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# Effect of a Combination of Auxin and Gibberellin Hormones on the Growth and Production of Cayyey Chilli Plant (Capsicum frutescens L.)

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**ABSTRACT**

This research aims to determine the effect of giving a combination of the hormones auxin and gibberellin on the growth and production of cayenne pepper plants. The design used in this research was a Completely Randomized Design (CRD) with 25 treatments and 2 replications using combined auxin and gibberellin concentrations of 0,50,100,150,200 ppm. It is applied three times, namely when soaking the seeds and spraying when flower buds form and after the young plants bear fruit. The research results were analyzed using Kruskall-Wallis which showed that there was no effect of giving a combination of auxin and gibberellin hormones on all observation parameters. Growth parameters including plant height and number of leaves were highest in treatment 17, namely a combination of 150 ppm auxin and 50 ppm gibberellin with a value of 21.46 cm and 18.9 fruit. Production yield parameters which include anthesis time and the highest number of flowers in treatment 17, namely a combination of 150 ppm auxin and 50 ppm gibberellin with values of 35.5 days and 3.94 fruit, then the number of fallen flowers and the lowest number of fallen fruit in treatment 21, namely the combination 200 ppm auxin and 0 ppm gibberellin with a value of 1.28 fruit and 0 fruit, then the highest number of fruit was in treatment 7, namely a combination of 50 ppm auxin and 50 ppm gibberellin with a value of 43.5 fruit. The most optimal combination in the P17 treatment is a combination of 150 ppm auxin and 50 ppm gibberellin.



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## 1. INTRODUCTION

Indonesia is a country with high biodiversity wealth. This is because Indonesia has a suitable climate and is located on the equator which can support the growth of various kinds of organisms, especially plants. This condition is what makes Indonesia nicknamed an agricultural country. The agricultural sector is one of the main sources of livelihood for the Indonesian population (Kusumaningrum, 2019). One example of Indonesian agricultural products that are often used in everyday life is chili plants. The chili plant is a horticultural plant which is usually used as a cooking spice, chili sauce or sauce, and as a medicinal mixture (Lelang et al., 2019). Apart from that, chilies are also widely used as raw materials for the ready-made food industry and to produce essential oils as raw materials for cosmetics (Cahyono, 2003).

The function of chilies in various dishes is mainly to provide a spicy or warm taste so that the food will be fresher (Telaumbanua, 2022). This spicy taste is caused by the capsaicin content in chilies (Amaliah, 2018). The use of chilies in everyday life and in industrial fields such as the chili powder, sauce and instant noodle industries which require tens or even hundreds of tons of chilies per month can result in the price of chilies increasing (Hamid & Haryanto, 2011). Apart from that, chili production in Indonesia is still considered very low, while the market prospects for cayenne pepper commodities continue to increase in line with the increase in population and the number of existing industries.

The low productivity of chilies in Indonesia is caused by several things, namely, the quality of the seeds is still low, the cultivation techniques applied are not optimal, and pest and disease problems (Alif, 2017). Based on data from the Ministry of Agriculture, total chili production was 1.96 million tons in 2016 and increased in 2017 by 2.35 million tons and there was a slight decrease of 2.30 million tons in 2018, then it is estimated that the 2019 production plan is 2 .90 million tons. Meanwhile, total chili consumption from 2016-1019 continues to increase. Consumption of cayenne pepper in 2016 was 1.35 kg capita, in 2017 it was 1.38 kg capita, in 2018 it was 1.43 kg capita, in 2019 it is predicted to be 1.46 kg capita Ministry of Trade, 2019. Based on this data it can be seen that the supply of chilies is insufficient or unstable, while the level of chili consumption increases every year. This is one of the causes of the spike in chili prices on the market.

Several factors cause fluctuations in chili prices because chili production is seasonal, rain factors, production costs, and the length of distribution channels (Ministry of Agriculture, 2016). Research regarding the application of the gibberellin hormone to plants has also been carried out, including research conducted by Yasmin et al., 2014with research results showing that giving 50 ppm and 100 ppm of the gibberellin hormone at the beginning of flowering to form flower buds, the beginning of young fruit bearing fruit and the beginning of flowering and fruiting can increase the height of large chili plants.

Next on research Tetuka et al., 2015showed that the application of soaking the seeds and spraying them once a week for five times with 100 ppm gibberellin gave the best results in increasing the percentage and germination rate of rubber seeds. Herdiandika, 2015 His research showed that giving 90 ppm GA3 gibberellin when fruit was forming was optimal in reducing flower and fruit loss in guava plants. Research resultSundahri et al., 2016also showed that the best response to growth and yield of tomato plants was by administering 100 ppm gibberellin once every 7 days, once every 14 days, and once every 21 days, which had an effect on the number of leaves, number of fruit, and fruit weight. Next on research Vebriansyah, 2018, the application of soaking seeds and spraying when flowers appear using 200 ppm gibberellin also provides the best growth and production of red chili plants.

## 2. METHOD

This research is an experimental study using a Completely Randomized Design (CRD) with 25 treatments and 2 repetitions calculated using the Federer formula as follows (n-1) (t-1) ≥ 15.

**Table 1.** Combination of Auxin and Gibberellin Hormones

| Combination of Auxin and Gibberellin Hormones (Ppm) | | | | |
|---|---|---|---|---|
| P1 | P6 | P11 | P16 | P21 |
| P2 | P7 | P12 | P17 | P22 |
| P3 | P8 | P13 | P18 | P23 |
| P4 | P9 | P14 | P19 | P24 |
| P5 | P10 | P15 | P20 | P25 |

Information:
Auxin Combination: Gibberellin P1. 0:0 ppm P6. 50:0 ppm P11. 100:0 ppm P16. 150:0 ppm P21. 200:0 ppm P2. 0:50 ppm P7. 50:50 ppm P12. 100:50 ppm P17. 150:50 ppm P22. 200:50 ppm P3. 0:100 ppm P8. 50:100 ppm P13. 100:100 ppm P18. 150:100 ppm P23. 200:100 ppm P4. 0:150 ppm P9. 50:150 ppm P14. 100:150 ppm P19. 150:150 ppm P24. 200:150 ppm P5. 0:200 ppm P10. 0:200 ppm P15. 100:200 ppm P20. 150:200 ppm P25. 200:200 ppm.

The tools used in this research were 60% paranet, bamboo, hammer, nails, raffia rope, measuring tape, try pot, polybag measuring 35x35 cm, wood, aqua glass, hand sprayer, measuring cup, labels, camera, scissors, stationery, basin, hoe, room thermometer, and digital soil tester. The materials used in this research were F1 Bhaskara variety cayenne pepper seeds, soil, manure,

NPK pearl fertilizer, dolomite agricultural lime, Furadan, Curacron 500 EC, Dithane M-45, water, pure liquid auxin hormone with an active ingredient concentrate of 500 ppm , pure liquid gibberellin hormone with an active ingredient concentrate of 500 ppm. The data obtained in this study used plant height, number of leaves, anthesis time, number of flowers, number of fallen flowers, number of fallen fruit, and the number of fruit was analyzed using the Kruskall-Wallis test.

## 3. RESULTS AND DISCUSSION

### 3.1 Research results

Based on the results of research that has been carried out regarding the effect of giving a combination of the hormones auxin and gibberellin on the growth and production of cayenne pepper, consisting of 25 treatments. This is done to determine the most optimum concentration for the growth and production of cayenne pepper plants. The statistical test results included plant growth parameters consisting of plant height and number of leaves, then plant production results parameters consisting of height, anthesis time, number of flowers, number of fallen flowers, number of fallen fruit, and number of fruit showed no significant differences between the groups. control and treatment groups.

**Table 2.** Results of Normality Test, Homogeneity, and Kruskall-Wallis Test on Observation Parameters of Cayenne Pepper (C. Frutescens L.)

| No | Observation Parameters | Normality Test (Sig.) | Homogeneity Test (Sig.) | Kruskall Wallis Test (Sig.) |
|---|---|---|---|---|
| 1 | Plant height | 0.732 | 0,000 | 0.499 |
| 2 | Number of Leaves | 0,406 | 0,000 | 0.487 |
| 3 | Anthesis Time | 0.653 | 0,000 | 0.454 |
| 4 | Amount of Interest | 0.297 | 0,000 | 0.427 |
| 5 | Number of Fall Flowers | 0.001 | 0,000 | 0.200 |
| 6 | Number of Fall Fruit | 0,000 | 0,000 | 0.138 |
| 7 | Number of Fruits | 0.071 | 0,000 | 0.220 |

Plant height growth is one form of increase in apical meristem division so that it can encourage primary growth. Wijiyanti et al., 2019. Observation of plant height is carried out by measuring the plant from the surface of the planting medium to the point of plant growth. Observations were carried out every week from the age of 7 HST to the age of 35 HST. Based on the statistical test results in Table 2 the normality value for the plant height parameter is 0.732, which means the data is normally distributed, then continued with a homogeneity test and a value of 0.000 is obtained, which means the data is not homogeneous. Data is normal and homogeneous if the p-value is 0.05. If the data is not normal and homogeneous then continue with the Kruskall-Wallis test. Based on the results of the Kruskall-Wallis test, a significant value of 0.499 or p-value 0.05 was obtained, which means there was no significant difference between the control group and the treatment group. There is no real effect of giving a combination of auxin and gibberellin hormones on plant height parameters, this can be caused by internal or external factors.

Plant growth is not only influenced by environmental factors but also influenced by genetic factors(Muhyidin et al., 2018). There was no real difference in each treatment possibly due to the lack of effectiveness of the growth regulator used. The effectiveness of providing growth regulators depends on the type of plant. On the other hand, growth regulators themselves function as precursors, namely compounds that can precede the rate of other compounds in the metabolic process and are part of the genetic process of the plant itself.(Aisyah et al., 2016). Environmental factors that cause no real influence on plant height parameters include temperature, sunlight intensity, pest and disease attacks.

Pests and diseases that attacked plants during research included lice and fungi which could cause plant growth to be stunted. Apart from pests and diseases that attack cayenne pepper plants, light can also have an influence on plant growth(Rostini, 2012). At the time of the research, the greenhouse was located close to several trees, so the light received by the plants was blocked by the trees for several hours.Lukitasari, 2012states that most plants grow well at light intensity below full light for one day. Each type of plant shows a different response to different light intensities.

The combination of auxin and gibberellin hormones had no effect on plant height parameters. This is in accordance with researchRohmawati & Hastuti, 2018that giving GA3 gibberellin concentrations of 10, 20, 30, and 40 ppm did not have a significant effect on the height parameters

of cayenne pepper plants. Even though the observation results showed that there was no real effect between the control and treatment groups, if seen from the average plant height results, the combination treatment of auxin and gibberellin hormones showed better results compared to the control. Treatments of 1 0 ppmm, 6 50 ppm, 11 100 ppm, 16 150 ppm, and 21 200 ppm showed average plant heights of 13.7 15.89 17.84 19.36 and 19.48 cm respectively.

**3.1.1 The results of securing the number of leaves, flowers and fruit.**

Leaves are one part of the plant that is usually used as a growth parameter. Leaves function as a place where the photosynthesis process takes place to produce food for plants(Suyatman, 2021). Counting the number of leaves was carried out on leaves that had completely opened and then recorded every week starting from the age of 7 HST to the age of 35 HST. n the normality value is 0.406, which means the data is normally distributed because the p-value is > 0.05, then continues with the homogeneity test and a value is obtained of 0.000, which means the data is not homogeneous because the p-value < 0.05. If the data is not homogeneous then continue with the Kruskall-Wallis test. Based on the results of the Kruskall-Wallis test, a significant value of 0.487 or p-value > 0.05 was obtained, which means there was no significant difference between the control group and the treatment group. Apart from that, plant growth was also influenced by environmental factors.

This research was carried out during the rainy season, where during this season chili plants are very susceptible to pests and disease. One of the pests that attacks chili plants is aphids. Leaves that are attacked by this pest become curly, thick, and curve downwards, resulting in stunted plants and stunted plant growth.(Meilin, 2014). Apart from pests, diseases can also attack chili plants during the rainy season. One of the diseases that can attack chili plants during the rainy season is leaf rot caused by the fungus Choanephora cucurbitarium.(Widnyana, 2023). Flowers on plants will appear when the vegetative phase enters the generative phase. Therefore, the speed of plant growth will also affect the appearance of flowers(Subekti et al., 2007). Observation of anthesis time is carried out every day when the plant has entered the generative phase or has started to flower. The anthesis time is calculated from the time of transplanting until the plant first flowers fully. the anthesis time parameter showed a normality value of 0.653, which means the data is normally distributed, then continued with a homogeneity test and obtained a value of 0.000, which means the data is not homogeneous. If the data is not homogeneous then continue with the Kruskall-Wallis test. Based on the results of the Kruskall-Wallis test, a significant value of 0.454 or p-value > 0.05 was obtained, which means there was no significant difference between the control group and the treatment group and was followed when the fruit was still fresh until the gugut flower pad, after which the gugut flower was fruit.

The number of fallen fruit is observed and recorded at the age of 70 HST to 98 HST or before harvest. Counting the number of fallen fruit is done every day at intervals of once a week. The parameter for the number of fallen fruit shows a normality value of 0.000, which means the data is not normally distributed, then continued with a homogeneity test and a value of 0.000 is obtained, which means the data is not homogeneous. If the data is not normal and not homogeneous then continue with the Kruskall-Wallis test. Based on the results of the Kruskall-Wallis test, a significant value of 0.138 or p-value > 0.05 was obtained, which means there was no significant difference between the control group and the treatment group.

Then the fallen fruit will be compared again with the number of fruit carried out at harvest, namely at the age of 98 HST. Harvesting is done once, namely on ripe fruit and fruit that is still green. The formation of fruit begins with the presence of flowers. The number of fruits shows a normality value of 0.071, which means the data is not normally distributed, then continues with a homogeneity test and a value of 0.000 is obtained, which means the data is not homogeneous. If the data is not normal and homogeneous then continue with the Kruskall-Wallis test. Based on the results of the Kruskall-Wallis test, a significant value of 0.220 or pvalue > 0.05 was obtained, which means there was no significant difference between the control group and the treatment group.

This shows that the combination of auxin and gibberellin hormones did not have a significant effect on fruit number parameters. The absence of a real effect from the combination of auxin and gibberellin hormones on fruit number parameters is thought to be caused by factors from the plant itself or environmental factors.Saefas et al., 2017states that the positive response of plants to the application of growth regulators is influenced by several factors including, namely the type of plant, plant growth phase, type of growth regulator, concentration, and method of application of the growth regulator. This research is in accordance with the research conductedRohmawati & Hastuti,

2018), that giving gibberellin concentrations of 10, 20, 30, and 40 ppm did not have a significant effect on the parameters of the number of fruit in cayenne pepper plants.

## 4. CONCLUSION

Based on the research that has been carried out, it can be concluded that: Giving a combination of the hormones auxin and gibberellin to cayenne pepper plants (C. frutescens L.) had no significant effect on growth parameters, both plant height and number of leaves. Giving a combination of the hormones auxin and gibberellin to cayenne pepper plants (C. frutescens L.) had no significant effect on production yield parameters which included anthesis time, number of flowers, number of fallen flowers, number of fallen fruit, and number of fruit. The optimum concentration of giving a combination of the hormone auxin and gibberellin on the growth parameters of cayenne pepper plants (C. frutescens L.) which includes plant height and the highest number of leaves in treatment 17 is a combination of 150 ppm auxin and 50 ppm gibberellin with respective values of 21.46 cm and 18.9 pieces. The optimum concentration of giving a combination of the hormones auxin and gibberellin on the production parameters of cayenne pepper plants (C. frutescens L.) which includes anthesis time and the highest number of flowers in treatment 17 is a combination of 150 ppm auxin and 50 ppm gibberellin with values respectively 35, 5 days and 3.94 fruit, then the number of fallen flowers and the optimum number of fallen fruit in treatment 21, namely a combination of auxin 200 ppm and gibberellin 0 ppm with values respectively 1.28 fruit and 0 fruit, while the optimum number of fruit in treatment 7 is a combination of auxin 50 ppm and gibberellin 50 ppm with a value of 43.5 pieces.

## THANK-YOU NOTE

Further research needs to be carried out regarding the application of a combination of the hormones auxin and gibberellins in the dry season so that the effects of planting during the rainy season and the dry season can be differentiated and their concentrations can also be differentiated. Furthermore, the object of research can also be replaced by using other plants to determine the effectiveness of the combination of the hormones auxin and gibberellin on other plants.

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