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THE EFFECT OF ADMINISTRATION OF GIBERELLIN ZPTON THE GROWTH AND YIELD OF PURPLE EGGPLANT(*Solanum melongena* L.) VARIETY YUVITA F1

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ABSTRACT

This study aimed to assess the impact of Gibberellin Plant Growth Regulator (PGR) on the growth and yield of purple eggplants (variety: Yuvita F1). Conducted from January to March 2022 in Loa Duri Ulu Village, Loa Janan District, Kutai Kartanegara Regency, the experiment followed a Randomized Complete Block Design (RCBD) with four different Gibberellin concentration treatments: p0 (0.00 mL gibberellin L-1, control), p1 (0.15 mL gibberellin L-1), p2 (0.30 mL gibberellin L-1), and p3 (0.45 mL gibberellin L-1), each with 10 replications. Statistical analysis included variance followed by the Least Significant Difference (LSD) test at a 5% significance level.The results highlighted that the p2 treatment (0.30 mL gibberellin L-1) exhibited a significant positive impact, promoting the optimal growth and yield of purple eggplants. Specifically, this treatment led to a 14.51cm increase in plant height (15.92% improvement compared to the control), 3.60 additional branches (38.88% increase comparedto the control), a 40.10 HSPT reduction in flowering age (-3.10% compared to the control), a 19.13 cm increase in fruit length (17.61% compared to the control), 6.90 more fruits per plant (24.63% compared to the control), and a 0.44 kg increase in fresh fruitweight per plant (22.72% compared to the control).

Keywords: Gibberellin, Purple eggplant, Growth, Yield, Yuvita F1

INTRODUCTION

Eggplant fruit generally has high nutritional value and is suitable for consumption to improve nutrition. Every100 g of fresh eggplant contains around 24 calories, 1.5% protein, 0.2 g fat, 5.5 g hydrate, 15 g calcium, 37 mg phosphorus, 0.4 mg iron, vitamin A 30 SI, vitamin B1 0.04 mg, and vitamin C 5 mg (Wijayanti, 2016). Along with the increase in population, demand for eggplant also continues to increase. However, this increase in demand was notaccompanied by an increase in production quantities. One of them is caused by the low productivity of eggplant. According to (BPS Indonesia 2020) and (the Directorate General of Horticulture 2022), national eggplant productionwas 509,724 Mg from a harvested area of 44,829 ha. Increasing eggplant production can be done through extensification and intensification, one of which is by increasing productivity and land use efficiency, so that intensification is the right choice to implement. One effort that can be done is through the use of fertilizer and ZPT (Astuti *et al*, 2014).

Gibberellin is used as a hormone that accelerates seed germination, helps shoot/embryo formation, stem elongation, leaf growth, stimulates flowering, fruit development, stem elongation, leaf growth, stimulates flowering, fruit development, influences root growth and differentiation. Gibberellins are able to influence the genetic characteristics and physiological processes found in plants, such as flowering, parthenocarpy, and carbohydrate mobilization during the germination period (Mandasari, 2021). The aim of the research was to determine the effect ofgiving Gibberellin ZPT with different concentrations on the growth and yield of purple eggplant (Solanum melongenaL.) Yufita F1 variety. and gibberellin ZPT concentration which provides the best growth and yield in purple eggplant(Solanum melongena L.) Yufita F1 variety.

MATERIALS AND METHODS

Time and Place

The research was carried out for 3 months, from January to March 2022, at Loa Duri Ulu Village, District.

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Materials and Tools

The materials used were purple eggplant seeds of the Yuvita F1 variety, gibberellin ZPT, plastic seedlings, gamal leaves, papaya leaves, tobacco leaves, detergent, soil and cow manure.The tools used were a hoe, polybag measuring 40 cm x 40 cm, measuring tape, writing utensils, basket, ruler, basin, digital scales, documentation tools, calculator, gembor, and hand sprayer.

Experimental design

The research was a single factor experiment, concentration of ZPT gibberellin (P), prepared using a Randomized Block Design (RAK), consisting of four treatments and ten replications. The treatments tested consistedof: p0 = 0.00 (Control/no gibberellin); p1 = 0.15 mL gibberellin L-1; p2 = 0.30 mL gibberellin L-1; p3 = 0.45 mL gibberellin L-1.

Observation

Increase in plant height

Measuring the increase in plant height starts from the base of the stem which is above the ground surface to the growing point where the plant height increases. The increase in plant height is the difference between the results of measuring the increase in plant height at the time of observation and the results of measuring the increase in plant height at the start of planting. Measurements were carried out at 14, 28 and 42 days after transplanting (HSPT) usinga rolling meter and expressed in centimeters (cm).

Number of Branches

The number of branches is determined by counting the number of branches that have grown perfectly startingafter transplanting until entering the generative (flowering) phase. Counting the number of branches was carried out when the plants were 14 days old after transplanting at 14-day intervals, and expressed in branch units.

Flowering Age

Observations of flowering age for each plant were calculated from transplanting until the plant flowered, marked when the flowers opened, expressed in days after transplanting (HSPT).

Age of Harvest

Observation of harvest age was carried out by observing eggplant fruit. The characteristics of fruit that is readyto be harvested are that the fruit is fully filled, the flesh is not yet hard, the color of the fruit is shiny purple, the fruit looks fresh, and the size of the fruit is neither too big nor too small, expressed in days after transplanting (HSPT).

Fruit Length

The length of the fruit is measured using a meter. Fruit length is measured from the tip to the base of the fruit and is expressed in centimeters (cm).

Number of Fruits per Plant

The number of fruits per plant is determined by calculating the number of fruits harvested on each plant from the first harvest to the fifth harvest with a harvest interval of 3 days, and expressed in fruit units.

Fresh Fruit Weight per Plant

The fresh weight of fruit is determined by weighing the fruit at harvest from the first harvest to the fifth harvestof each plant, then adding them up, expressed in kg units.

Data Analysis Method

The research data were analyzed using variance tests, if the variance results showed significantly different treatment effects, then it was continued with the Least Significant Difference Test (BNT) at a significance level of 5%.

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RESULTS AND DISCUSSION

Results

The results of the chemical analysis of the planting media, the results of the chemical analysis of the soil beforethe research, showed a pH content of 6.70, organic C 2.21%, total N 0.26%, C/N ratio 8.4, P 4.85 ppm, K 9.68 ppm, Cat. AI3+ acid 0.5, H+ 0.29, while after research it shows pH content 6.98, organic C 2.63%, total N 0.34%, C/N ratio7.8 P 42.32 ppm, K 114 .68 ppm, Cat. Acid AI3+ 0.6 H+ 0.35

Table 1. changes in the nutritional status of the plant media before and after planting the test plants

No	Nutrition	Before planting	Status	After Planting	Status	Changes of status
1.	pH	6,70	Neutral	6,98	Neutral	Increase
2.	Organic-C (%)	2,21%	Moderate	2,63%	Moderate	Increase
3.	Total of N (%)	0,26%	Moderate	0,34%	Moderate	Increase
4.	C/N ratios	8,40	Low	7,90	Low	Decrease
5.	P available (ppm)	4,85	Low	42,32	Very High	Increase
6.	K available (ppm)	9,68	Low	114,68	Very High	Increase
7.	Aluminum Saturation	0,50	Very low	0,60	Very low	Increase
8.	Base Saturation	0,29	Very low	0,35	Very low	Increase

Source: Primerly Data

The guidelines for the criteria for assessing soil chemical properties used are the guidelines used by BalittanahBogor, as in the table below.

Table 2. The criteria for assessing soil chemical properties for agriculture – the best conditions for soil fertility

No.	Chemical Properties of Soil	Very Low	Low	Moderate	High	Very High
1,	C (%)	< 1,0	1,0 – 1,9	2,0 – 2,9	3,0 – 5,0	> 5,0
2.	Organic Matter	< 1,72	1,71 – 3,27	3,28 – 4,99	5,0 – 8,6	> 8,6
3.	N (%)	< 0,10	0,10 – 0,20	0,21 - 0,50	0,51 – 0,75	> 7,5
4.	C/N rasio	< 5	5 – 10	11 - 15	16 – 25	> 25
5.	P Bray (ppm)	< 4	4 – 6	7 - 11	12 – 15	> 15
6.	K	< 5	5 – 16	17 - 24	25 – 40	> 40
7	pH H_2O Very Acidic	Acidic	Slighly acidic	Neutral	Slighly Alkaline	Alkaline
	< 4,5	4,5 – 5,5	5,6 -6,5	6,6 – 7,5	7,6 – 8,5	> 8,5

Source: Soil Research Institute of Bogor

The method for testing the nutritional parameters of the planting media used is as shown in the table below.

Table 3. The Test of parameters and the methods used

No	Test Parameter	Method Used
1	pH H_2O	pH H_2O determined using a pH meter with a soil to solvent ratio of 1: 12
2	Organic-C	Organic-C was determined using wet digestion and using potassium bichromate according to the Walkley and Black method
3	N (Total)	Total of N was determined by the Kjehldahl method
4	C/N Ratios	The C/N ratio is determined by directly dividing the Organic C number by the Total N number
5	P_2O_5 (Available)	Total phosphate content (mg/100g) was determined using 25% HCl extraction, while available phosphate (ppm) was determined using Bray extraction.
6	K_2O (Available)	Total potassium was determined using 25% HCl extraction

Source: Soil Science Laboratory of Agriculture Faculty of Mulawarman University

The results of research data analysis on the effect of giving gibberellin ZPT on the growth and yield of purpleeggplant (Solanum melongena L.) of the Yufita F1 variety, are presented in the table below

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Table 4. Recapitulation of Data and Results of Data Analysis Research on the Effect of Giving Gibberellin ZPT on the Growthand Yield of Purple Eggplant (Solanum melongena L.) Yufita F1 Variety.

Concentration of Gibgerelin (P) (mL L-1)	Increase in Plant Height (cm)			Number of Branches (Branch)	Flowering Age (DAT)	Harvest Age (DAT)	Fruit Length (cm)	Number of Fruits per Plant (Fruit)	Fresh Fruit Weight per Plant (kg)
	14 DAT	28 DAT	42 DAT						
p0 : 0.00	5,82[a]	12,20[a]	36,80	2,20[a]	41,70[b]	59,10	15,76[a]	5,20[a]	0,34[a]
p1 : 0.15	6,60[ab]	12,07[a]	36,40	2,40[a]	41,80[b]	58,90	16,25[a]	5,20[a]	0,35[a]
p2 : 0.30	7,17[b]	14,51[b]	41,20	3,60[b]	40,10[a]	58,70	19,13[b]	6,90[b]	0,44[b]
p3 : 0.45	6,29[ab]	12,36[a]	37,40	2,60[a]	41,60[b]	59,40	16,51[a]	5,00[a]	0,38[a]
Anova	*	*	NS	**	*	NS	**	**	**
LSD 5%	0,89	1,93	-	0,61	1,19	-	0,85	0,56	0,05

Remark: DAT = Day After Transplating, NS: Not significant, *: Significant, **: Very Significant

DISCUSSION

Increase in plant height

The results of variance analysis for the plant height increase variable showed that the effect of gibberellin concentration was significantly different at 14 and 28 days after transplanting (DAT). The highest increases in plant height were obtained, namely 7.17 and 14.51 cm. This figure is smaller than the results of research (Wulansari, 2014),namely 51.01 cm. This is due to the provision of Plants Growth Regulator (PGR) gibberellin so that plants can absorbPGR well through the stomata on the leaves, and gibberellin is a PGR that can control enzyme synthesis and can stimulate cells so that the cells elongate because in these cells an osmotic process occurs which causes water to be forced upwards which process It is formed by the amylase enzyme which hydrolyzes starch and the sugar levels in cells increase (Wulansari, 2014).

Number of Branches

The results of variance analysis on the variable number of branches showed that the effect of different gibberellin concentrations was very significant, treatment p2 (0.30 mL gibberellin L-1). The best result was obtained,namely 3.60 branches. This figure is smaller than the results of research (Zainal, 2015), namely 11.67 branches. Thisis because gibberellin is a PGR that stimulates cell division and elongation, and has an effect on plant vegetative growth which stimulates plant growth such as enlargement of stem segments, increasing the number of branches, leaves, flowers and even fruit. The higher the gibberellin concentration applied to plants, the better it will support thegibberellin PGR that the plants need (Zainal, 2015).

Flowering Age

The results of variance analysis on the flowering age variable showed that the effect of gibberellin concentration was significantly different, treatment p2 (0.30 mL Gibberellin L-1). The fastest flowering age was obtained, namely 40.10 HSPT. This figure is greater than the results of research (Triani, 2020), namely 36.56 HSPT with the administration of gibberellin PGR with a concentration of 0.30 mL L- water causing plants to flower more quickly. This happens because gibberellin affects cell differentiation. Gibberellins play a role in accelerating plant flowering by producing proteins that will induce the expression of genes for the formation of floral organs, sub-apicalmeristem and producing bolting that initiates the emergence of flowers (Triani, 2020).

Age of Harvest

The results of variance analysis for the harvest age variable showed that the effect of different gibberellin concentrations was not significant. P3 treatment (0.30 mL gibberellin L-1), The fastest harvest age was obtained, namely 58.70 DAP. This happens because gibberellins can accelerate seed germination, help shoot/embryo formation,stem elongation, leaf growth, stimulate flowering, fruit development, stem elongation, leaf growth, stimulate flowering, fruit development, harvest time is influenced by environmental factors (Sodiqin *et al*, 2017).

Fruit Length

The results of variance analysis on fruit length variables show that the effect of different gibberellin concentrations is very significant. The p2 treatment (0.30 mL gibberellin L-1The longest fruit was obtained, namely
19.13 cm. This figure is greater than the results of research (Sodiqin *et al*, 2017), namely 4.20 cm. This occurs due tothe provision of gibberellin which is carried out from the beginning of the fruit formation period

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which is able to meetthe gibberellin content requirements required by solanecea plants, the provision of gibberellin PGR which is given isable to increase the process of absorbing nutrients from the soil, increase the amount of chlorophyll, increase the formation of branches, increase the number of buds and flowers as well as preventing flower drop and increasing fruitsize (Sodiqin *et al*, 2017).

Number of Fruits per Plant

The results of variance analysis on the variable number of fruit per plant show that the effect of different gibberellin concentrations is very significant. The p2 treatment (0.30 mL gibberellin L-1obtained the most fruit, namely, 6.90 fruit. This figure is smaller than the results of research (Triani, 2020), namely 18 fruit, giving gibberellinPGR can increase the number of flowers which can result in a greater number of fruit being formed but also increasesthe risk of the flowers and fruit dropping more. Flower drop occurs due to organic nutria deficiency caused by competition between flowers and fruit on a head, or panicle. The main hormones that play a role in fruit growth are auxin and gibberellin. These two hormones work synergistically in the fruit formation process. The increase in gibberellin concentration given was positively correlated with an increase in the number of fruit formed. The numberof fruits per plant will affect the total fruit per plant. The concentration of gibberellin PGR can increase the number of fruit and the fresh weight of the fruit (Triani, 2020).

Fresh Fruit Weight per Plant

The results of variance analysis on fresh fruit weight per plant showed that the effect of different gibberellin concentrations was very significant. Treatment p2 (0.30 mL gibberellin L-1). The heaviest fruit was obtained, namely
0.44 kg. This figure is smaller than the research results (Triani, 2020), namely 0.67 kg. Fruit weight increases due to two processes, namely cell division followed by cell enlargement. The concentration of gibberellin is able to increaseauxin levels which have a role in cell division, while gibberellin itself has a role in cell expansion so that the synergyof the two can increase cell size. This process is able to increase the gibberellin PGR and increase the weight of the fruit produced by the plant (Triani, 2020).

The results of the analysis of variance of orthogonal polynomial regression analysis of gibberellin PGR application on fresh fruit weight per plant showed a quadratic relationship with the equation $\hat{y}$=0.3603 + 0.0601x witha coefficient of determination R2=0.0371. This shows that the effect of giving gibberellin PGR on the fresh weight offruit per plant is 0.37%, meaning that there is a close relationship between giving gibberellin PGR and fresh fruit weight per plant. The effect of giving the best gibberellin PGR concentration of 0.30 mL gibberellin L-1 with a yield of 0.44 kg.

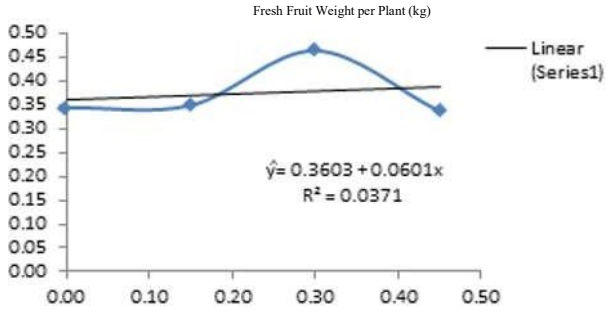

Figure 1. Graph of the effect of gibberellin plant growth regulator (PGR) application on fresh fruit weight per plant

CONCLUSION

Based on the results of the research concerning the impact of Gibberellin Plant Growth Regulator (PGR) on thegrowth and yield of the Yuvita F1 variety of purple eggplants (Solanum melongena L.), several key conclusions can be drawn:

1. Gibberellin PGR significantly influences various growth and yield parameters of Yuvita F1 purple eggplantplants. These variables include an increase in plant height, the number of branches, flowering age, fruit length, the number of fruits per plant, and the weight of fresh fruits per plant.

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2. Among the different concentrations tested, a dosage of 0.30 mL gibberellin L-1 emerged as the most effectivefor promoting the growth and yield of Yuvita F1 purple eggplant plants. Specifically, this concentration resulted in a substantial increase in plant height (14.51 cm), a higher number of branches (3.60 branches), a delayed flowering age (40.10 HSPT), longer fruit length (19.13 cm), a greater number of fruits per plant (6.90), and a higher fresh fruit weight per plant (0.44 kg)

Furthermore, the relationship between the concentration (mL L-1) of gibberellin PGR and fresh fruit weight per plant indicates a correlation coefficient of 0.4338. This signifies a direct association between gibberellin PGR concentration and fresh fruit weight per plant, with an optimal concentration of 0.30 mL L-1, resulting in the maximum yield of fresh fruit weight per plant, namely 0.44 kg.

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