fertilizer dose treatment and Phosphate fertilizer at 30 days after planting (DAP). Separately, the Nitrogen fertilizer dose treatment had a significant effect on plant height at the observation ages of 20, 30, and 40 DAP. The average values of the results of observations of plant height due to the Nitrogen and Phosphate fertilizer dose treatments are presented in Table 1 and Table 2.

In table 1 it can be seen that the highest plant height was produced by the N3P2 treatment combination of 35.40 cm and the lowest result was achieved by the N1P1 combination of 16.68 cm. while in table 2 it can be seen that in the N3 Nitrogen fertilizer treatment the results were higher than N2 and N1, and the highest Phosphorus fertilizer treatment was achieved by P2.

Table 1. Average Plant Height (cm) of Red Chili Peppers in Combination of Nitrogen and Phosphorus Fertilizer Doses

Treatment	Plant Age
N1P1	16,86 a
N2P1	19,06 ab
N3P1	24,56 cd
N1P2	18, 86 ab
N2P2	23, 40 cd
N3P2	35,40 cd
Bnt 5%	4, 84

Description: Numbers accompanied by the same letter show no significant difference in the 5% BNT test.

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Table 2. Average Plant Height (cm) of Red Chili Peppers in Nitrogen and Phosphorus Fertilizer Dose Treatments

Treatment	Observation Age (HST)			
	10	20	30	40
N Fertilizer Dosage N1 N2 N3	 12,25 13,59 15, 46	 16,45 18,24 20,16	 21,46 23,23 23,33	 25,76 25,66 26,07
BNT 5%	tn	tn	tn	tn
Dosage of P fertilizer P1 P2	14,80 15,46	16,50 18,16	18,50 a 21,41 ab	24,89 25,33
BNT 5%	tn	tn	3,04	tn

Description: Numbers accompanied by the same letter show no significant difference in the 5% BNT test. tn = not significantly different

Number of Leaves

The results of the statistical analysis of the number of leaves (Appendix 2) did not indicate any interaction between the nitrogen and phosphorus fertilizer doses. However, separately, the nitrogen fertilizer dose treatment had a significant effect on the number of leaves at all observation ages, while the phosphorus fertilizer dose treatment only had an effect at 10, 20, and 30 days after planting (DAP). The average observation of the number of red chili leaves due to the nitrogen and phosphorus fertilizer dose treatments at various observation ages is presented in Table 3.

Table 3 shows that the dose of nitrogen fertilizer N3 produced a greater number of leaves compared to N1 and N2. For the phosphorus fertilizer dose treatment, the highest number of leaves was achieved by P2 at all observation ages.

Table 3. Average Number of Red Chili Leaves in Nitrogen and Phosphorus Fertilizer Dose Treatments

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Treatment	Observation Age (HST)			
	10	20	30	40
N Fertilizer Dosage N1 N2 N3	 14,25 15,59 17, 46	 39,45 40,24 45,16	 49,46 50,23 53,33	 56,76 59,66 64,07
BNT 5%	tn	tn	tn	tn
Dosage of P fertilizer P1 P2	14,80 18,46	36,50 47,16	45,50 a 57,41 ab	53,89 60,33
BNT 5%	0,959	2,879	2.857,04	2,766

Description: Numbers accompanied by the same letter show no significant difference in the 5% BNT test. tn = not significantly different

Number of Branches

The statistical analysis of the number of branches (Appendix 3) did not show any interaction between the nitrogen and phosphorus fertilizer doses. However, separately, the nitrogen fertilizer dose treatment had a significant effect on the number of branches at 30 days after planting (DAP), while the phosphorus fertilizer dose treatment did not provide a significant difference at all observation ages. The average results of observations on the number of red chili branches for the nitrogen and phosphorus fertilizer doses at various observation ages are presented in Table 4.

In table 4 it appears that Nitrogen fertilizer (N3 9.07) at the observation age of 40 days after planting (DAP) produced a greater number of branches compared to N1 and N2. For the Phosphorus fertilizer dose treatment, the highest branch was achieved at (P2 8.33) at the observation age of 40 days after planting (DAP).

Table 4. Average Number of Red Chili Branches in Nitrogen and Phosphorus Fertilizer Dose Treatments

	Observation Age (HST)

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Treatment	10	20	30	40
N Fertilizer Dosage				
N1	1,25	2,45	5,47	8,76
N2	1,59	2,24	5,23	8,66
N3	2, 98	4,16	7,33	9,07
BNT 5%	tn	tn	tn	tn
Dosage of P fertilizer				
P1	1,80	3,50	5,50 a	7,89
P2	2,46	4,16	6,41 ab	8,33
BNT 5%	tn	tn	tn	tn

Description: Numbers accompanied by the same letter show no significant difference in the 5% BNT test. tn = not significantly different

Discussion

Based on the results of the analysis of variance, it can be seen that the combination of Nitrogen and Phosphorus fertilizer doses shows an interaction with the parameters of plant height at the age of 10, 20, 30 days after planting (DAP) and the number of leaves at the observation age of 10, 30, 40 days after planting and the parameter of the number of branches at the age of 10 days after planting.

There is an interaction between the dose of Nitrogen fertilizer and the dose of phosphorus fertilizer on plant height, number of leaves and number of branches at that age because the nutrients contained in Nitrogen and Phosphorus fertilizers are available to plants and are able to increase plant growth. Because Nitrogen fertilizers contain very important macro nutrients that are needed for growth. (Kurniawan et al., 2017) stated that the nutrient N is one of the nutrients that is needed by plants, to support plant growth and development and its needs are needed in large quantities. This is supported by the opinion (Rahmatika, 2013) that with proper and correct fertilization it will be able to help in the continuous provision of nutrients so that plants grow shoots faster. Separately, nitrogen fertilizer dosage significantly affected leaf number, while phosphorus fertilizer dosage significantly affected plant height, leaf number, and branch number.

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From the statistical results, it is known that the combination of Nitrogen fertilizer doses and phosphorus fertilizer doses has a significant interaction effect on plant height variables at 30 HST (N3) with the highest results in the combination of Nitrogen fertilizer doses and P2 phosphorus fertilizers but not significantly different from other treatment combinations. This is because in the initial growth, the elements Nitrogen, Phosphorus are very much needed for normal growth, as a result of the administration of Nitrogen and phosphorus fertilizers and other elements will cause the growth of the number of leaves and plants to be good. So that if the number of leaves is greater, the possibility of the photosynthate process being produced is greater. This is in accordance with the opinion of (Sapseli et al., 2022) that the elements N and P available in sufficient quantities will be able to help the process of plant growth and development. that nutrients available to plants through the process of photosynthesis will produce carbohydrates which will then be transported to the apical meristem and the growing point of the plant. This will stimulate the rate of growth, elongation and cells resulting in better plant development and growth.

The results of the statistical analysis of the number of leaves did not show any interaction between the treatment of Nitrogen fertilizer doses and Phosphorus fertilizer. However, separately the treatment of Nitrogen fertilizer doses had a significant effect on the number of leaves at all observation ages, while for the treatment of phosphorus fertilizer doses only had a significant effect on the number of leaves, where P2 produced the number of leaves 60.33 compared to P1 53.89 in the treatment of Nitrogen fertilizer doses N3 was significantly different from all Nitrogen fertilizer doses at the age of 10, 20, days after planting (DAP), while at the age of 40 DAP the Nitrogen fertilizer dose N3 was significantly different from N1 but not different from N2 and N3.

The results of the statistical analysis of the number of branches did not show any interaction between the Nitrogen fertilizer dose treatment and Phosphorus fertilizer, but separately the Nitrogen fertilizer dose treatment had a significant effect on the number of branches at the age of 30 days after planting (DAP), in the phosphorus fertilizer dose treatment there was no significant difference, but there was a tendency for the P2 phosphorus fertilizer dose to have the largest number of branches compared to other phosphorus fertilizer

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dose treatments. Furthermore, if viewed from the dosage factor of nitrogen fertilizer combined with nitrogen and phosphorus, the more up to a certain limit, the better the initial growth.

4. CONCLUSION

1. Regarding the real interaction between the combination of Nitrogen and Phosphorus treatments on observations of Plant Height.
2. The correct (highest) dose of Nitrogen fertilizer was shown by the N3 treatment and was significantly different from the N1 and N2 treatments regarding the parameters of plant height, number of leaves and number of branches.
3. The correct (highest) dose of phosphorus fertilizer was shown by treatment P2 and was significantly different from treatment P1 in terms of plant height, number of leaves and number of branches.

Suggestion

It is recommended to use or re-examine the dosage of Nitrogen and Phosphorus fertilizers because of the extent to which the use of N and P fertilizers affects the vegetative growth of red chili plants.

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