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Effect of Hormone Concentration and frequency of administration of Gibberellins on Growth and Yield of Tomato Fruit

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Abstract

The aim of this research was to identify the influence of giberellin hormone concentration and its application frequency on the growth and the yield of tomato fruit. This research had been undertaken at Agrotechnopark, the University of Jember 6 November 2017 - 10 February 2018. The experiment using randomized complete block design (RCBD) with two factors namely the concentration of giberellin hormone consisted of 4 levels (0 ppm, 50 ppm, 75 ppm, 100 ppm) and the second was its frequency application consisted of three levels (spraying once every 7 days, 14 days, and 21 days). Reviews These were arranged in a factorial design and each combination was repeated by three times. The results Showed that (1) siqnificantly influenced concentrations of hormone on the growth and the yield of tomatoes. (2) the frequency of its application on the number affected siqnificantly productive branches, the number and weight of fruit, the weight of the tomato fruit. (3) there was no interaction of giberellin and its aplication on all paramters. (4) the best treatment is G3F3, the gibereellin concentration of 100 ppm and the frequency of 21 days once.

Keywords:concentration, frequecy, gibberellins, tomato.

1. INTRODUCTION

The tomato plant is widely cultivated commercially in Indonesia, usually cultivated in the highlands. According Harjadi and Sunarjono (1990), a good quality tomatoes only be achieved at an altitude of 800 meters above sea level. Cultivation of tomato plants will produce good growth which will lead to the production of fruit and fruit quality, when the tomato plant food needs can be met. Food needs enough plants then can menghailkan normal plant growth and high production. Food for plants especially tomato plants that must be met consisting of nutrients, and plant growth regulators (Martodireso, 2001).

Plant growth regulators are organic compounds which are not nutrients in low concentrations (<1 mM) may encourage, inhibit or qualitatively can alter plant growth and development (Moore, 1979). Plant growth regulators play a role in regulating plant growth and development. In the absence of growth regulators it will directly affect the growth and production. In the plant has provided fitohormon to mondorong growth and development

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also exist that hinder reverse (Salisbury and Ross, 1995). One of the hormones that can stimulate the growth of tomato plants, especially the development and growth of tomatoes and help to generate higher production is the hormone gibberellin.

According Wattimena (1988), that gibberellin (GA_3)a growth regulator that has a physiological role in the elongation of stems (buds) and suppress the aging process as well as threshing plant organs. Giberelin applications have been carried out by researchers and has many inventions, such as the example, by wearing giberellat acid on dwarf beans, the plants will grow into a normal pea (Ali, 2015). In the dwarf maize varieties will grow normally if slightly acidic giberellat put didaun. Many plants two years can be induced to have a life cycle of one year (annual) using giberellat acid, if given the gibberellic acid kool, kool are usually short round with dense leaves are stimulated to grow panhandle (Heddy, 1996).

Gibberellins have a variety of functions for the physiology of plants, so it has more than one location for the main action. The first is stimulated cell division at the top of the stem, the second two are giberelin can stimulate cell growth, and a third three gibberellins increase the plasticity of the cell wall (Lakitan, 1996). To increase the production of tomatoes, of course, all the crop needs to grow to be fulfilled, with the addition of plant growth regulator that is giberelin as hormone administered exogenously is expected to spur the growth of tomato plants, so the tomato plants are able to produce optimal growth, high production and fruit quality good.

2. MATERIALS AND METHODS

This study was conducted on land Agroteknopark, University of Jember in 6 November 2017 - 10 February 2018. The experiment effect of the concentration and frequency of administration of hormone gibberellins on growth and yield of tomatoes use using randomized design group (RAK) factorial (4 x 3) with two factors: the concentration of gibberellins comprising 4 levels G0 = 0 ppm gibberellin, G1 = 50 ppm gibberellin, G2 = 75 ppm Giberelin and G3 = 100 ppm gibberellin and factors the second frequency comprising gibberellin 3 levels F1 = frequency of 7 days, F2 = frekuensi14 days, and F3 = frequency of 21 days, and each combination is repeated three times.

Materials used in the study of compost, sand, tomatoes are varieties of gems, hormone gibberellin GAwith a concentration$_3$ of 40%, polybag size 40x60 cm, stakes, rope, water, and fertilizer NPK. Tools used include, knife and cutter, sprayer, measuring cups, glass

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beaker, pipette ruler, hoes, sickles, shovels, sieve wire diameter of two millimeters, yells, oven, analytical balance, calipers, tape measure.

3. RESULTS AND DISCUSSION

The results of the analysis of variance of all parameter above effect of the concentration and frequency of administration of hormone gibberellins on growth and yield of tomatoes is shown in Table 1.

Table 1 Summary of F-Calculate Entire Parameter Experiment

No.	Parameter	Treatment		
		Concentration Giberelin (G)	Frequency Giberelin (F)	intraksi Giberelin G x F
1	Plant High	4.79 *	0.18 ns	0.60ns
2	Diameter	4.87**	0.23 ns	2.22ns
3	Leaf Number	5.23**	3.77 **	0.65 ns
4	Number of Branches Productive	4,09 *	1,58 ns	2,12ns
5	Moisture	3.51 *	0.58ns	0.79ns
6	Dry weight	3.87 *	0.34 ns	1.00 ns
7	Long Roots	6.72 **	0.08 ns	1.00ns
8	Volume Root	**5.64	1.89ns	1.00ns
9	Total Fruit Harvest cropping	12.07 **	6.88 **	2.44 ns
10	Planting Harvest Fruit weight	3.47 *	6.69 **	0.76 ns

Note: * = real contrast
** = very real contrast
ns unreal = Different

Table 1 shows that the concentration of the hormone gibberellin effect on all parameters. In the treatment of hormone gibberellin frequency effect on the number of leaves, fruit number and weight of fruit crop cultivation. While the interaction between hormone concentration of gibberellins and gibberellin hormones frequency showed no significant effect on all parameters of the study.

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3.1. Effect of Gibberellins on Growth Hormone Concentration and Tomato Crop Production

According Lakitan (1996), the size of the plant as an indicator of the growth can be viewed in one dimension, for example by measuring plant height, two dimensions by measuring the growth of leaves, and three dimensions by measuring the root growth. The results of the treatment concentration plant height parameter can be seen in Figure 1.

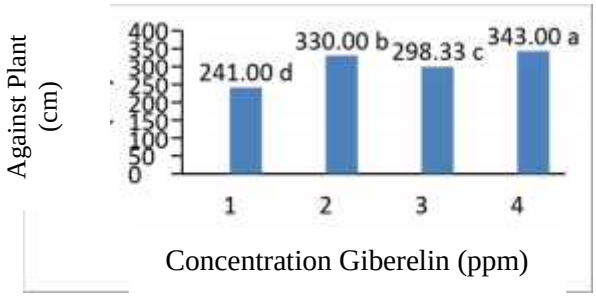

Figure 1. Effect of High Concentration Giberelin against Plant

Based on the analysis by Duncan test at level of 95% in Figure 1, show that the concentration of gibberellins significant effect on plant height. Treatment of 100 ppm (G3) provides high response kindest plant is 343.00, compared to the control treatment (G0) of 241.00. An increase of 42% due to the application concentration of gibberellin, while on treatment 75 ppm (G2), plant height achieved is still lower compared to the treatment of 50 ppm gibberellin (G1) at 10%, but gibberellins 50 ppm (G2) is lower compared with 100 ppm gibberellin (G1) that is equal to 4%. This is consistent with the statement Abidin (1990) giberelin has a role in supporting the extension of the cells, the activity of the cambium. Prawiranata *et*al.(1981), GA_3 included in the group of gibberellins that function in the trunk spur growth, increase the magnification and multiplication of cells in plants, so the plants can reach the maximum height. The increasing plant height will affect the growth of stem diameter tanamam tomatoes. Results of treatment concentration of the trunk diameter parameter can be seen in Figure 2.

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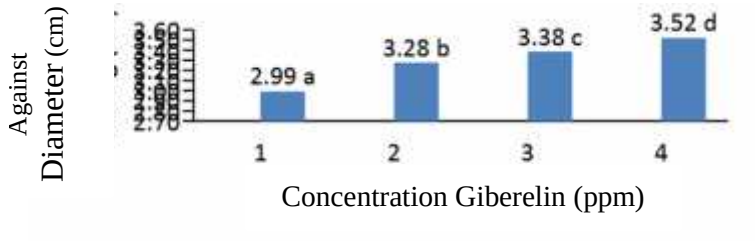

Figure 2. Effect Concentration Giberelin against Diameter

In Figure 2 shows that the concentration of gibberellins significant effect on stem diameter. Highest stem diameter due to the application of gibberellins concentrations indicated in the treatment of 100 ppm (G3) on the outcome of 3.52 compared with controls (G0) of 2.99, an increase of 0.18% in response to the administration of the concentration of gibberellins. According to Salisbury and Ross (1995) note that giberelin encourage Giberelin spur cell division because cells in the G1 phase to enter S phase, and because Giberelin also shortens the phase S. Increasing the number of stem cells causing faster growth because each cell will grow. Vegetetif growth than can be measured by plant height, stem diameter can also be seen from the growth in the number of leaves. Results Giberelin concentration treatments against leaf number of parameters can be seen in Figure 3.

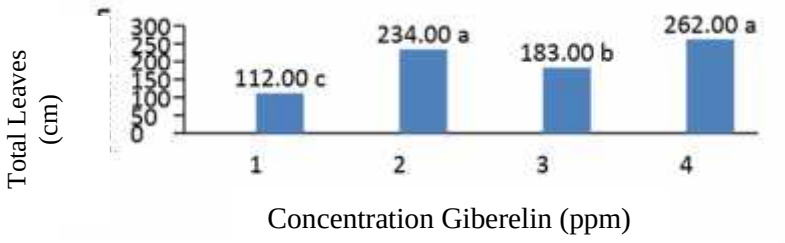

Figure 3. Effect Concentration Giberelin against Total Leaves

On parameter number of leaves (Figure 3) shows, the best giberelin concentration at 100 ppm treatment (G3) by the number of leaves to be 262, 00 compared to the control treatment (G0). An increase of 1.34% in response to gibberellins of concentration .. According Wattimena (1987), in addition to the extension of the rod, giberelin also memeprbesar leaf area, as well as influencing growth in the number of leaves. This is similar to that expressed by Heddy (1996) and Lakitan (1996) that the application directly to the leaves gibberellins stimulate

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leaf growth. Leaves of tomato plants growing attached to the tomato plant branches, the more the number of leaves the more the number of branches produced tomato plants. The result of the concentration of gibberellin treatment on parameters the number of productive branches can be seen in Figure 4.

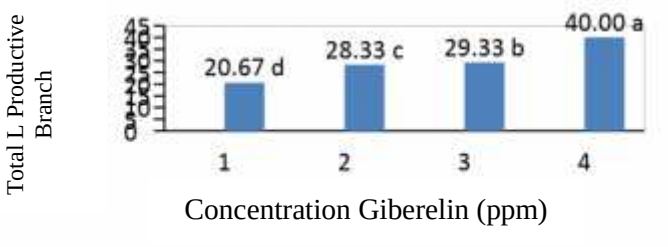

Figure 4. Effect Concentration Giberelin to Total Productive Branch

In Figure 4 shows that the concentration of gibberellin significantly affect the number of productive branches. The highest number of productive branches generated at a concentration of 100 ppm gibberellin (G3) is 40.00 compared to the control treatment (G0) 20.67, an increase in the number of productive branches of 0.93% in response to the concentration of gibberellins towards productive branches, it is appropriate with the opinion of Wilkins (1989), the hormone gibberellins acting on genes and thus require proper concentration in plants, gibberellin hormone concentration of 100 ppm in the research can provide significant results in flowering tomato, and provide significant results on the percentage of fruit at the plant flowers. Observation of plant growth has many components including the measurement of biomass). The result of the concentration of gibberellin treatment on parameters of water content and dry weight can be seen in Figure 5 and Figure 6.

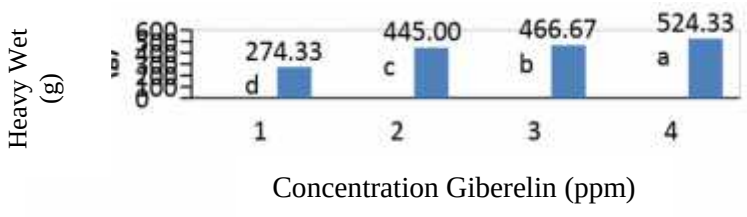

Figure 5. Effect Concentration Giberelin against Heavy Wet

On moisture content parameters (Figure 5) shows the best giberelin concentration at 100 ppm treatment (G3) by the number water content of 524.33

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compared to the control treatment (G0) is 274.33. There was an increase of 0.91% in response to gibberellins of concentration.

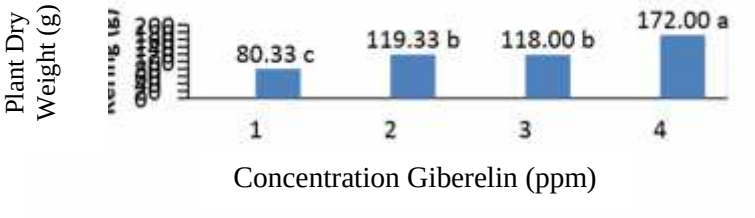

Figure 6. Effect Concentration Giberelin to Plant Dry Weight

Plant dry weight in the image (6) treatment of 100 ppm gibberellin (G3) with a weight of 172.00 showed the highest value compared to the control treatment (G0) that occur peningkatam 80.33 by 1, 14%, the control treatment (G0) is the lowest compared to all other treatments treatments. Wet weight parameter is only used as an indicator of how the water content contained in the crop after a dry weight unknown. According Lakitan (1996), plant dry weight reflects the accumulation of organic compounds synthesized plants from inorganic compounds, mainly water and carbon dioxide (CO_2).Nutrients that have been absorbed by the roots, both of which are used in the synthesis of organic compounds and which remain in ionic form in the tissues of the plant, will memberkontribusi to plant dry weight gain. According Sitompul (1995), the measurement of plant biomass consisting of fresh weight and dry weight, then obtained the water content in all organs of useful plants in the application example fiiologi crops in agriculture.

The result of the concentration of gibberellin treatment on parameters root length and root volume can be seen in Figure 7 and 8.

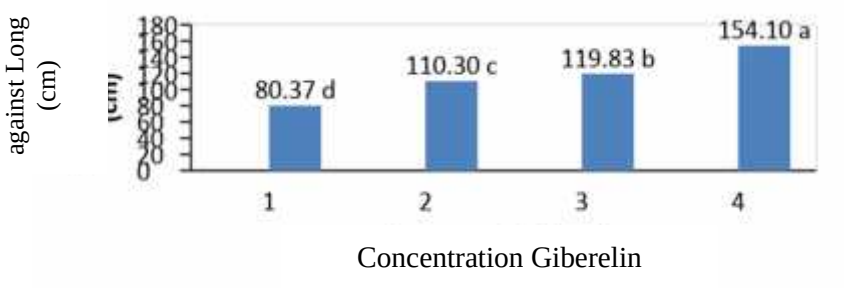

Figure 7. Effect Concentration Plant Roots Giberelin against Long

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Figure 7 shows the concentration of highly significant giberelin against tomato plant root length, root length with a concentration of 100 ppm (G3) giving the best response to the value of 154.10 compared to the control treatment (G0) of 80.37, an increase of 0.92% root length, followed by 75 ppm (G2) with a value of 119.83, higher of a concentration of 50 ppm (G1) amounted to 110.30. There was an increase of 0.07%.

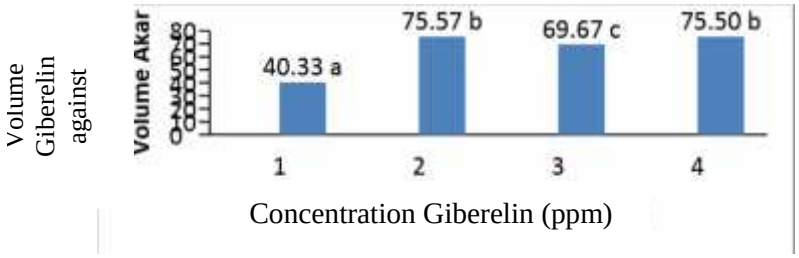

Figure 8. Effect Concentration Plant Roots Volume Giberelin against

Root volume parameter in figure 8 gave the same response to the length of the root that is highly significant. According to Salisbury and Ross (1995), roots also synthesise exogenous gibberellin giberelin but little effect on root growth, and inhibit the growth of wild roots, most of the supply of gibberellins in the header comes from the roots through the xylem. Giberelin not only useful for stem elongation, but also the growth of all organs of plants, including the leaves and roots, the hormone gibberellin exogenously not directly visible effect on the roots but can increase cell division and the apex of the canopy, which can stimulate the growth of stems and young leaves, and thus more accelerated the process of photosynthesis and produce increased growth in all organs of the plant, including the roots. The result of the concentration of gibberellin treatment on parameters of fruit number and fruit weight can be seen in Figure 9 and 10.

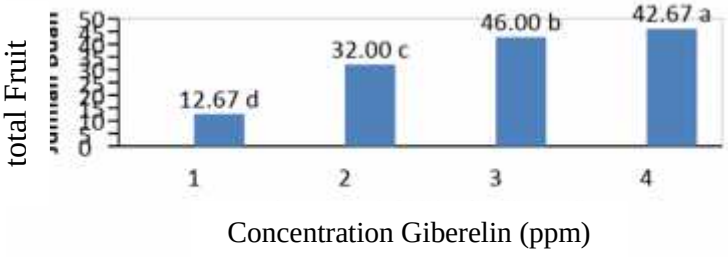

Figure 9. Effect Concentration Giberelin of the total Fruit

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Amount of fruit (picture 9) highly significant effect on the concentration of gibberellins, gibberellin concentration of 100 ppm (G1) has the best result is 42.67, compared to the control treatment (G0) 12,67 which has the lowest value compared to all treatment, a decline of 2.37%. gibberellin concentration treatments by 75 (G2) has a value of 46 ppm, while the concentration of gibberellins 50 ppm (G1) has a value of 32, and also an increase of 0.44%.

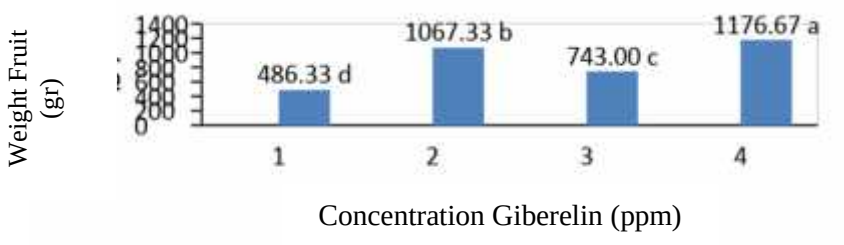

Figure 10. Effect of concentration on weight Giberelin Fruit

In Figure 10 the effect of hormone concentration against the weight of the fruit giberelin significantly different effect, after the Duncan test with a level of 5%, treatment giberelin concentration of 100 ppm (G1) has the highest value is 1176.67 , compared to the control treatment (G0) at 486.33 an increase of 1.42%. Gibberellins 50 ppm treatment concentration (G2) is the second largest after the G1 with a value of 1067.33 and has a higher value than the concentration of gibberellins with 75 ppm (G2), a decline of 0.43%. According to Salisbury and Ross (1995), the hormone gibberellin concentrations suitable, not only for stem elongation growth alone but the entire plant can be motivated and will lead to the production. Giberelin on grape plants are sprayed 2 times that at the flowering and the fruit formation phase resulting in grapes have good fruit and not beregerombol, so that the production of grapes widened increases (Nickell, 1979). Giberelin when sprayed on the fruit and leaves of citrus can prevent skin irritation fruit during storage, here hormones can delay aging and maintain rind still tight (Salisbury and Ross, 1995).

3.2. Effect of Gibberellins on Growth Hormone frequency and Tomato Crop Production

Giberelin exogenous application will provide optimum response if there is a hormone gibberellin spraying frequency setting in accordance with the needs of the tomato plants. According to Salisbury and Ross (1995), is a plant hormone

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biosynthesized organic compounds in one part of the plant and transferred to another place, and at very low concentrations capable of causing a physiological differences. So the need for regulating the concentration and frequency appropriate to generate growth and high production in tomato plants. Results giberelin frequency treatment on parameters number of leaves, fruit number and fruit weight can be seen in Figure 12.

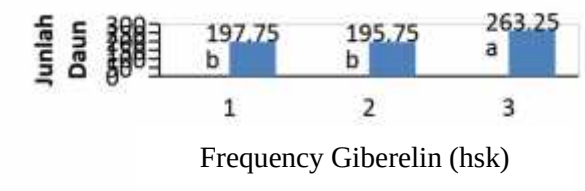
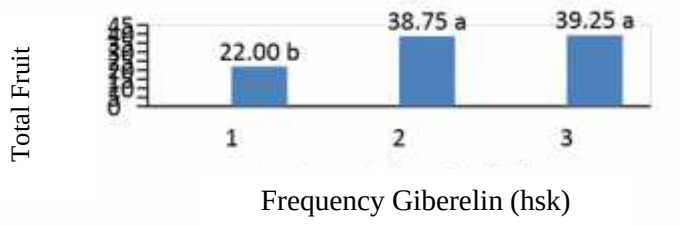


Figure 12. Effect of Frequency Giving Giberelin against Leaf Number.



Gambar13. Effect of Frequency Giving Giberelin against Total Fruit.

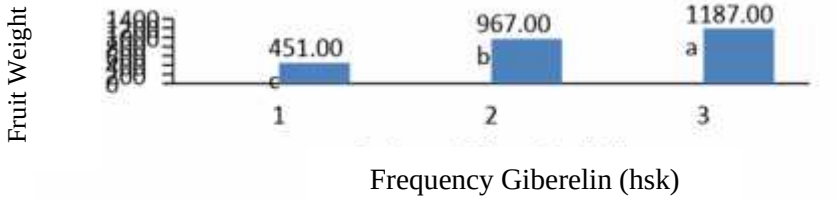


Figure 14. Effect of Frequency Giving Fruit Weight Giberelin against

Parameter leaf number, fruit number and fruit weight in the figure 12, 13 and 14 showed 12 shows treatment with spraying frequency of 21 days (F3) giving the best response, spraying gibberellin with a frequency of 14 days (F2) and 7 days (F1), a response that was not significantly different and have the same value, so the frequency of 21 days (F3) is the best frequency.

Treatment frequency on tomato plants only provide a response to the parameters of the number of productive branches, fruit number and fruit weight it can be expected because of the usefulness of hormone gibberellin to support the

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extension of the cells, the activity of the cambium, flowering, as well as for the growth of fruit, especially *partohenocarpy* (Abidin, 1990) so that with the frequency regulation of the hormone gibberellin could spur the growth and production of tomato fruit. This is in accordance with the opinion of Wilkins (1989), that the hormone gibberellins acting on genes and thus require appropriate concentrations in plants, the concentration of the hormone gibberellin 100 ppm in the research can provide significant results in flowering tomato, and provide significant results in the percentage of interest into the fruit on the plant.

3.3. Influence interaction Giberelin against growth and results Crop Tomato

Treatment interaction between the concentration of gibberellins and frequency giberelin give different results is not real and this is because the treatment has its own function, so that when combined or in intraksi not visible effects of the two factors (concentration of gibberellins x frekuesi gibberellins). According to Salisbury and Ross (1995), when more hormones can be characterized and studied the effects and the endogennya concentration, two things become apparent. First, each of hormones affect the response in many parts of the plant. The response depends on the species, plant parts, phases of development, hormone concentrations, the interaction between hormones, and various environmental factors.

4. CONCLUSION

Based on the results of data analysis and discussion, can be obtained some conclusions as follows, The concentration of the hormone gibberellin significant effect on the growth and yield of tomato plants, Frequency of gibberellin significant effect on the number of productive branches, the number of pieces, and the weight of tomatoes, No interaction between treatment concentration and frequency giberelin on all parameters and Giberelin treatment concentration of 100 ppm, and the frequency of spraying 21 days (G3F3) as a single factor showed the best results on the growth and yield of tomato.

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