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Parthenocarpy Fruit Formation in Cucumber (*Cucumis sativus* L.) with Giberelin Hormone Application on The Lowland of Palopo

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Abstract

This study aimed to observe (1) The formation of parthenocarpy fruit in cucumber with the application of Giberelin hormone and (2) the concentration of Giberelin to form the parthenocarpy fruit on cucumber. This study was held at campus 2 trial land, Faculty of Agriculture Cokroaminoto University, Palopo. The method used in this study was group randomized design method with five treatments and three replications, i.e P0 (without Giberelin application), P1 (200 mg/L Giberelin), P2 (250 mg/L Giberelin), P3 (300 mg/L Giberelin) and P4 (350 mg/L Giberelin). The result showed that the application of Giberelin with 350 mg/L concentration (P4) significantly affected the formation of parthenocarpy fruit on the number of seed produced with 379.96 seeds. The highest number of seeds produced was observed in control treatment (P0) with 496.27 seeds. Furthermore, the fruit fresh weight, diameter, and length had no significant difference

Keywords: giberelin, cucumber, parthenocarpy

A. Introduction

Cucumber is famous vegetable type that is widely consumed by the community, both freshly and processed as *asinan*, pickles, and salad. Cucumber can also be utilized as medicine and cosmetic ingredients (Wulandari, Guritno & Aini, 2014). Therefore, the fruit quality becomes very important especially when meeting with the demands of traditional and modern markets (Rukmana, 2010).

BPS (2018) reported that the production data of cucumber in South Sulawesi Province on the last three years was fluctuative, as 8,810 tons in 2016, decreased at 6,596 tons in 2017, and increased at 7,629 tons in 2018, while the cucumber demand continued to increase along with the public awareness to consume vegetables. Declined cucumber production in Indonesia is because of the cucumber farming cucumber is still considered as a side farming business (Kartikasari, Aini & Koesriharti, 2016).

Efforts applied to increase the cucumber production to meet the market demand is by improving the fruit quality concerned in the color, taste, aroma and seed presence. Consumers generally prefer less fruit seeds (parthenocarpy) than more seeds. The supplementation of growth regulator (ZPT) can be utilized for the formation of fruit without seeds. The application of phytohormones can substitute the role of seeds in stimulating the formation and development of fruit (Saptowo, 2001). The formation of seedless fruit (parthenocarpy) can be induced through a growth regulatory application, such as Giberelin.

Giberelin is one of the ZPT that is commonly used to produce the fruit growth without seeds, which is widely used by the seedless wine producers for grape seed cultivars. Giberelin has been widely used as ZPT to induce the seedless fruit formation (Suswanto, 2002). Some previous studies utilizing Giberelin to induce the seedless fruit formation (parthenocarpy) comprised watermelon (Wijayanto, Yani & Arsana, 2012), tomato (Rolistro, Sunaryo & Wardiyati, 2014), and cucumber (Wulandari *et al*., 2014). This study used the highest concentrations of Giberelin with 350 mg/L referred to the previous study research conducted on watermelon (Wijayanto et al., 2012) as the concentrations of 300 mg/L still produced fruit with plenty seeds.

Based on the explanation above, it is necessary to conduct the study to obtain the formation of parthenocarpy fruit in cucumber, thus improving the quality and quantity of crop production.

B. Methodology

This study was held at the campus 2 trial land, faculty of agriculture, Cokroaminoto University, Palopo, Lamaranginang Street, Batupasi Village, Wara Utara District, Palopo.

Materials used in this study were cucumber seeds, Giberelin, lable, water, and natural fertilizer. Equipments used in this study were pen, book, bucket, camera, ruler gauge, shovel, scoop, chopping knife, bamboo, scale, caliper, and hose.

This study used group randomized design with five treatments and five replications, thus resulting 25 experimental units. Treatments in this study comprised:

P0: Without any treatments (control)

P1: 200 mg/L concentration of Giberelin application

P2: 250 mg/L concentration of Giberelin application

P3: 300 mg/L concentration of Giberelin application

P4: 350 mg/L concentration of Giberelin application

Data obtained were analyzed statistically. Continued analysis on the data was performed whether all treatments indicated significant difference using honestly significant difference test with 5% degree of confidence.

The procedure methods in this study were as follows:

1. Preparation

Materials and equipments preparation was firstly conducted, before crop planting during the study. Land area measurement and crop bed layout adjustments were also conducted against the sunlight direction.

2. Land processing

Land processing was performed by clearing the land area from weeds and other disruptive materials, before crop planting. Soil was processed using shovel to form crop bed. Crop bed was made at the size of 60 cm length, 30 cm width, and 30 cm height with 40 cm distance on each bed.

3. Planting

Cucumber planting was performed directly on the prepared bed. Holes were created on the bed, before planting the cucumber, with two holes on each bed separated at 30 cm distance. Two cucumber seeds were planted on each holes.

4. Giberelin Dilution

The process of Giberelin (Gibgro) dilution included: Giberelin was measured as much as 200 mg, 250 mg, 300 mg, 350 mg and placed in different containers. Measurement results were taken into the Beaker glass. Water was added into the glass until reaching 1000 ml. Diluted results were stored on the supplied bottles.

5. Giberelin Application

Giberelin solution was sprayed onto the female flower. The application process included:

a. Note each flower that would be sprayed with spoid.
b. The spoid hole that contained Giberelin hormone was brought closer to the flower crown hole.
c. Giberelin was sprayed based on the concentration used in the flower crown hole.
d. Mark the sprayed flower with a rope.
e. Second spraying was performed on each flower after 24 hours.
f. 6. Maintenance

Maintenance activities included watering the crops daily in the morning and evening when not raining. Stitching was performed soon or directly after planting until 15 days after planting to replace the dead plants. The installation of stake for crop propagation was performed at 10 days after planting. Weeds around crops were removed mechanically using sickle or other similar equipments or directly removing and clean weeds by bare hand. Pest and disease control was also conducted whether there were visible symptoms of pest and disease attacks on crops using pesticides or traps.

7. Observation

Observations were performed after Giberelin application starting from the first day after the application until the last day on the harvesting period. Observations conducted were based on the parameters determined. Crop diameter and height were observed every week, while the percentage of germination, fruit fresh weight, diameter, length, seed number, and formation percentage were performed during the harvesting period.

Parameter Observation

Observed parameters in this study included:

1. Fruit fresh weight (g)
2. Fruit diameter (cm)
3. Fruit length (cm)
4. Number of seeds (seeds)

C. Result and Discussion

1. Fruit weight

Analysis of variance result indicated significant difference on the fruit weight presented on Figure 1.

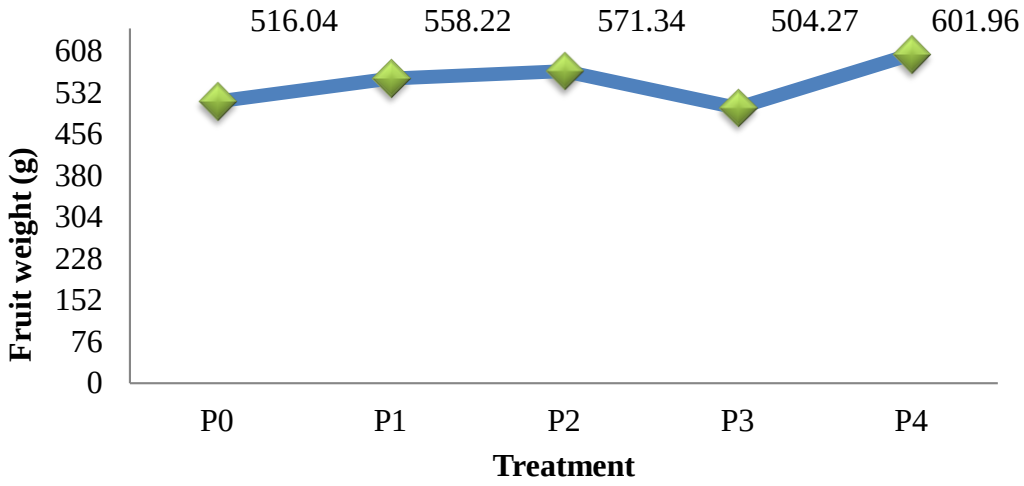

Figure 1. Cucumber average fruit weight on different concentration of Giberelin against parthenocarpy fruit formation.

2. Fruit Diameter

Giberelin application resulted in insignificant different against the fruit diameter of cucumber with the average value is presented on Figure 5.

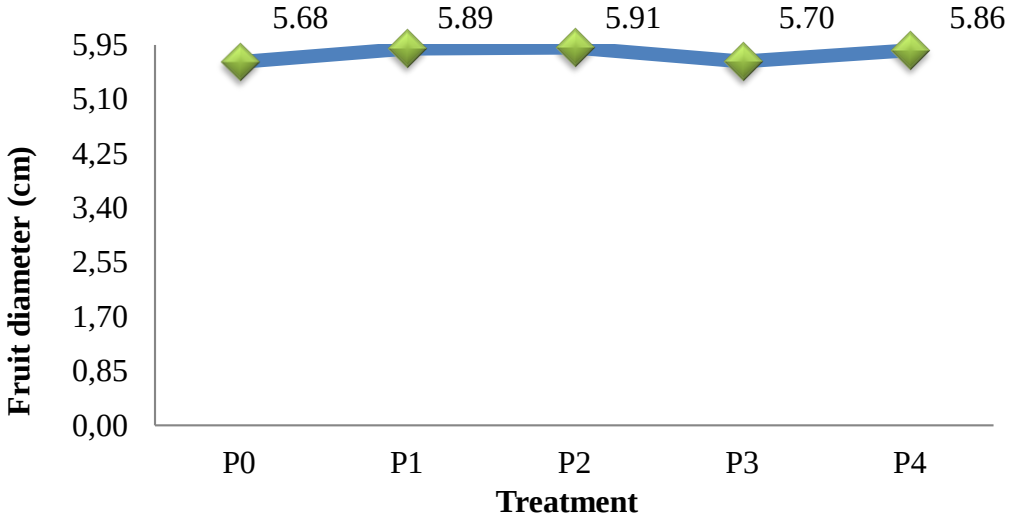

Figure 5. Cucumber average fruit diameter on different concentration of Giberelin against parthenocarpy fruit.

3. Fruit Length

Analysis of variance obtained insignificant different result on the fruit length as presented on Figure 6.

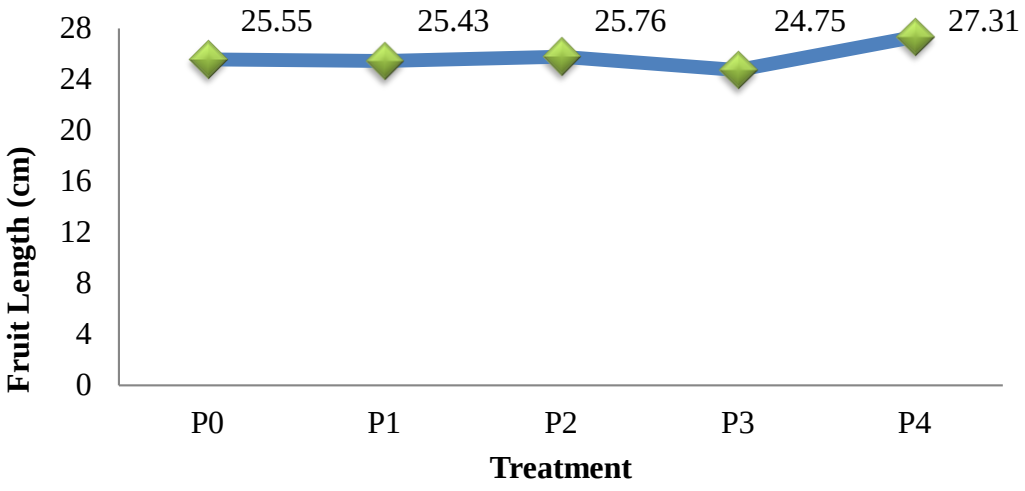

Figure 6. **Cucumber average fruit length on different concentration of Giberelin against parthenocarpy fruit formation.**

4. The number of seeds

The final data of seed total number observation based on the analysis of variance indicated significant difference on each concentration of Giberelin against the parthenocarpy fruit formation. The average value of seed number is presented on Figure 8.

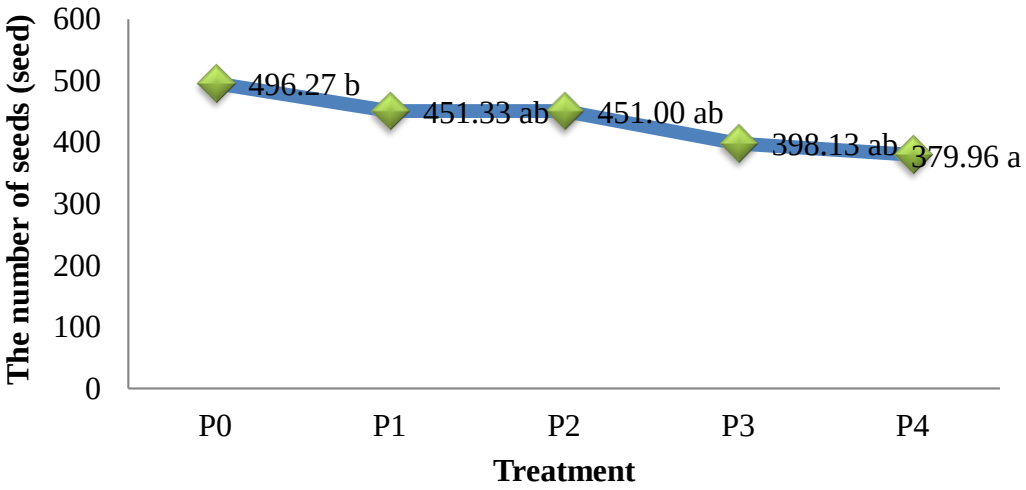

Figure 8. **Cucumber average number of fruit seeds weight on different concentration of Giberelin against parthenocarpy fruit formation. Numbers with the same letter mark shows insignificant different based on the honestly significant difference test with 5% degree of confidence.**

Discussion

Various Giberelin concentrations indicated significant difference based on the analysis of variance against the seed formation of cucumber crop. This is because the application was performed in the female flowers and the entire male flowers were cut during the application, causing the cucumber crop fertilization was inoccured. This is in accordance with the previous studies resulting in the formation of the most concentrated parthenocarpy fruit. Wijayanto, *et al.* (2012) mentioned that Giberelin with the highest concentration (300 mg/L) showed the best significant influence with the lowest number of seeds, i.e 13.667. The seed formation still lasted on each treatment as Giberelin hormone inhibited the embryo development, producing imperfect seeds. In addition, outer factor, namely insects and wind influence could also help pollination process to induce the seed formation. No seeds formed in the fruit produced were caused as the female gamete cells (ovule or seed candidate) were unaffected by male gamete cell (sperm), resulting ovary cells to perform cell cleavage, differentiation, specialization, growth and development with the influence of Giberelin application (Serrani, Fos, Atares, & GarciaMartines 2008).

The highest concentration treatment on P4 was able to provide the highest fruit length and weight among other treatments. The application of Giberelin to the plant will increase the cell size, improving the fruit length and weight. The formation of lighter and smaller fruit is thought to be caused by the unformed seeds in the fruit produced. As described earlier that the seed formation in the fruit should be accompanied by the active synthesis of phytohormones (such as Auxin and Giberelin), thus the metabolite translocation to the fruit can actively synthesizes the phytohormones to become more intensive, resulting larger size of the fruit (Pandolfini, 2009). Although affecting the fruit size, Pandolfini (2009) also reported that the fruit without seeds has an advantage, namely longer shelf life as unpresented seeds will reduce the synthesis of secondary metabolites (such as phenolics), therefore the browning process (browning or damage) in the fruit flesh becomes longer (Maestrelli, LoScalzo, Rotino, Acciarri, Spena, Vitelli, & Bertolo, 2003).

Giberelin with the right concentration will be able to affect the growth of fruit plants, thus producing the best fruit diameter. However, Giberelin influence tends to be less effective to influence the fruit diameter in the cucumber. P3 and P4 treatment indicated the fruit diameter were lower than P2. This was because high concentrations of Giberelin were able to lower the fruit diameter. In addition, P0 and P1 treatment indicated increased fruit diameter as the concentration of Giberelin applied. According to Utama (2015), Giberelin plays a role in stimulating the cell enlargement and division, specifically in the diameter of stem. Nonetheless, stem diameter data showed no significant difference among the treatments. This condition was not separated from the application of Giberelin that was only applied in the female flowers. The same condition also happened in the crop height. The absence of Giberelin treatment against the crop diameter was observed based on the data showing stabilized diameter from the beginning until end of the observation.

D. Conclusion

Giberelin application affects the parthenocarpy fruit formation in cucumber (*Cucumis sativus* L.) based on the number of seeds formed parameter, however having no effect on the fruit weight, diameter and length. The best Giberelin concentration to influence the formation of parthenocarpy fruit in cucumber was found at P4 treatment with 350 mg/L concentration, which was also the highest Giberelin concentration applied. The average number of seeds formed in P4 was 379.96 seeds, indicating the lowest number of seeds among other treatments, while P0 showed the highest number of seeds formed with 496.27 seeds.

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