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| RESEARCH ARTICLE

APPLICATION OF GIBBERELLINS (GA_3) IN MELON CULTIVATION BASED ON SUBSTRATE HYDROPONIC SYSTEM WITH DRIP FERTIGATION

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| ABSTRACT
Gibberellins (GA_3) are a group of plant hormones that play a role in regulating plant growth and development. This study aimed to determine the most effective of timing and concentration of GA_3 application to stimulating vegetative and generative growth of melon in a substrate hydroponic system using the drip fertigation method. This research carried out from May to August 2023 in Surakarta. This study was conducted using a one-factor Complete Randomized Design that has seven levels based on the method of GA_3 application, namely without GA_3 (as the control); GA_3 concentration 60 ppm sprayed on 5, 10, and 15 days after transplanting (dat); GA_3 concentration 60 ppm sprayed on 20, 25 and 30 dat; GA_3 concentration 80 ppm sprayed on 20, 25 and 30 dat; GA_3 concentration 80 ppm sprayed on 30, 35 and 40 dat; GA_3 concentration 100 ppm sprayed on 30, 35 and 40 dat; GA_3 concentration 100 ppm sprayed on 30 ,40 and 50 dat. The variables observed were dry weight of shoot and root, total content (a+b) of chlorophyl, weight, diameter, and sweetness levels of fruits. The results indicated no significant differences responses in the use of GA_3, both against the control as well as between all treatments of GA_3 on all variables observed except for fruit weight per plant.

| KEYWORDS

Application Timing, GA_3 Concentration, Sweetness Levels, Fruits.

| ARTICLE INFORMATION

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1. Introduction

Melon, (Cucumis melo L.) belongs to the Cucurbitaceae family and is a very popular fruit in Indonesia, not only known for its sweet and fresh taste, but also because it is rich in nutrients such as protein, vitamin C and magnesium. Every 100 grams of melon contains 23.0 calories, 0.6 g protein, 17 mg calcium, 2,400 IU vitamin A, 30 mg vitamin C, 0.045 mg thiamin, 0.065 mg ribloflavin, 1.0 mg niacin, 6.0 g carbohydrates, 0.4 mg iron, 0.5 mg nicotinamide, 93.0 air, 0.4 g fiber. (Sari et al. 2013).

GA_3 are a group of plant hormones that play a role in regulating plant growth and development. This hormone is involved in a number of physiological processes in plants, including cell elongation, regulation of seed dormancy, fruit formation, and influence on stem and root growth (Zhang et al. 2021). GA_3 concentration of 0.5 mL.L-1 can significantly increase fruit weight, fruit diameter, fruit thickness, wet and dry fruit weight of melon plants (Winarti et al. 2022).

Giving a dose of GA_3 of 0.5–2.0 significantly increased plant height, tuber weight, dry weight per plant, and weight per plot of shallots (Cokrosudibyo at al. 2023). Spraying GA_3 at 1 and 3 weeks after anthesia was able to reduce the amount of shedding on citrus fruit (Kalsum et al. 2021).

Eggplant plants that were treated with 200 ppm GA_3 with 2 applications experienced interactions with plant height parameters at the age of 28-56 days after planting (Triani et al. 2020). GA_3 concentration independently influences the length of shoots of lowland rice varieties (Hadi 2020).

This research will focus on determining the most effective time and optimal concentration of GA_3 application to stimulate melon plants vegetative and generative growth based on substrate hydroponics system. The results of this study are expected to significantly contribute to developing more efficient and sustainable agricultural practices in the future.

2. Materials and Methods

This research was conducted from May to August 2023 in Surakarta. The laboratory research will be conducted at the Laboratory of the Faculty of Agriculture, Sebelas Maret University, Surakarta.

The tools used in this study include meters, rulers, scales, digital cameras, rope, sprayers, polybags, measuring cups, fertigation system hydroponic installations, thermometers, pH meters and TDS meters. The materials used in this study include melon seeds, cocopeat, AB mix nutrients, and GA_3.

This study was conducted using Complete Randomized Design that has seven levels of treatments based on the method of application of GA_3, namely :

G0 = Without Gibberellins (GA_3) Control
G1= GA_3 concentration 60 ppm sprayed on 5,10,15 days after transplanting (dat)
G2= GA_3 concentration 60 ppm sprayed on 20,25,30 (dat)
G3= GA_3 concentration 80 ppm sprayed on 20,25,30 (dat)
G4= GA_3 concentration 80 ppm sprayed on 30,35,40 (dat)
G5= GA_3 concentration 100 ppm sprayed on 30,35,40 (dat)
G6= GA_3 concentration 100 ppm sprayed on 30,40,50 (dat)

The treatments were repeated 4 times, resulting in 28 experimental units. The variables observed were dry weight of shoot and root, total content (a+b) of chlorophyl, weight, diameter, and sweetness levels of fruits. Data were analyzed using ANOVA. If the treatments showed a significant difference in response based on the F test at a significance level of 5%, DMRT test was performed at a 5% significance level.

Planting was carried out using cocopeat, placed in polybags measuring 35 x 35 cm with a planting distance of 40 x 40 cm. The composition of AB Mix fertilizer contains: N of 215 ppm, P of 86 ppm, K of 343 ppm, Ca of 175 ppm, S of 114.02 ppm, Mg of 85 ppm and micro elements: Mo of 0.122 ppm, Zn of 0.805 ppm, Bo of 0.488 ppm, Mn of 0.732 ppm, Cu of 0.78 ppm, and Fe of 6.8 ppm. The water used to dissolve AB Mix fertilizer materials is RO water with pH 6, TDS 56 ppm, and EC 0.09. Once the stock solution is formed, its pH is 4.6, TDS is 8638 ppm, and EC is 17.540. Fertilizing application on plants were carried out at a ratio of 1 : 200. The seedbed were planted for 14 days and then transplanted into polybags. Each polybag is filled with 2 plants. Nutrient feeding to plants is carried out with TDS concentrations of arouns 1400-1600 ppm and EC between 2.9-3.2. At 1-5 days after planting, watering is carried out 1 time a day with 500 ml per polybag. At the age of 6-10 dap, watering is carried out 2 time a day in 1000 ml per polybag. From the age of 11 dap until harvest, watering is carried out 3 times daily in 1500 ml per polybag. The irrigation system used is a drip irrigation system. Pruning of the main stem is carried out at 40 dat. Plants that have grown tall are tied using rope to the wire provided as a support. The application of GA_3 was done by spraying all parts of melon plants according to treatment. Harvesting was carried out by cutting the fruit stalk with a distance of at least 3 cm from the base of the fruit to avoid biological damage due to microorganisms at 70 dat.

3. Results and Discussion

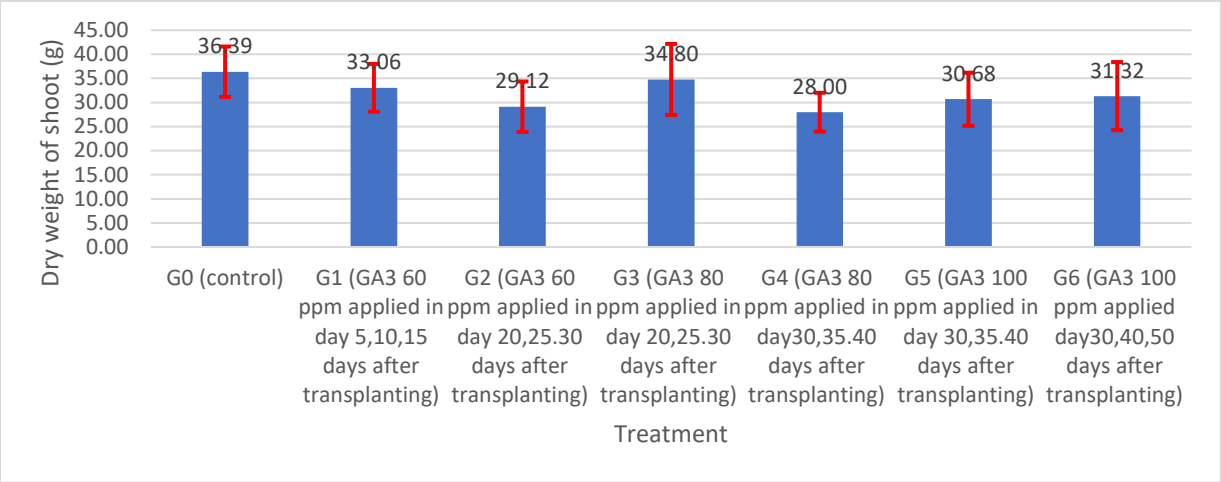

Figure 1. Dry weight of shoot (g) diagram

There were no significant differences in the use of gibberellins (GA_3) in relation to dry weight of shoot among all treatments (G1, G2, G3, G4, G5, and G6), as well as in the control groups in this study. The results indicated that the administered treatments did not have a significant impact on the crown weight of the plant. Heading weights ranged from a minimum value of 28 grams to a maximum value of 36.39 grams, with the highest standard deviation for dry weight to shoot reached 7.375547437, while the lowest was 4.030313263.

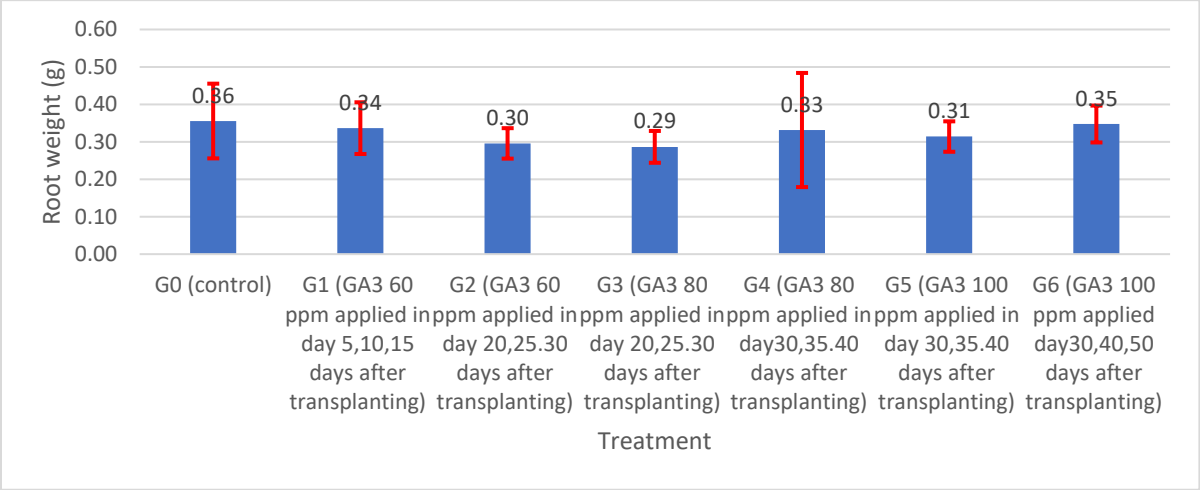

Figure 2. Dry weight of root (g) diagram

There were no significant differences in the use of gibberellins $\left(GA_3\right)$against root weight across all treatments (G1, G2, G3, G4, G5, and G6), as well as in the control groups. These results indicate that the variation in treatment given did not have a significant impact on root weight. Root weight varies between 0.29 to 0.36 grams, with the highest standard deviation of 0.152389 and the lowest of 0.040628.

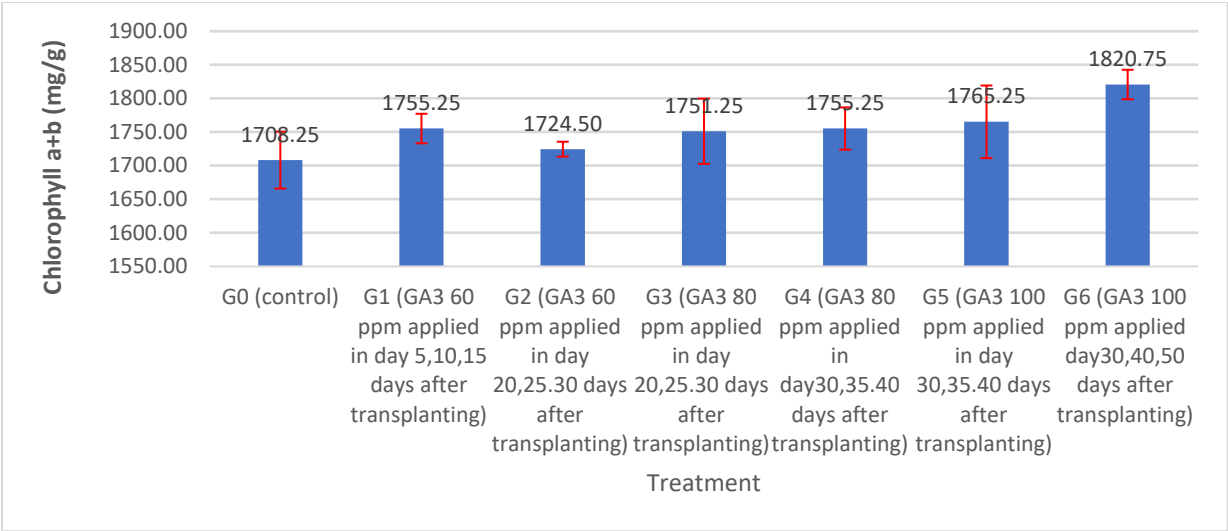

Figure 3.Total Chlorophyll a+b (mg/) diagram

There was no significant difference in the use of GA_(3) on chlorophyll a+b (total) in all treatments (G1, G2, G3, G4, G5, and G6), as well as in the control group in this study. The results showed that the variations in treatment provided did not have a significant impact on chlorophyll a+b (total). . The minimum value for chlorophyll a+b is 1708.23 mg/g, the maximum value is 1820.75 mg/g and the highest standard deviation for chlorophyll a+b is 54.07633, while the lowest is 11.09054.

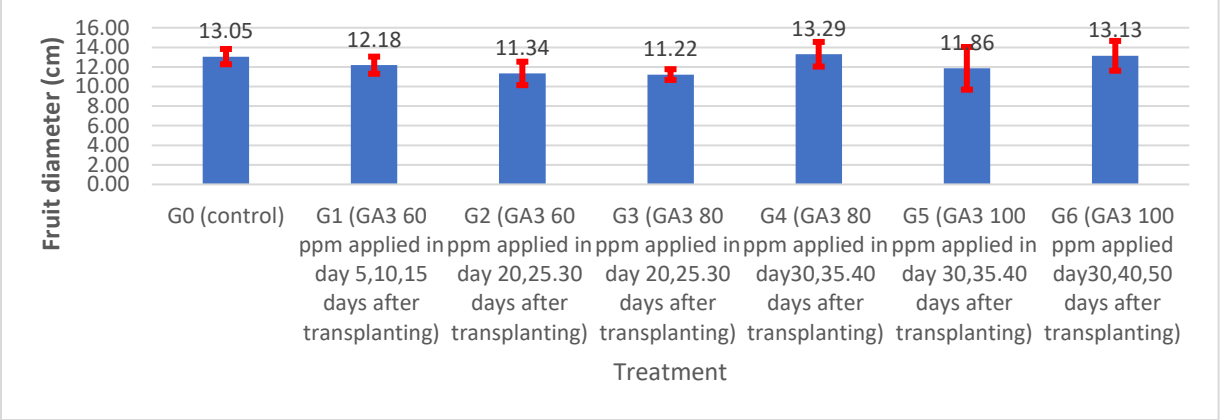

Figure 4. Fruit diameter (cm) diagram

There were no significant differences in the use of gibberellins (GA_3) across all treatments (G1, G2, G3, G4, G5, and G6), as well as controls, in terms of melon diameters. These results suggest that the variation in treatments given does not significantly impact the diameter of the fruit. The melon fruit diameter ranges from a minimum of 11.22 cm to a maximum of 13.13 cm, with the highest standard deviation for the diameter being 2.17982224 and the lowest standard deviation being 0.546504041. Despite variations in fruit diameter, statistically, this data is still considered part of the population. Therefore, the standard deviation value is deemed an important indicator to describe the heterogeneity or homogeneity of the fruit diameter data.

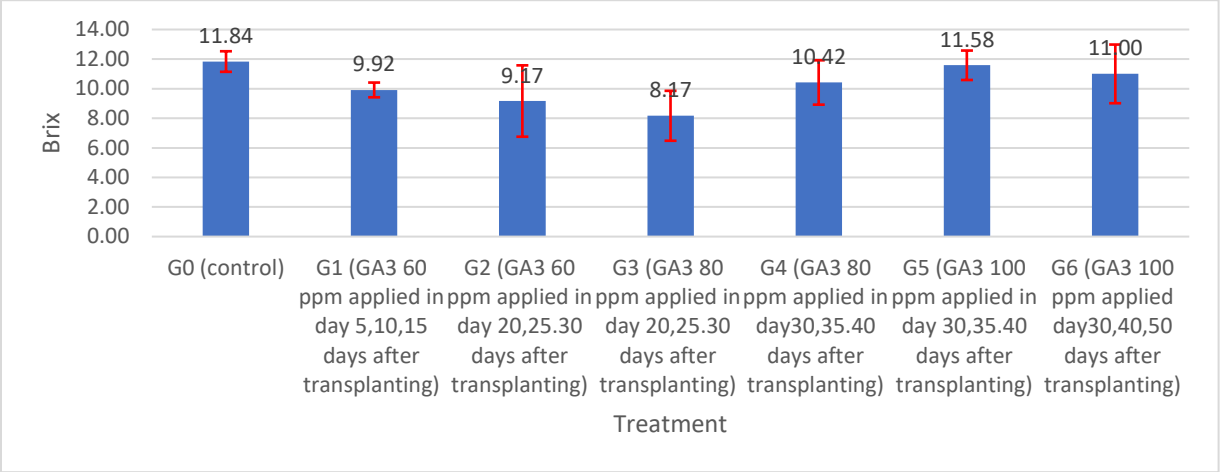

Figure 5. Sweetness levels of fruit (brix) diagram

There was no significant difference in the use of GA_3 on the sweetness level of melons in all treatments (G1, G2, G3, G4, G5, and G6), as well as the control. These results indicate that the variation in treatment given did not have a significant impact on the level of sweetness of the melon fruit. The range of sweetness level (Brix) values ranges from 8.17 brix to 11.84 brix, with the highest standard deviation reaching 2.411701, while the lowest standard deviation is 0.498899. Even though there are differences in the sweetness level of melons, statistically, these data are still considered to be part of the same population.

4. Conclusion

The results of the study showed that there were no significant differences in the response to the use of GA_3, either against the control or between all GA_3 treatments on all variables observed except for fruit weight per plant.

The results of the study show that the nutrient composition used in the droplet fertigation hydroponic system for melons has already reached an adequate level of quality without requiring additional GA_3.

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