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Effect of Multiple of Plant Growth Regulator from Free Clean Maize to Growth and Production of Red Onion (*Allium ascalonicum* L.)

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A B S T R A C T

The Government of Indonesia is still importing onions, to achieve self-sufficiency of red onion, and then the red onion production should be improved. Farmers' constraints is due to the high price of chemical fertilizers and the level of soil residues. An alternative that is believed to reduce the use of chemical fertilizers and be able to reduce residues in the soil is the use plant growth regulators of natural. The aim of this research is to get PGR from sweet corn, pulut corn, yellow corn, and white corn that can increase the growth and production of one of red onion plant varieties. The results showed that PGR which showed significant result both growth component and production component on red onion plant was PGR sweet corn. And red onion that has a high adaptation is red onion of Bima varieties.

Introduction

The Government of Indonesia is still importing onions (BPS, 2015), to achieve self-sufficiency in the red onion, the red onion production should be increased. Farmers' constraints' is because of the high price of chemical fertilizers and soil residue levels. Alternatives are believed to reduce the use of chemical fertilizers and were able to reduce the residue in the soil is the use of plant growth regulators naturally.

The use of biological fertilizers is one way to increase onion production by developing agricultural technology, such as the use of natural hormones (Usama Mheidi H., *et al.*, 2017). Plants are naturally already contains a growth hormone called endogenous hormones. However, this hormone affects less optimum vegetative growth and generative process plant. The addition of plant growth regulator (PGR) is often performed to optimize the vegetative and generative growth of plants, for example gibberellin (GA) who is able to accelerate the growth and flowering (Abidin 1985 *in* Siti Komariyah *et al.*, 2012).

Floral meristem gene activation by produce proteins that induce the expression of genes

forming flower organs was able to accelerate flowering plants with the use of hormone goberelin (Arika *et al.,* 2009). Other hormones that could stimulate cell elongation are hormone auxin (Zhao, 2010; Andrzej and Alicja, 2009). Now it is known a number of classes of substances that are considered as phytohormones, ie auxin, cytokinin, giberilin or gibberellic acid (GA), ethylene, abscisic acid (ABA), jasmonic acid, steroids (brassinosteroid), salicylic and polyamines (Rochimi, 2008). Application of growth regulators in modern agriculture include securing the result, increase the size and improve product quality, or uniform flowering time (Supriyanto and Kaka, 2011).

The plant extracts provide the plant growth and the production of potato mini tubers better than synthetic PGR applications (2,4D and NAA) (Altaf Simair *et al.,* 2013). as well as water and corn seed extract at a concentration of PGR giberelin 41.23 ppm; auxin 1.67 ppm; and cytokinins equivalent to 53.94 ppm gibberellin comparison: auxin: cytokinin (25: 1: 32), giving growth of seed potatoes and the best mini tuber production (Ulfa, 2014). Research Results (Asrijal *et al.,* 2018), obtained auxin content 27.9303 ppm; gibberellin 442.8318; and Kinetin 34.5724; of the sweet corn zpt, the best zpt of the four zpt were analyzed.

According to Kyozuka (2007) and Raffaele (2008), that kind of hormone cytokines can stimulate the formation of roots and stems as well as the establishment of branches and roots by inhibiting the dominance of apical, regulate the growth of leaves and shoots, and inhibit the aging process by stimulating the process as well as the transportation of mineral salts and amino acids to the leaves. Furthermore Jauhar *et al.,* (2013), states that the gibberellin with a low concentration does not stimulate root formation, but at high concentrations will stimulate root formation.

Materials and Methods

Implementation of research at the Experimental Farm College of Agricultural Sciences Puangrimaggalatung Sengkang, starting in December 2016 until May 2017. This study uses material from the corn plant growth regulator that is open pollinated sweet corn, corn sticky rice, yellow corn and white corn. There are three varieties of onion plants (Bima varieties, Tajuk varieties and Super Philip varieties), distilled water, urea, SP36, KCl fertilizer, NPK fertilizer pearls and organic fertilizers (BPPP, 2016).

The tools used are scales electric meter, roll-meter, hoes, hand tractor mini (raised bed), hand sprayer semi-automatic, knapsack sprayer semi-automatic, Dinamao water pumps, measuring cups (size 20ml), PLN, Sprinklers springkel eight set, sickles, machetes, hoes, labels, camera, and stationery. The analytical method used is the split plot design (SPD) with the treatment of the three varieties of onion plants (Bima varieties, Tajuk varieties, and Super Philip varieties) as Plots Main (PU) (symbol "v") consists of 3 include: Bima varieties (v_1), Tajuk varieties (v_2), and Super Philip varieties (v_3). The next four extracts PGR (sweet corn, pulut corn, yellow corn, and white corn) plus one without extract PGR as Son Plots (AP) (symbol "z"), consisting of 5 among others: without extract PGR (z_0), PGR sweet corn (z_1), pulut corn PGR (z_2), yellow corn PGR (z_3), and white corn PGR (z_4).

Treatment there are 15 combinations (3 PU x 5 AP) and each combination treatment was repeated 3 times, so the number of combinations of treatment by 45 (15 x 3). Furthermore, each treatment combination were planted in each plot which has been prepared with a size of 1 x 1 m2, and a spacing of 10 x 20 cm2, so it is necessary to map as many as 45 plots, a research unit.

Stages of implementation

Preparation of planting with minimum soil tillage involves cleaning of weeds and other weeds that grow around the land by using sickles, machetes, or hoe. Land management first made two weeks prior to planting, the next week, followed by processing light using a hand tractor mini to manufacture mapped simultaneously organic fertilizers as much as 2,000 kg / ha (200 g / m^2), the number of plots for one group of as many as 15 pieces, because there are three groups, the number of plots are all there are 45 plots with the size of each plot of 1 mx 1 m, the distance between plots of 50 cm and the distance between groups of 100 cm, so it takes an area of 168 m^2 (24 mx 7 m) (including each 1 m outside the research unit).

The seeds used are varieties of red onion seeds Bima, Tajuk varieties and Super Philip varieties. Before planting onion bulbs first cut edges 1/3, then doused with a solution of Biopesticides antagonists (Dithane M-45) to avoid pests and diseases of onion crop.

Once the map is completed and ready for planting, the planting carried out by means of drill depth of approximately 3 cm (adjustable size of the tubers), with a spacing of 10 cm x 20 cm. Each planting hole is filled onion 1 bulb, to obtain the planting rows regularly used ropes rapia which each have been marked in accordance spacing used. Fertilization onion as much as 400 kg / ha ZA, 700 kg / ha of NPK Mutiara, and 2,000 kg / ha of organic fertilizer Fertilizer done when the plant was 15 days after planting (DAP) 50% 50% ZA and NPK fertilizer when the plant next at 30 days after planting. Maintenance consists of weeding, water regulation, and pest and disease control.

PGR giving treatment carried out when the plant was 15 and 30 days after planting (DAP), after fertilizer application. Each extract PGR sprayed with a dose of 400 ml / ha at a concentration of 1 ml / liter of water, on every hedge evenly, based on the treatment of randomization results.

Processing of measured data in the field through Program Exel in 2013, then analyzed using SPSS 18, if the results of the Analysis of Variance (ANOVA), shows the real effect or very real, it will be Test Analysis Territory Duncan's Multiple at 5% level (Gaspersz, 1991).

Observation component consists of the components of growth: plant height, number of leaves, number of tillers. And component production: tuber weight of the sample, the sample weight outer bulb, tuber weight perpetak, perpetak tuber dry weight of 7 days, and the production per hectare as follows: 1) Plant height of stem to highest leaf at age 28, 35, and 42 days after planting (cm). 2) the number of tillers that were formed at 28, 35, and 42 days after planting (tillers). 3) Number of bulbs 70 days after planting (bulbs). And 4) plot production 77 days after planting (kg)

Results and Discussion

Growth phase

Plant height (cm)

The results showed that high-variance analysis onion plants aged 28, 35, and 42 days after transplanting (DAT) shows results very significant effect on the treatment of PGR (AP). While the treatment of onion varieties (PU) (Figure 1), and the interaction between the PU x AP influential not evident in all parameters of plant height (Figure 2).

Duncan test results, showing that the treatment plant growth regulator sweet corn (z_1) significantly different PGR treatments pulut

corn (z_2), yellow corn PGR (z_3), and without PGR (z_0). However, no significant effect with white corn plant growth regulator treatment (z_4), plant height age of 28, 35 and 42 DAP (Table 1).

Red onion plant height measurements at 28, 35 and 42 days after planting (DAP) real effect on plant growth regulator (AP). Plant growth regulators of sweet corn plant height showed the highest onion 31.96 cm, while the lowest in treatment without plant growth regulator that is 26.98 cm. This is due to the hormone content of the plant growth regulator of sweet corn is higher compared to other treatments.

Auxin is a plant hormone that can regulate many physiological processes, such as growth, division and differentiation of cells and protein synthesis (Zhao, 2010; Andrzej and Alicja, 2009). Furthermore, to accelerate the growth (Idhan, 2016).

A similar argument by Simair Altaf *et al.*, (2013), that the application of growth regulators on the plant could affect the transport orientation assimilate, delays senensen and cell enlargement. Mini potato tuber crop growth very well with natural plant growth regulator application, (Ulfa, 2014; Asrijal, *et al.*, 2018).

Certain concentrations of plant hormones such as indole acetic acid (IAA), cytokinin, ethylene and gibberellic acid in the plant can improve plant growth. Auxin plays a role in growth to spur the process of cell elongation, (Zhao, 2010; Andrzej and Alicja 2009) the formation of lateral roots and fibrous root cause water and mineral absorption processes can run optimally.

Treatment of various varieties of onion and interaction showed no real effect (Figure 1 and 2). It is caused by genetic factors plants. However, the variety and interaction between varieties bima bima with PGR sweet corn, still exhibit high average crop better than others. In line with the opinion of the Sajdjad in Idhan A., (2016), that the power difference between the varieties grown are determined by genetic factors. Suwandi *et al.*, (2015), that the other factors that determine the outcome of the onion is genetic and it seems more determined by genetic factors influence differences in varieties than fertilization factors or growth environment management.

Number of puppies (puppies)

The results showed that the analysis of variance amount of onion seedlings aged 28, 35, and 42 days after planting (DAP) shows results very significant effect on the treatment of PGR (AP). While the treatment of onion varieties (PU) and the interaction between (PU x AP) effect is not real at all the parameters of the number of tillers (Figure 3 and 4).

Duncan test results, showing that the treatment plant growth regulator sweet corn (z_1) significantly different PGR treatments pulut corn (z_2), yellow corn PGR (z_3), and without PGR (z_0).

However, no significant effect with white corn plant growth regulator treatment (z_4), the number of tillers aged 28, 35 and 42 DAP (Table 2).

The observation of the number of seedlings of onion at the age of 28, 35 and 42 days after planting (DAP) real effect on plant growth regulator (AP).

Plant growth regulators of sweet corn showing the number of seedlings of onion as the highest, 8.23 tillers, while the lowest in the treatment without PGR is 6.12 tillers. This is due to the content of PGR of sweet corn is higher compared to other treatments.

Table.1 Duncan test results of red onion plant height 28, 35, and 42 days after planting (DAP), on treatment of PGR (cm)

Plant Heigh	Plant Growth Regulator (PGR)					NP Duncan α = 0,05
	z_0	z_3	z_2	z_4	z_1	
Age 28 DAP	25.85	26.60	27.88	28.97	30.25	1.81
						1.91
						1.96
						2.00
Age 35 DAP	26.59	27.40	28.60	29.63	31.23	1.58
						1.66
						1.71
						1.75
Age 42 DAP	26.98	27.53	28.91	30.07	31.96	1.58
						1.66
						1.70
						1.74

Description: middle value followed by underscore, different not significant on Duncan test α = 0,05

Table.2 Duncan test results of average number of tillage red onion plants 28, 35, and 42 days after planting (DAP), on the treatment of PGR (puppies)

Puppies	Plant Growth Regulator (PGR)					NP Duncan α = 0,05
	z_0	z_3	z_2	z_4	z_1	
Age 28 DAP	05.61	06.03	06.52	06.75	07.09	0.50
						0.52
						0.53
						0.55
Age 35 DAP	06.12	06.54	07.10	07.26	08.15	0.85
						0.90
						0.92
						0.94
Age 42 DAP	06.12	06.59	07.15	07.35	08.23	0.89
						0.94
						0.96
						0.98

Description: middle value followed by underscore, different not significant on Duncan test α = 0,05

Table.3 Duncan test results of average number of sample tubers during red onion plant harvest 70 days after planting (DAP), on the treatment of PGR (tuber)

Tuber	Plant Growth Regulator (PGR)					NP Duncan α = 0,05
	z_0	z_3	z_2	z_4	z_1	
Average	4.47	5.73	6.50	7.04	8.11	0.86
						0.90
						0.93
						0.95

Description: middle value followed by underscore, different not significant on Duncan test α = 0,05

Table.4 Duncan test results on average plot production of red onion plants 77 days after planting (DAP), on the treatment of PGR (kg).

Plot Production (77 DAP)	Plant Growth Regulator (PGR)					NP Duncan α = 0,05
	z_0	z_3	z_2	z_4	z_1	
Average	0.614	0.730	0.824	1.007	1.208	0.203
						0.214
						0.219
						0.224

Description: middle value followed by underscore, different not significant on Duncan test α = 0,05

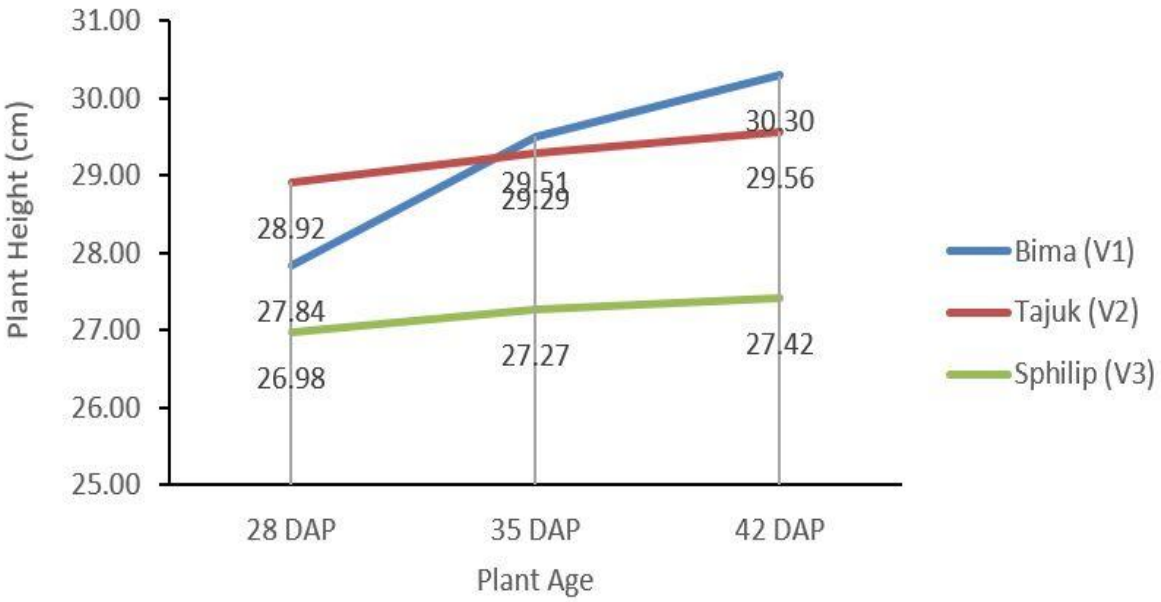

Figure 1. The height of red onion plants 28, 35, and 42 days after planting (DAP), on the treatment of red onion varieties (cm).

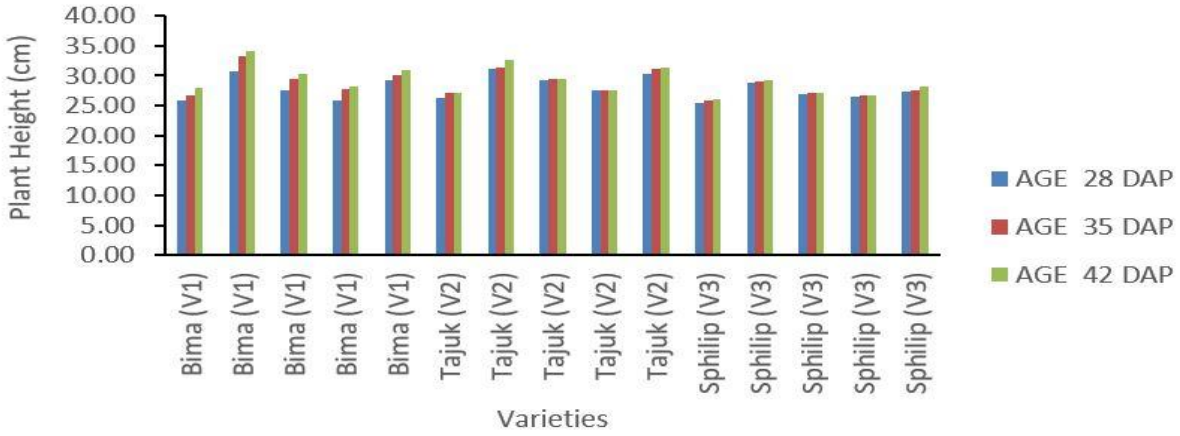

Figure 2. The mean height of red onion plants 28, 35, and 42 days after planting (DAP), on the treatment of PGR interaction with red onion varieties (cm).

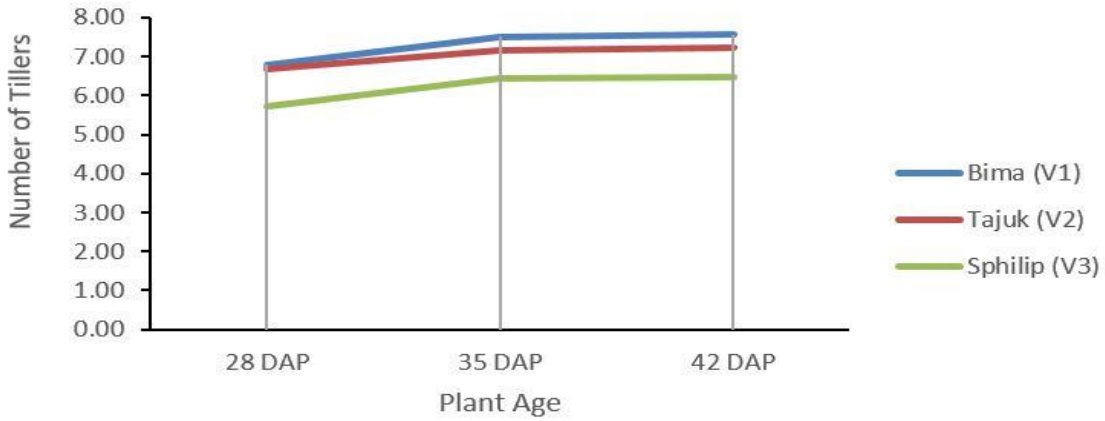

Figure 3. Mean number of tillage, red onion plants 28, 35, and 42 days after planting (DAP), on the treatment of red onion varieties (puppies).

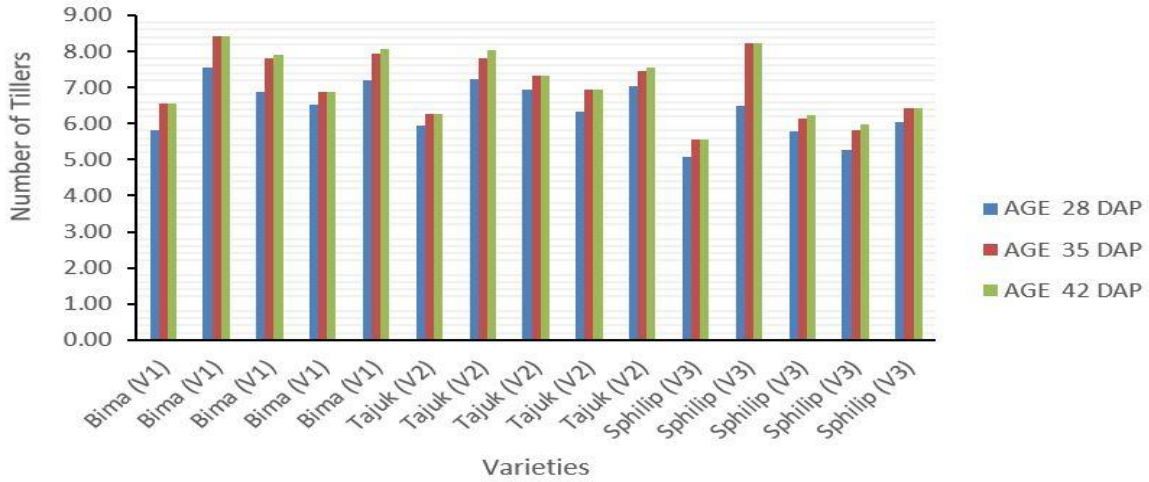

Figure 4. Average number of tillage, red onion plants 28, 35, and 42 days after planting (DAP), on the treatment of PGR interaction with red onion varieties (puppies).

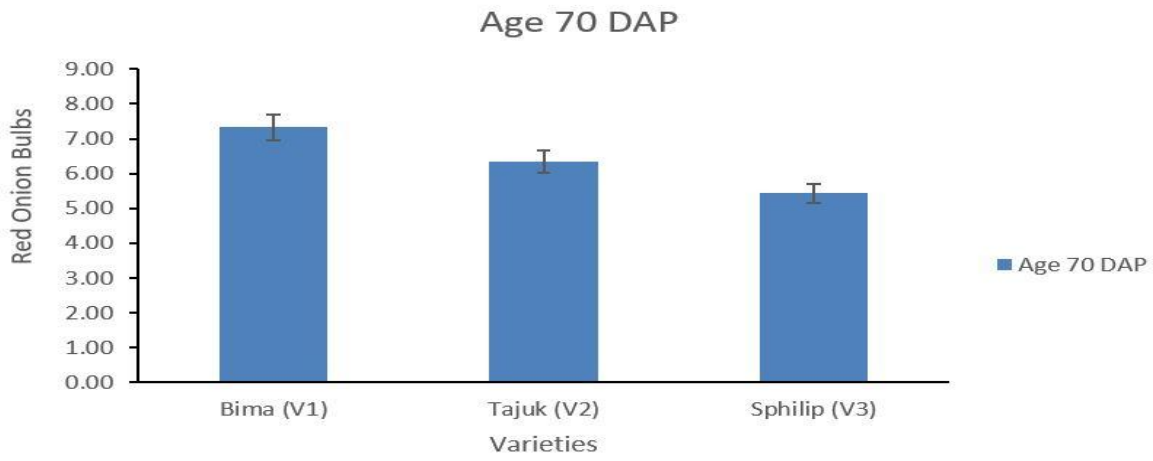

Figure 5. Average number of sample bulbs during harvest, red onion plants 70 days after planting (DAP), on the treatment of red onion varieties (tubers).

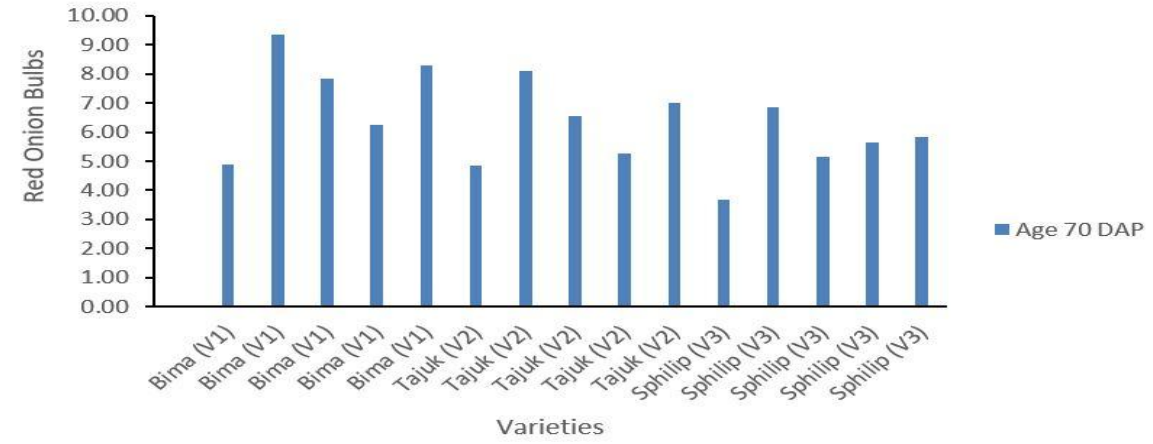

Figure 6. Average number of sample bulbs at harvest, red onion plants 70 days after planting (DAP), on the treatment of PGR interaction with red onion varieties (tubers).

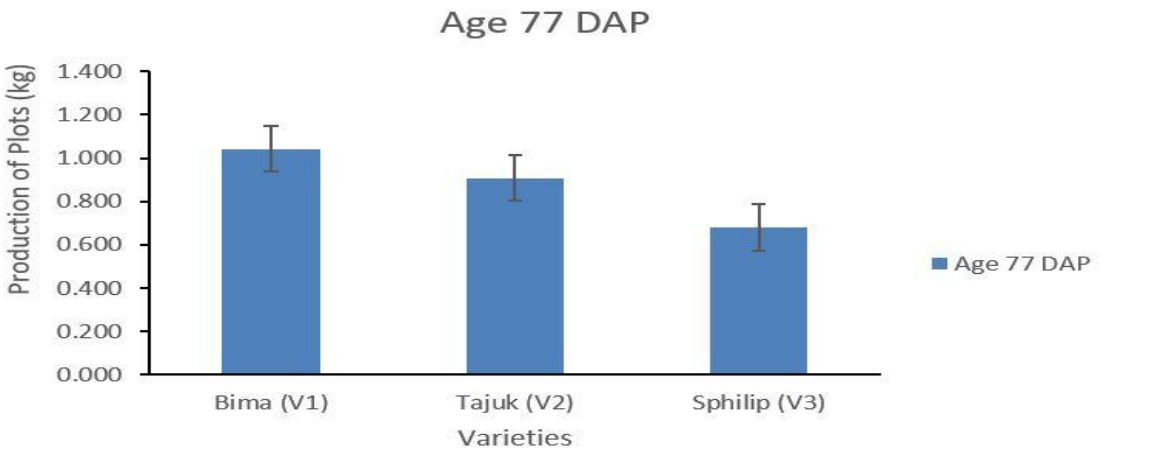

Figure 7. The average production of red onion plant plots, 77 days after planting (DAP), on the treatment of red onion varieties (kg).

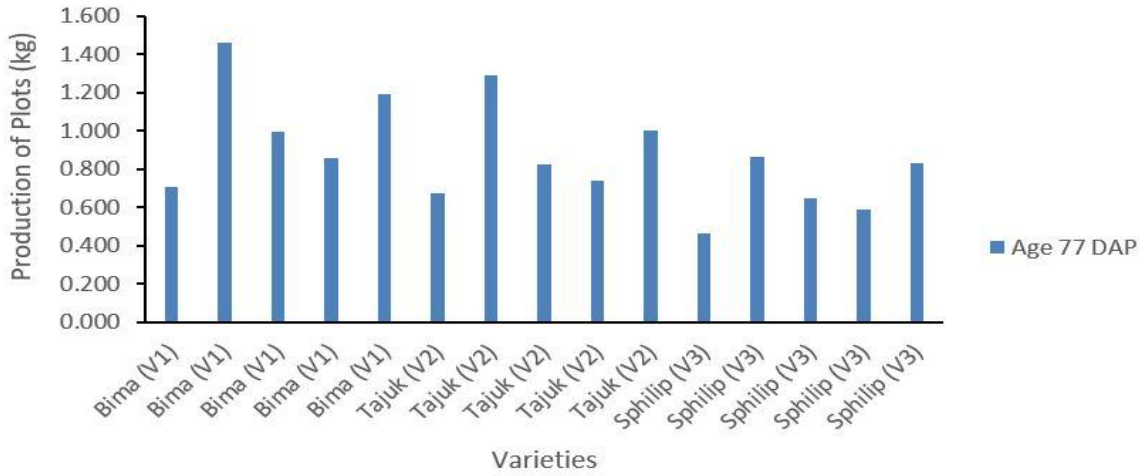

Figure 8. The average production of red onion plant plots, 77 days after planting (DAP), on the treatment of PGR interaction with red onion varieties (kg).

According (Wattimena, 1988 in Amraini and Sugiyanta (2008), the application of growth regulators in plants can affect the orientation of the transport of assimilates, delays senesen and cell enlargement. Effects application of plant growth regulators in a plant would be obvious if the plant health conditions, nutrient requirements met, and good maintenance (Ahmed *et al.*, 2017).

High content of gibberellins which will stimulate cell division and elongation in shoot apex, especially in the meristematic cells, thus stimulate vegetative growth (Tumbull *et al.*, 1996 in Siti Komariyah *et al.*, 2012).

Treatment of various varieties of onion and interaction showed no real effect (Figure 3 and 4). It is caused by factors of adaptability of plants. However, the variety and interaction between varieties bima bima with sweet corn plant growth regulators, still shows the average number of tillers were higher than others. In line with the opinions (Jumin, 2005 in Idhan, 2016), that the plant will undergo physiological and morphological changes in the direction corresponding to the growth environment.

Production phase

Number of bulbs age 70 DAP (bulbs)

The results showed that the analysis of variance the number of tubers samples of onion crop at harvest age of 70 days after planting (DAP) shows results very significant effect on the treatment of PGR (AP). While the treatment of onion varieties (PU) (Figure 5) and the interaction between the PU x AP influential not evident in all parameters of the sample number of tubers at harvest (Figure 6).

Duncan test results, showing that the treatment plant growth regulator sweet corn (z_1) significantly different from other PGR treatment. While the PGR treatment of white maize (z_4) significantly different from the treatment plant growth regulator yellow corn (z_3) and without PGR (z_0). However, no significant with pulut corn plant growth regulator treatment (z_2), the number of samples of tubers at harvest onion plants aged 70 days after planting (DAP) (Table 3).

The observation of the sample bulb onion crop harvest time at the age of 70 days after planting (DAP) real effect on plant growth

regulator (AP). Plant growth regulators of sweet corn samples showed the number of tubers at harvest crops as the highest onion bulb 8:11, while the lowest in the treatment without PGR is 4:47 bulbs. This is due to the content of PGR of sweet corn is higher compared to other treatments.

According to Zhao, (2010) and Andrzej and Alicja, (2009), auxin plays a role in growth to spur the process of cell elongation, the formation of lateral roots and fibrous root cause water and mineral absorption processes can run optimally (Kyozuka 2007). Cytokines are hormone that plays a role in cell division (cytokinesis).

Treatment of various varieties of onion and interaction showed no real effect (Figures 5 and 6). It is caused by environmental factors of plant genetic tumbuhdan. However, the variety and interaction between varieties bima bima with PGR sweet corn, still shows the average tuber plants larger than others.

In line with the opinion of the (Sajdjad in Idhan, 2016), that the power difference between the varieties grown are determined by genetic factors (Jumin, 2005 in Idhan, 2016), that the plant will undergo physiological and morphological changes in the direction corresponding to the growth environment.

Production of plots of age 77 days after harvest (kg)

The results showed that the analysis of variance production per plot onion plants aged 77 days after planting (DAP) shows results very significant effect on the treatment of PGR (AP). While the treatment of onion varieties (PU) (Figure 7) and the interaction between (PU x AP) effect is not noticeable at all production parameters per plot onion plants aged 77 days after planting (DAP), (Figure 8). Duncan test results, showing that the treatment plant growth regulator sweet corn (Z1) significantly different PGR treatments sticky corn (Z2), yellow corn PGR (Z3), and without PGR (Z0). However, no significant effect with white corn plant growth regulator treatment (Z4), on production of onion plants per plot the age of 77 days after transplanting (DAT) (Table 4).

The results of measurements per plot production of onion crop at the age of 77 days after planting (DAP) real effect on plant growth regulator (AP). Plant growth regulators show production of sweet corn plants per plot as the highest onion 1,208 kg, while the lowest in the treatment without PGR is 0.614 kg. This is due to the content of PGR of sweet corn is higher compared to other treatments. However, if production per plot above is converted to per hectare, the production results obtained by 12:08 t h^{-1} the highest, and the lowest was 6.14 t h^{-1}. Gibberellin low concentrations did not stimulate root formation, but at high concentrations will stimulate root formation (Jauhar *et al.,* 2013). Karadeniz *et al.,* (2006); Samse and Tiurmaida, (2006) Giberelin function in the formation of seeds, which stimulate the formation of pollen (pollen), increase fruit size, stimulates flower formation, and ending the seed dormancy period.

Treatment of various varieties of onion and interaction showed no real effect (Figures 7 and 8). It is caused by genetic factors and adaptability of plants, as well as a high factor of endogenous hormone in plants onion, so that administration of exogenous hormone had no effect on the production of red onion. However, the variety and interaction between varieties bima bima with PGR sweet corn, still shows the average production per plot were higher than others. In line with the opinions Idhan (2016), that basically own

plant hormone called endogenous hormone. According to Suwandi *et al.*, (2015), that other factors determining onion yields are genetic factors and appear to be more determined by genetic factors of varietal variation than the effect of fertilization factors or the management of the growing environment.

1). PGR which shows significant result both growth component and production component on shallot plant is PGR sweet corn. 2). Red onion that has a high adaptation is the red onion of Bima varieties.

Suggestion

1). Optimizing production by conducting the second best study of PGR on red onion of Bima varieties. 2). Variety Bima quite adaptive at the location of the planting.

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