EFFECT OF GIBBERELLIN HORMONES ON THE GROWTH AND YIELD OF CAYENNE PEPPER (*Capsicum Frutescens* L.)

Bernadino Narto Enggor[1], Jessyca Putri Choirunnisa[2]*, Yuliana Wahyu[3]

[1-3]*Department of Agronomy, Universitas Katolik Indonesia Santu Paulus Ruteng, Ahmad Yani Street No. 10, Ruteng, Nusa Tenggara Timur, Indonesia*

*Corresponding author: jessycaputri6@gmail.com

Abstract: Cayenne pepper (*Capsicum frutescens* L.) is a horticultural commodity containing 0.1-1% capsaicin and can produce a spicy taste. The consumption of cayenne pepper continues to increase but is not balanced with maximum production. One of the efforts to increase cayenne pepper production can be done by applying gibberellin hormone. This study aims to determine the effect of gibberellin hormone on the growth and yield of cayenne pepper. This study was conducted in Lempe, Pau Village, Langke Rembong District, Manggarai Regency from March to July 2024. This study used a Randomized Block Design (RBD) with 1 factor consisting of 4 treatment levels and 6 replications. The treatments used were G0 (without gibberellin), G1 (gibberellin concentration of 100 ppm/L), G2 (gibberellin concentration of 200 ppm/L) and G3 (gibberellin concentration of 300 ppm/L). The results of the study showed that the gibberellin hormone had a significant effect on the growth and yield of cayenne pepper. Gibberellin concentration of 200 ppm/L was the best treatment in increasing growth and yield of cayenne pepper.
Keywords: *Cayenne pepper, gibberellin, growth, yield.*

INTRODUCTION

Cayenne pepper (*Capsicum frutescens* L.) is a horticultural plant that is highly sought after by the public because it is used to increase appetite in the form of processed chili sauce and sauce. Cayenne pepper is thought to contain 0.1-1% capsaicin which can cause a spicy taste (Edowai et al. 2016). Cayenne pepper plants are also

plants that are easily adaptable because they can be cultivated in the highlands and lowlands (Hapsoh et al. 2017). The need for cayenne pepper is currently very large because many industrial sectors use cayenne pepper as the main raw material for spices (Septiadi et al. 2020).

Cayenne pepper production in the Manggarai region in 2020 was 2,304 quintals and in 2021 cayenne pepper production decreased by 1,036 quintals (BPS of Nusa Tenggara Timur Province, 2022). The decline in cayenne pepper production has caused the need for cayenne peppers in the Manggarai region to be less than fully met, so that the price of cayenne peppers often increases. The decline in cayenne pepper production is caused by improper maintenance, especially in terms of increasing hormones through growth regulators.

Plant growth regulators (PGRs) are synthetic compounds that have the same working activity as plant hormones (Seswita, 2020). One of the PGRs that is beneficial for cayenne pepper plants is gibberellin (GA3). Gibberellin can stimulate flowering, fruit development, affect root growth and differentiation, and increase plant height and leaf area. In addition, gibberellin can affect genetic traits and physiological processes in plants such as parthenocarpy and carbohydrate mobilization during germination and growth (Yasmin et al. 2014).

The response to increased hormones is closely related to concentration, at the appropriate concentration, hormones can regulate the physiological processes of plants, so that they can stimulate growth, while at excessive concentrations they can inhibit the growth process in plants because they can interfere with cell functions (Utami et al. 2016). The results of research by Triani et al. (2020) showed that a concentration of gibberellin of 200 ppm can increase the height of eggplant plants by 135.61 cm. Based on this description, it is necessary to conduct research on the administration of gibberellin hormones to increase the production of cayenne

pepper plants. This study aims to determine the effect of gibberellin hormones on the growth and yield of cayenne pepper plants.

METHOD

This research was conducted in Lempe, Pau Village, Langke Rembong District, Manggarai Regency, Nusa Tenggara Timur from March to July 2024. The tools used in this study were hoes, machetes, buckets, seedling trays, stakes, measuring cups, hand sprayers, watering cans, meters, analytical scales and calipers. The materials used in this study were polybags, cayenne pepper seeds of the Pelita 8 F1 variety, gibberellin hormone, distilled water, soil, chicken manure and raffia rope.

This study used a one-factor Randomized Block Design (RBD) in the form of gibberellin hormone concentration consisting of 4 treatment levels, namely 0 ppm/L (G0), 100 ppm/L (G1), 200 ppm/L (G2) and 300 ppm/L (G3). Each treatment was repeated 6 times, so the total experimental units were 24. The application of gibberellin hormone was done by making a gibberellin solution into 1.000 ml of distilled water, then spraying 42 ml per plant on the stems and leaves of the plant. The application of gibberellin hormone was carried out at the age of 7 Days After Planting (DAP) and 14 DAP. Observation variables were plant height, number of branches, flowering age, number of fruits and fruit weight per plant. The analysis of observation data was carried out using Analysis of Variance (ANOVA) and further Duncan Multiple Range Test (DMRT) with a level of 5%.

RESULT

Plant Heigh

Various concentrations of gibberellin hormone significantly affected the height of cayenne pepper plants at the ages of 14 DAP,

21 DAP and 28 DAP. The average height of cayenne pepper plants can be seen in Table 1.

Table 1. Height of Cayenne Pepper Plants at Various Gibberellin Concentrations of Gibberellin Hormone

Gibberellin Concentration	Plant Height (cm)		
	14 DAP	21 DAP	28 DAP
G0 (0 ppm/L)	12.71 a	16.93 a	24.43 a
G1 (100 ppm/L)	15.98 b	22.39 bc	31.73 bc
G2 (200 ppm/L)	18.13 c	22.85 c	32.84 c
G3 (300 ppm/L)	16.72 b	20.83 b	31.21 b

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

Number of Branches

Various concentrations of gibberellin hormone significantly affected the number of cayenne pepper plant branches at the ages of 14 DAP, 21 DAP and 28 DAP. The average number of cayenne pepper plant branches can be seen in Table 2.

Table 2. Number of Branches of Cayenne Pepper Plants at Various Concentrations of Gibberellin Hormone

Gibberellin Concentration	Number of Branches		
	14 DAP	21 DAP	28 DAP
G0 (0 ppm/L)	4.80 a	6.20 a	8.60 a
G1 (100 ppm/L)	5.20 b	6.60 ab	8.87 a
G2 (200 ppm/L)	5.80 c	7.87 c	10.47 b
G3 (300 ppm/L)	5.47 bc	7.27 bc	9.33 a

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

Flowering Age

Various concentrations of gibberellin hormone significantly affect the flowering age of cayenne pepper plants. The average flowering age of cayenne pepper plants can be seen in Table 3.

Table 3. Flowering Age of Cayenne Pepper Plants at Various Gibberellin Concentrations of Gibberellin Hormone

Gibberellin Concentration	Flowering Age (DAP)
G0 (0 ppm/L)	47.83 [c]
G1 (100 ppm/L)	46.37 [b]
G2 (200 ppm/L)	45.00 [a]
G3 (300 ppm/L)	45.91 [b]

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

Number of Fruit

Various concentrations of gibberellin hormone significantly affect the number of cayenne pepper fruits. The average number of cayenne pepper fruits can be seen in Table 4.

Table 4. Number of Fruit of Cayenne Pepper Plants at Various Gibberellin Concentrations of Gibberellin Hormone

Gibberellin Concentration	Number of Fruit
G0 (0 ppm/L)	15.16 [a]
G1 (100 ppm/L)	15.75 [b]
G2 (200 ppm/L)	16.75 [c]
G3 (300 ppm/L)	15.25 [a]

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

Fruit Weight Per Plant

Various concentrations of gibberellin hormone significantly affected the weight of cayenne pepper fruit per plant. The average weight of cayenne pepper fruit per plant can be seen in Table 5.

Table 5. Weight of Cayenne Pepper Fruit Per Plant at Various Concentrations of Gibberellin Hormone

Gibberellin Concentration	Fruit Weight Per Plant (g)
G0 (0 ppm/L)	44.31 [a]
G1 (100 ppm/L)	52.35 [b]
G2 (200 ppm/L)	54.79 [c]
G3 (300 ppm/L)	51.71 [b]

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

DISCUSSION

Gibberellin concentration of 200 ppm/L produced the highest plant height of 18.13 cm at 14 DAP, 22.85 cm at 21 DAP, and 32.84 cm at 28 DAP (Table 1). The gibberellin concentration also showed significantly different results from other treatments. This is thought to be because the gibberellin concentration of 200 ppm/L is the optimal concentration for plant growth (not too high and not too low). Sundahri et al. (2016) stated that giving gibberellin hormone with the right concentration can provide a good response for tomato plant growth compared to treatment without giving gibberellin hormone. Setiawan & Wahyudi (2014) stated that gibberellin hormone can stimulate stem elongation by inducing the formation of amylase enzyme which hydrolyzes starch so that it increases sugar content and osmotic pressure of cell fluid, so it can cause water to enter the cell and cell elongation occurs, thereby increasing plant height. According to research by Triani et al. (2020), a combination treatment of 200 ppm gibberellin with a frequency of 2 applications can increase plant height in eggplant plants.

The highest number of branches, namely 5.80 stems at 14 DAP, 7.87 stems at 21 DAP, and 10.47 stems at 28 DAP, were found at a gibberellin concentration of 200 ppm/L (Table 2). This proves that the application of gibberellin with a concentration of 200 ppm/L can stimulate vegetative plant growth such as the number of branches. Widiwurjani & Arista (2020), said that the application of gibberellin in the vegetative phase with the right concentration can increase cell division and elongation, and result in increased stem elongation and plant height also increases. The increased plant height due to the application of gibberellin can affect the formation of more segments on the main stem, so that these segments will form more branches.

According to Asra & Ubaidillah (2012), gibberellin encourages cell division to form branches because gibberellin stimulates cells in the G1 phase (growth and physical development of cells) to enter the S phase (cell synthesis), and gibberellin can shorten the S phase, so that there is an increase in the number of cells which causes faster branch growth.

Cayenne pepper plants flowered the fastest at 45.00 DAP which were given the application of gibberellin hormone with a concentration of 200 ppm/L (Table 3). This proves that gibberellin treatment with the appropriate concentration can increase flower initiation faster than without gibberellin hormone administration. Gibberellin applied with a concentration that is not too high can play a role in cell activity for faster flower formation (Yasmin et al. 2014). According to Pertiwi et al. (2014), the main function of the gibberellin hormone is to accelerate flower initiation by activating flower meristem genes and can produce proteins to induce the expression of genes in increasing the formation of flower organs. In addition, gibberellin can also activate sub-apical meristems and produce bolting as a precursor to flower release (Rolistyo et al. 2014).

The largest number of fruits of cayenne peppers, namely 16.75, was found in the 200 ppm/L gibberellin concentration (Table 4). This concentration also gave significantly different results in the number of fruits compared to other treatments. This is thought to be because the 200 ppm/L gibberellin concentration is the appropriate concentration to support generative development such as fruit formation. According to Yeni & Mulyani (2014), gibberellin can stimulate faster and more abundant flowering, and reduce flower shedding before fruiting, where flowers function to stimulate fruit formation. Increasing the number of fruits can be achieved by applying gibberellin before the generative phase at the right dose, because gibberellin can encourage the growth and multiplication of ovarian cells which are an indication of fruit formation (Nirmala,

2019). According to Sokmawati (2021), gibberellin also needs to be applied to prevent premature fruit shedding.

The highest weight of cayenne pepper fruit per plant was found at a gibberellin concentration of 200 ppm/L with a resulting weight of 54.79 g (Table 5). The treatment at this concentration also gave significantly different fruit weight results from other treatments. The gibberellin hormone is thought to be able to increase photosynthesis results in the form of carbohydrates and proteins for fruit size development. The presence of gibberellin in fruit can stimulate the formation of the amylase enzyme which functions to increase sugar levels in cells, so that water from outside the cell will enter by osmosis, which causes an increase in osmotic pressure and results in cell elongation which has an impact on changes in fruit size (Permatasari et al. 2016). According to Alfiani (2019) exogenous hormones in the form of gibberellin can increase the storage capacity of photosynthesis results by activating enzymes to enlarge the storage tissue, so that it can receive more photosynthesis results and result in an increase in the size of the storage tissue in the form of fruit.

CONCLUSION

The results of this study demonstrate that the application of gibberellin hormone significantly enhances the growth and yield performance of cayenne pepper. Among the tested treatments, a gibberellin concentration of 200 ppm/L produced the most optimal response, resulting in the highest plant height of 32.84 cm and the highest number of branches at 28 days after planting (DAP), with an average of 10.47 stems. In addition, this concentration accelerated flowering initiation, occurring at 45.00 DAP, indicating a positive effect on the vegetative-to-generative transition phase.

Furthermore, the 200 ppm/L gibberellin treatment increased yield components, as reflected by a higher number of fruits and greater fruit weight per plant, reaching 16.75 fruits and 54.79 g,

respectively. These findings confirm that the application of gibberellin at 200 ppm/L is effective in improving both vegetative growth and generative yield parameters of cayenne pepper, thereby providing practical implications for optimizing production.

REFERENCES

Alfiani, N. (2019). Pengaruh GA3 (Gibberellic acid) dan Skarifikasi Mekanik Terhadap Perkecambahan Biji Kurma (*Phoenix dactylifera* L.) Var. Mazafati secara In Vitro. *Disertasi*. Pascasarjana. Universitas Islam Negeri Maulana Malik Ibrahim.

Asra, R., & Ubaidillah. (2012). Pengaruh Konsentrasi Giberelin (GA3) Terhadap Nilai Nutrisi *Calopogonium caeruleum*. Jurnal *Produksi Tanaman*, 15(2), 82-90.

Badan Pusat Statistik [BPS] Provinsi Nusa Tenggara Timur [NTT]. (2022). Produksi Tanaman Sayuran Menurut Kabupaten/Kota 2021/2022. In *https://ntt.bps.go.id/indicator55/595/1/produksitanamansayuranmenurutkabupatenkota.html*#. Accessed on January 01, 2024.

Edowai, D. N., Kairupan, S., & Rawung, H. (2016). Mutu Cabai Rawit (*Capsicum frutescens* L.) pada Tingkat Kematangan dan Suhu yang Berbeda Selama Penyimpanan. *Jurnal AGROTEK*, 10(1), 12-20.

Hapsoh., Gusmawartati, A., Amri, I., & Diansyah, A. (2017). Respon Pertumbuhan dan Produksi Tanaman Cabai Keriting (*Capsicum annuum* L.) Terhadap Aplikasi Pupuk Kompos dan Pupuk Anorganik di Polybag. *Jurnal Hortikultura Indonesia*, 8(3), 203-208.

Nirmala, S. (2019). Pengaruh Konsentrasi Giberelin (GA3) dan Lama Perendaman Terhadap Viabilitas Jeruk (*Citrus limonia Osbeck*) Kultivar *Japansche citroen*. *Skripsi*. Fakultas Sains dan Teknologi. Universitas Islam Negeri Maulana Malik Ibrahim.

Permatasari, D. A., Rahayu, Y. S., & Ratnasari, E. (2016). Pengaruh Pemberian Hormon Giberelin Terhadap Pertumbuhan Buah Secara Partenokarpi Pada Tanaman Tomat Varietas Tombatu F1. *Lentera Bio*, *5*(1), 25-31.

Pertiwi, D. P., Agustiansyah, A., & Nurmiaty, Y. (2014). Pengaruh Giberelin (GA3) Terhadap Pertumbuhan dan Produksi Tanaman Kedelai (*Glycine max* (L.) Merrill.). *Jurnal Agrotek Tropika*, 2(2), 276–281.

Rolistyo., Alpano., Sunaryo., & Tatik, W. (2014). Pengaruh Pemberian Giberelin Terhadap Produktivitas Dua Varietas Tanaman Tomat (*Lycopersicum esculentum* Mill). *Jurnal Produksi Tanaman*, 2(6), 457-463.

Septiadi, D., Sari, N. M. W., & Zainuddin, A. (2020). Permintaan Konsumsi Cabai Rawit pada Rumah Tangga di Kota Mataram. *Agrimor*, 5(2), 36–39.

Seswita, D. (2020). Penggunaan Air Kelapa Sebagai Zat Pengatur Tumbuh Pada Multiplikasi Tunas Temulawak (*Curcuma xanthorrhiza* Roxb.) in Vitro. *Jurnal Penelitian Tanaman Industri*, 16(4), 135–140.

Setiawan., & Wahyudi, A. (2014). Pengaruh Giberelin Terhadap Pertumbuhan Beberapa Varietas Lada untuk Penyediaan Benih secara Cepat. *Bul. Littro*, 25(2), 1-8.

Sokmawati, D. (2021). Pengaruh Pemberian Kombinasi Hormone Auksin dan Giberelin terhadap Pertumbuhan dan Hasil Produksi Tanaman Cabai Rawit (*Capsicum frutescens* L.). *Skripsi*. Fakultas Sains dan Teknologi. Universitas Islam Negeri Sunan Ampel.

Sundahri, S., Tyas, H. N., & Setiyono, S. (2016). Efektivitas Pemberian Giberelin Terhadap Pertumbuhan dan Produksi Tomat. *Agritrop: Jurnal Ilmu-Ilmu Pertanian*, 14(1), 42–47.

Triani, N., Permatasari, V. P., & Guniarti, G. (2020). Pengaruh Konsentrasi dan Frekuensi Pemberian Zat Pengatur Tumbuh Giberelin Terhadap Pertumbuhan dan Hasil Tanaman Terung (*Solanum melongena* L.). *Agro Bali: Agricultural Journal*, 3(2), 144-155.

Utami, T., Hermansyah., & Merakati, H. (2016). Respon Pertumbuhan Stek Anggur (*Vitis vinifera* L.) Terhadap Pemberian Beberapa Konsentrasi Ekstrak Bawang Merah (*Allium ascalonicum* L.). *Jurnal Akta Agrosia*, 19(1), 20-27.

Widiwurjani, W., & Arista, R. A. (2020). Peran Giberelin pada Morfologi Pertumbuhan dan Produksi Tanaman Cabai Besar

di Dataran Rendah (*Capsicum annum* L.). *Jurnal Ilmiah Hijau Cendekia*, 5(1), 28-36.

Yasmin, S., Wardiyati, T., & Koesriharti. (2014). Pengaruh Perbedaan Waktu Aplikasi dan Konsentrasi Giberelin (GA3) Terhadap Pertumbuhan dan Hasil Tanaman Cabai Besar (*Capsicum annum* L.). *Jurnal Produksi Tanaman*, 2(5), 395-403.

Yeni, T., & Mulyani, H. R. A. (2014). Pengaruh Induksi Giberelin terhadap Pertumbuhan dan Produksi Tanaman Cabai Merah (*Capsicum annum* L) sebagai Sumber Belajar Biologi. *BIO EDUKASI: Jurnal Pendidikan Biologi*, 5(1), 18-25.