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THE EFFECT OF PRUNING ON CHILI PEPPER STEMS (CAPSICUM FRUTESCENS L) ON PRODUCTIVITY

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Abstract

This study aims to determine the effect of stem pruning on chili pepper plants (Capsicum frutescens L.) on plant height growth, number of productive branches, and fruit weight. The study was conducted using an experimental method with a randomized block design (RBD) consisting of two treatments, namely without pruning (control) and stem tip pruning, each with 21 sample plants. Data analysis was performed using the non-parametric Wilcoxon Signed Ranks Test. The results showed that stem pruning shortened the plants to an average of 69.14 cm, lower than the control at 132.91 cm, but was able to increase the number of productive branches to an average of 25.95 branches, much higher than the control at 5.86 branches. The average fruit weight of the treated plants was also greater, although not statistically significantly different.

Keywords: Cabai Rawit, Shoot Pruning, Plant Growth

INTRODUCTION

Chili pepper (Capsicum frutescens L.) is one of Indonesia's plants because chili fruits are widely used as an additive in cooking and as processed products for business opportunities. Chili fruits contain compounds that are good for health. According to Sujitno and Dianawati (2015). Data from the Ministry of Agriculture shows that several major red chili pepper producing provinces, such as East Java, Central Java, and North Sumatra, experienced a decrease in production. In East Java Province, the total production of chili peppers decreased from approximately 646,740 tons in 2022 to 455,975 tons in 2023. Meanwhile, Central Java Province also recorded a decrease in production, from approximately 248,067 tons in 2022 to approximately 117,550 tons in 2023, while in North Sumatra, it decreased from 84,600 tons in 2022 to approximately 81,582 tons in 2023. Conversely, household consumption of chili peppers in Indonesia experienced a significant increase. Total consumption in 2023 reached 610.85 thousand tons, up 7.2% from 2022 consumption of 569.65 thousand tons. In the last five years, Indonesia's chili consumption has even surged by 15%. This increase in consumption is triggered by high demand in the domestic market, driven by the popularity of chili peppers as a cooking ingredient in various traditional Indonesian dishes. The price of red chili peppers is still creeping up. The price of chili is due to the drastic surge in chili consumption by Indonesian citizens. Data from the National Strategic Food Price Information Center (PIHPSN) shows that the price of red chili

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peppers on Friday (2/8/2024) was Rp 76,850/kg, a jump of 44.6% in one month. The price of chili also surged sharply compared to August 2023, which was at Rp 48,550/kg. Chili peppers even contributed 0.09% to inflation when the Consumer Price Index (CPI) generally decreased or experienced deflation in July 2024.

One cultivation technique that can be applied to increase chili pepper production is stem tip pruning. Yolanda et al. (2021) stated that tip pruning can stimulate the apical buds (stem tips) of plants to immediately produce flowers and fruits. The buds at the tip are the center of auxin formation. This auxin will spread to the stem after pruning and encourage the emergence of lateral shoots. If there are more lateral shoots, maximum production will be obtained. This study aims to determine the effect of stem tip pruning on the growth and yield of chili peppers.

IMPLEMENTATION METHOD

The research was conducted in Darungan village, Sumberwringin sub-district, Bondowoso regency, from November 2024 to February 2025. The type of research used was pure experimental research with a quantitative approach to determine the effect of independent variables on dependent variables. The research design used was a Randomized Block Design (RBD) with 2 treatments, namely pruning and control. The research procedure began with the sowing of chili seeds by soaking them in a 10% potassium hypochlorite solution to select viable seeds. Seeds that sank were sown in a medium of soil and manure mixed in a 1:1 ratio. Seedlings were then transplanted to permanent planting beds after 30 days. Plant care involved routine watering as needed, fertilization with urea according to a gradual dosage based on plant age, weeding to reduce competition with weeds, and pest and disease control through isolation of affected plants. Pruning treatment was performed 21 days after planting by cutting the stem tip 10–15 cm from the soil surface.

Data collection techniques were carried out through direct observation using rulers, scales, and observation sheets. Height measurements were taken from the soil surface to the highest shoot tip of the plant, the number of branches was counted manually, while fruit weight measurements were taken using scales. The observed data were analyzed using normality and homogeneity tests as prerequisites for parametric analysis. If the data were normally distributed and homogeneous, Analysis of Variance (ANOVA) was performed to test the effect of the treatment on growth variables. If there was a significant difference, a Duncan test was then performed to compare between treatments. However, if the assumptions of normality or homogeneity were not met, the non-parametric Wilcoxon test was used.

RESULTS AND DISCUSSION

Diagram 1. Results of normality test for chili plant height pruning

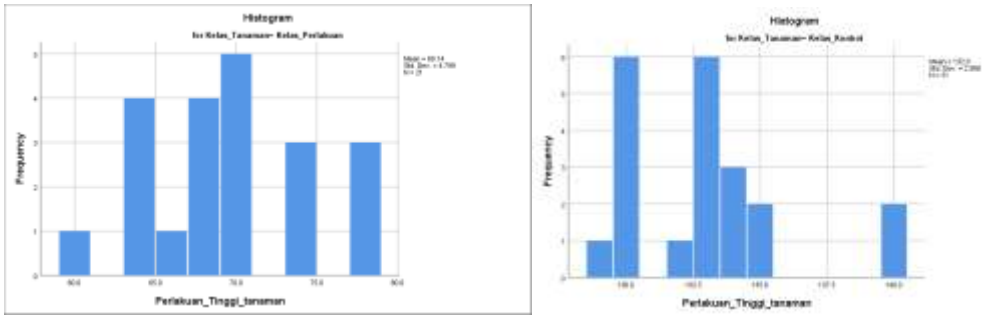

Figure 1. chili plant height pruning

Figure 1 shows the results of plant height measurements in both groups, namely the treatment group and the control group, presented in histogram form in Figure 1 and Figure 2. Based on these histograms, it is known that the distribution of plant height in the treatment group shows a wider range, namely between 68.5 cm and 80.5 cm, with an average (mean) value of 69.74 cm and a standard deviation of 3.78. The highest frequency was recorded in the height range of 70.5 cm, indicating that most plants in this group had a height close to this figure. Conversely, in the control group, plant height tended to be more uniform with a value range between 134.0 cm and 137.5 cm. The average plant height in this group reached 134.2 cm with a relatively small standard deviation of 0.89, indicating that plant growth in the control group was more consistent compared to the treatment group. This difference in distribution and average plant height indicates a significant effect of the given treatment. The control group showed higher and more stable plant growth, while the treatment group experienced lower growth with greater variation among individual plants.

Diagram 2. Results of normality test for chili plant branch number pruning

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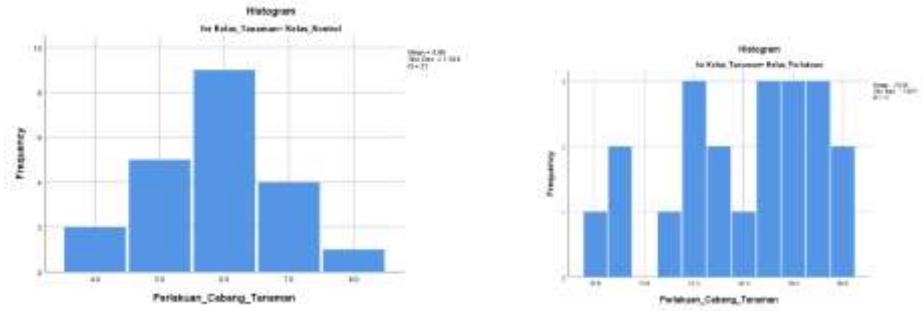

Figure 2. Diagram of chili branch number pruning

Figure 2 shows that the observation results for the number of plant branches indicate a striking difference between the control group and the treatment group. In the control group, the number of plant branches ranged from 4 to 8 branches with an average of 5.56 and a standard deviation of 1.01. This indicates that most plants in the control group had a relatively small number of branches and tended to vary among individuals. Conversely, the treatment group showed much higher and more consistent results, where the number of plant branches

ranged from 19.5 to 20.5 branches with an average of 20.00 and a very small standard deviation of 0.37. This data indicates that the given treatment was able to significantly increase the number of plant branches while producing more uniform growth. Thus,the applied treatment proved effective in promoting the growth of plant branches compared to the control group.

Diagram 3. Normality test results for fruit weight pruning

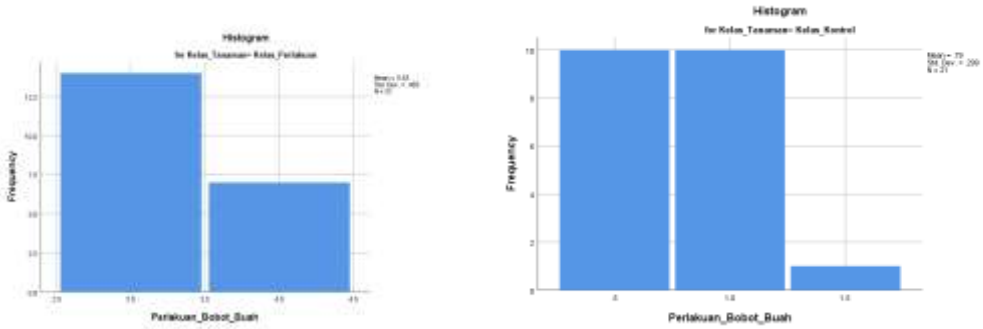

Figure 3. Diagram of fruit weight pruning results

Based on Figure 3, there is a striking difference between the control group and the treatment group in terms of the number of plant branches. In the control group, the number of plant branches ranged from 4 to 8 branches, with an average value of 5.56 and a standard deviation of 1.01. The highest frequency was found in plants with 6 branches, indicating that most plants in the control group only had a moderate number of branches and their growth varied considerably. In contrast, in the treatment group, the number of plant branches ranged from 19.5 to 20.5 branches, with an average value of 20.00 and a very low standard deviation of 0.37. This indicates that the given treatment had a significant impact on increasing the number of plant branches. Not only was it higher, but the number of branches in the treatment group was also more uniform, reflecting the effectiveness of the treatment in promoting optimal and consistent plant branch growth. Thus, this data indicates that the applied treatment contributed positively to the increase in quantity and stability of plant branch growth compared to the control group.

Table 1. Homogeneity test results for chili plant pruning

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Perlakuan_Tinggi_tanaman	Based on Mean	5.367	1	40	.026
	Based on Median	4.765	1	40	.035
	Based on Median and with adjusted df	4.765	1	36.241	.036
	Based on trimmed mean	5.145	1	40	.029
Perlakuan_Cabang_Tanaman	Based on Mean	23.112	1	40	.000
	Based on Median	14.897	1	40	.000
	Based on Median and with adjusted df	14.897	1	25.234	.001
	Based on trimmed mean	22.324	1	40	.000
Perlakuan_Bobot_Buah	Based on Mean	16.647	1	40	.000
	Based on Median	.359	1	40	.553
	Based on Median and with adjusted df	.359	1	30.405	.554

Based on Table 1, the results of the homogeneity of variances test using Levene's test show that for the plant height variable, the Levene statistic value based on the mean is 5.367 with a significance (Sig.) of 0.026. This value is below the significance level of 0.05, so it can be interpreted that the variance of plant height is not homogeneous or differs significantly between the treatment and control groups. Levene's values based on the median and trimmed mean also show similar results, with significances of 0.035, 0.036, and 0.029 respectively, all of which are below 0.05. This strengthens the conclusion that the variation in plant height data in both groups differs significantly. For the plant branch count variable, Levene's test results show an even smaller value. Based on the mean, the Levene statistic value is 23.112 with a significance of 0.000. The same significance value also appears in calculations based on the median (0.000) and trimmed mean (0.000), with the adjusted df also showing a significant

value (0.001). Thus, the variance of the number of branches between the pruning treatment group and the control group is not homogeneous, meaning that the variation in the number of branches in the two groups differs significantly.

In contrast, for the fruit weight variable, Levene's test results based on the mean show a Levene statistic value of 16.647 with a significance of 0.000, meaning that the variance based on the mean is not homogeneous. However, based on the median, the Levene statistic value is only 0.359 with a significance of 0.553, and with adjusted df the significance value remains 0.554. This value is well above 0.05, indicating that the variance of fruit weight is homogeneous when tested based on the median, but not homogeneous when based on the mean. This inconsistency can occur because the data distribution tends to be skewed, so the median gives different results compared to the mean. From the data above, the data can be categorized as normally distributed and not homogeneous. Therefore, a non-parametric test was performed using the Wilcoxon test to determine the effect of pruning on chili plant stems.

Table 2. Pruning of chili plant stems

Test Statistics[a]

	y - x
Z	-4.017[b]
Asymp. Sig. (2-tailed)	.000

a wilcoxon signed ranks test
b based on negative ranks

Based on the results of the Wilcoxon Signed Ranks Test in Table 2, a Z statistic value of –4.017 was obtained, with an asymptotic two-tailed significance (Asymp. Sig. (2-tailed)) of 0.000. This significance value is well below the significance level of 0.05,"""which means there is a significant difference between the two groups or conditions being compared. The negative sign on the Z value (–4.017) indicates that the average difference (deviation) tends to be in the negative rank, meaning that the values in group x are generally larger than the values in group y (because the table shows "y – x"). Thus, it can be interpreted that data x generally has higher values than data y.

Table 3. Number of chili plant branches

Test Statistics[a]

	y - x
Z	-4.021[b]
Asymp. Sig. (2-tailed)	.000

a wilcoxon signed ranks test
b based on negative ranks

Based on the results of the Wilcoxon Signed Ranks Test in Table 3, a Z statistic value of –4.021 was obtained, with an asymptotic two-tailed significance (Asymp. Sig. (2-tailed)) of 0.000. This significance value is far below the 5% significance level (α = 0.05), so it can be concluded that there is a significant difference between the compared groups x and y. The negative Z value (–4.021) indicates the direction of the tested data difference based on positive ranks, meaning that the calculation is performed from cases where the value of y is greater than x. With a negative Z sign and a positive rank basis, it can be interpreted that the difference in values (y – x) tends to produce positive ranks, but the statistical direction shows a decreasing trend. This indicates that the value of x is generally smaller than y, so the average difference supports that group y has a larger value than group x.

Table 4. Number of chili plant branches

Test Statistics[a]

	y - x
Z	-.613[b]
Asymp. Sig. (2-tailed)	.540

a wilcoxon signed ranks test

Based on the results of the Wilcoxon Signed Ranks Test in Table 4, a Z statistic value of –0.613 was obtained, with an asymptotic two-tailed significance (Asymp. Sig. (2-tailed)) of 0.540. This significance value is far above the 0.05 significance level (α = 5%), so it can be concluded that there is no significant difference between the compared groups x and y. The negative Z value (–0.613) and the "based on positive ranks" description mean that the calculation is performed in cases where the value of y is greater than x, but the statistical direction indicates that the resulting rank difference is not strong enough to show a real difference. A significance value of 0.540, which is close to 0.5, indicates that the distribution of the y – x difference is balanced between positive and negative ranks, so there is no dominant tendency in either group. b based on negative ranks

Figure 4. Pruning results after 2 months

CONCLUSION

Based on the research results, it can be concluded that the treatment of pruning the stem tips of cayenne pepper plants (Capsicum frutescens L.) has a significant effect on vegetative growth and plant yield. Pruning can suppress the vertical growth of plants, as evidenced by the average lower plant height in the treated plants compared to the control. However, pruning significantly increases the number of productive branches on the plant, which potentially supports an increase in the number of flowers and fruits. Overall, pruning the stem tips can be an effective cultivation technique to increase the number of productive branches on cayenne pepper plants. With more branches, the plant has the potential to produce more fruit, although it does not always significantly increase the individual fruit weight. This technique is highly relevant to be applied to support the increase in cayenne pepper production, especially amidst the increasing domestic market demand and relatively high price fluctuations in Indonesia. In addition to impacting agronomic aspects, the application of pruning techniques can also support economic aspects, as plant productivity can be increased in a relatively simple and inexpensive way. In the future, further research can be conducted to optimize the timing and intensity of pruning, and combine it with other treatments such as fertilization and planting distance regulation, to obtain maximum results in terms of both quantity and quality of fruit.

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