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Effect of Pruning Time on Flower Regulation of Guava (*Psidium Guajava*)

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Abstract. Guava (*Psidium guajava L.*) 'Kristal' is one of the fruits that have high economic value in Indonesia. The increase of growth, production, and quality of 'Crystal' guava can be done by pruning. This study aims to determine the effect of various times of pruning for controlling the flowering of 'Crystal' guava plants. The experiment was conducted from March to October 2017, at the Cikabayan Experimental Garden in Bogor. The design used was a Completely Randomized Design (CRD) with a single factor, namely the pruning time consisting of 4 levels, namely without pruning, pruning in April, pruning in May and pruning in June. The results showed that pruning treatment was able to accelerate the appearance of flowers and increase the number of generative shoots, the number of flowers per tree, the amount of fruit harvested. Increased flowering response due to pruning is supported by the rate of stomatal conduction, the number of stomata is higher than without pruning. The pruning treatment can accelerate the time the flower appears 10 days faster than without trimming. Fruit quality such as total dissolved solids, fruit acidity, and fruit diameter was not affected by pruning treatment.

1. Introduction

Guava fruit is one of the fruits that are really loved by Indonesian, because of its sweet fruit flavor. Guava has been known to have good taste and aroma, rich in vitamin C content and has numerous health benefits which make this fruit popular with the community. Guava cultivars in Indonesia have various size and taste. Guava fruit types can be distinguished by shape, color, taste and nutritional content. 'Crystal' guava is one type of guava which is currently widely cultivated in Indonesia because it is very popular with the community. This type of guava has almost no seeds and has crispy flesh texture. 'Crystal' guava is a mutation of Muang Thai residue that entered Indonesia in 1991[1].

The 'Crystal' guava cultivation is very prospective to be developed commercially because it can produce fruit throughout the year and is potential as fruit for import substitution. Along with increasing public awareness of the importance of consuming fresh fruit for health, market demand for fresh fruit is expected to continue to increase. In addition, increasing population and increasing per capita income, it is estimated that the need for "Crystal" guava will continue to increase both at domestic and abroad. Increased growth, production, and quality of 'Crystal' guava can be done by pruning.

Pruning is required to stimulate the growth of productive shoots and eliminate unproductive shoots, or shoots that point inward, facilitate the plants' maintenance and form tree canopies (young plants) [2]. The success of 'Crystal' guava plants cultivation, one of which depends on good pruning [3], therefore the management of pruning needs to be studied for 'Crystal' guava plants development.

Research conducted by [4] showed that pruning on 'Crystal' guava plants (*Psidium guajava*) has resulted in the appearance of new buds and flowers so as to increase the number of fruits. Pruning with



8 pairs of leaves leaving produce fruit with slightly larger size than the fruits resulted from pruning of 4 pairs of leaves.

The aim of this study was to explain the relationship between different pruning times with flowering patterns of 'Crystal' guava plants (*Psidium guajava L.*).

2. Materials and Methods

The research was conducted at Leuwikopo Experimental Garden, Bogor Agricultural University Campus, Dramaga Bogor. This research was conducted from April 2017 to November 2017. The material used was 'Crystal' guava (*Psidium guajava L.*) which was ± 3.0 years old.

This study used Completely Randomized Design (CRD) with single-factor (pruning time) with 4 levels of treatment, namely without pruning, pruning in April 2017, pruning in May 2017, and pruning in June 2017. Pruning is carried out by leaving 6 pairs of leaves after the base of the stem [5]. There were 4 treatments, each experimental unit consisted of 2 'crystal' guava plants and the treatment was repeated 3 times so there were 24 experimental units.

Homogeneity of the inter-treatment variance was tested by Bartlett test and the data were tested by Tukey test. If the assumptions are fulfilled, the data collected are analyzed by the variety and followed by a test of the middle value with the smallest real difference at 5% level.

The implementation of this study began with the uniformity of 'Crystal' guava plants at 3.0 years of age and threshing the existing flowers and fruit, thus later they will have a uniform flowering and fruiting phase.

Pruning of leaves is carried out step by step according to the treatment level that has been determined by leaving 6 pairs of leaves from the base of the stem. Pruning of leaves is done by using pruning shears. During the study, observation of growth and development of plants from each population was carried out once every week (1x/week) until the 16th week of MSP.

The variables observed include the number of new shoots formed calculated using a hand counter; the time of flower appear was calculated since the first flower appears; the number of flowers was calculated as a whole using a hand counter; the amount of harvested fruits per tree was calculated using a hand counter; analysis of total leaf carbohydrates was measured by Somogyi-Nelson method ; and nitrogen analysis was measured using Kjeldahl method (William, 1984)[6].

3. Results and Discussion

Canopy pruning is one of the techniques for regulating plant growth. The pruning treatment on 'Crystal' guava plants can significantly increase the total number of shoots, although the difference in application time of pruning has no significant effect (Table 1). An increase in the total number of shots due to a 49% reduction compared to controls. This is consistent with previous research by [4] on red getas guava (getas merah guava) plants. It is assumed to be caused by weakening of the apical dominance due to pruning, thus inducing the growth of more lateral shoots [7].

Table 1 Effect of different pruning times application on the number of vegetative shoots, generative shoots and total shoots on 'Crystal' guava plants

Treatment	Vegetative Shoot	Generative Shoot	Total Shoots
Pruning in April	27.83b	46.33a	75.00a
Pruning in May	29.33b	57.00a	86.17a
Pruning in June	30.17b	46.00a	76.67a
Without pruning	45.67a	25.67b	53.17b

Description: the numbers followed by the same letters are not significantly different based on BNT at the level of 5%.

In addition to the total buds, pruning treatment can also increase generative shoot formation and at the same time reduce the number of vegetative shoots on 'Crystal' guava plants (Table 1). Nevertheless, there is no difference in the number of generative and vegetative shoots that are

significant between the application times of pruning. Compared to control, pruning significantly increased generative shoots by 94% and suppressed vegetative shoot formation by 36%. There is a dominance of generative growth compared to vegetative growth due to pruning treatment. This means that this trial is successful in the implementation of production pruning. Production pruning is pruning which aims to stimulate flowering by cutting branches that are less productive, the canopy that is too dense or thick [3]. Branches that are less productive, for example, are dead branches, stricken branches, or water sprouts that grow into the inside of the canopy. Too dense canopies also limit the exposure of sunlight, particularly the inner canopy. With production pruning, plants can receive more exposure of sunlight so that they can stimulate the growth of productive new shoots [8]. The higher number of productive branches, the higher amount of fruits will be produced.

Table 2 Effect of different pruning times application on leaf carbohydrates, leaf nitrogen and the ratio of C / N 'Crystal' guava leaves

Treatment	Leaf Carbohydrate (%)	Leaf Nitrogen (%)	The ratio of C/N Leaf
Pruning in April	10.26a	2.16b	5.76a
Pruning in May	10.24a	2.20b	4.65a
Pruning in June	10.22a	2.23b	4.59a
Without pruning	10.02b	2.62a	3.82b

Description: the numbers followed by the same letters are not significantly different based on BNT at the level of 5%.

The dominance of generative growth versus vegetative growth is also related to the ratio of C/N 'Crystal' guava plants leaves. The content of carbohydrates, nitrogen and the ratio of both do not show any significant difference at various times of pruning application. Nonetheless, in general, the pruning treatment significantly increases carbohydrate content and also decreases leaf nitrogen content, therefore the ratio of both is lower than the control (Table 2). The increase in carbohydrate content is assumed due to the increasing source capacity in photosynthesis. The growth of many shoots due to pruning certainly increases the number of leaves that the plant has. The new leaf acts as a productive source organ. The high C/N ratio is indeed a strong indicator of flowering plants success, for example in mangosteen, tangerine [9] and pamelito citrus [10].

Table 3 Effect of different pruning times application on the number of flowers, amount of fruits and fruit set of 'Crystal' guava plants

Treatment	Flowering time (day)	Number of flowers	Amount of Fruits	Fruit set (%)	Description: the numbers followed by the same letters are
Pruning in April	29.00b	118.30a	69.33a	60.23a	not significantly different based on BNT at the level of 5%.
Pruning in May	25.00b	138.70a	84.70a	60.03a	
Pruning in June	29.33b	113.33a	67.33a	60.89a	
Without pruning	38.67a	64.30b	37.00b	60.20a	

Flowering response of 'Crystal' guava plants increased significantly with the pruning treatment (Table 3). The number of flowers induced by pruning is significantly higher than the control, with a large average increase of 92%. Pruning can also increase the number of fruits almost doubling the number or 99% compared to controls. Fruit set percentage of 'Crystal' guava plants is not significantly affected by pruning treatment. Different pruning application time does not significantly affect the time of flower appears, the number of flowers, the amount of fruits and fruit set of 'Crystal' guava plant, although the pruning in May tends to show the best results compared to April and June.

A better flowering response due to pruning treatment is related to the total height of shoots and the dominance of generative shoots appearing. This is consistent with the results of the study conducted

by Fitria [5] which states that the number of shoots is strongly correlated with the number of flowers formed ($R^2 = 0.98$).

Pruning can accelerate the appearance of flowers 10-14 days earlier than controls. This is in accordance with the research conducted by [4] on red getas guava (getas merah guava) plants. Flowering that appears earlier is thought to be related to assimilates adequacy is fulfilled sooner in plants that are pruned due to an increase in plant source capacity.

Table 4 Effect of different pruning times application on the number of fruits and weight of 'Crystal' guava fruit

Treatment	t of fruits	Fruit weight (gram)
Pruning in April	28.83a	227.24a
Pruning in May	30.33a	223.90a
Pruning in June	27.16a	225.44a
Without pruning	22.00b	230.21a

Description: the numbers followed by the same letters are not significantly different based on BNT at the level of 5%.

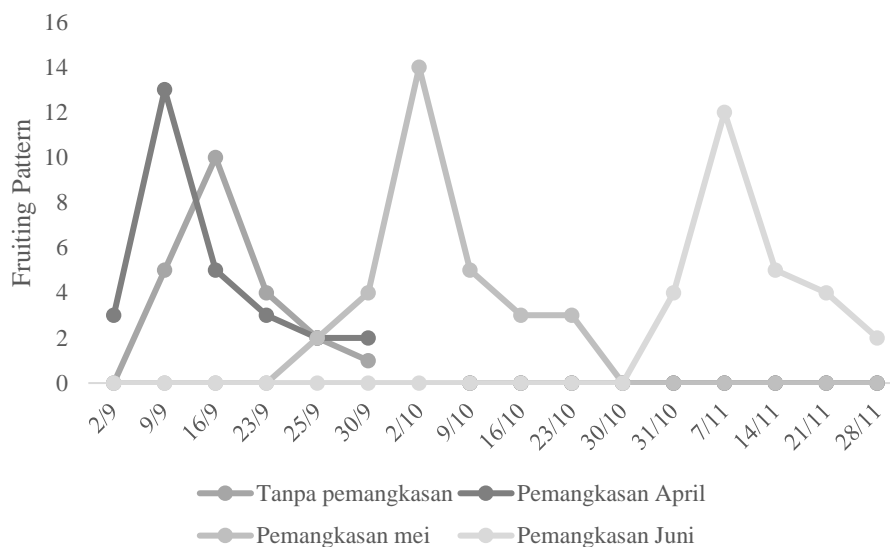


Figure 1 The fruiting pattern of 'Crystal' guava at different pruning times application treatment

In addition to the increase in the number of flowers, there was a significant increase in the number of fruit on 'Crystal' guava plants due to pruning treatment (Table 4). In general, the number of fruits increased by 8% due to pruning treatment compared to controls. The time difference in pruning application is more dominant in shifting the peak harvest of 'Crystal' guava fruits (Figure 1). Crops with pruning treatment at April had the highest number of fruits in September, as well as control plants. However, both are clearly different in terms of the amount of harvested fruit, namely April pruning as many as 13 pieces, while the control was 10 pieces. Pruning applied in May had the highest number of fruits in October as many as 14 pieces, while the pruning in June, the highest number of fruits in November, was 12.

Improvement of flowering and fruiting response due to pruning treatment on 'Crystal' guava plants in accordance with the results of previous studies conducted by [5]. This was allegedly related to increased plant source capacity and the decrease in photosynthetic competition among sinking organs in pruned plants. The number of sink organs and the availability of source organs greatly affects the allocation of carbohydrates from source to sink [11].

In guava plants, bud buds, young leaves that are actively growing, negative leaves (shaded) or fruit act as organ sinks that require photosynthate intake from the organ source, which is productive adult

leaves. The level of competition becomes lower if the sink in the form of buds or young leaves is reduced. Canopy pruning is one way to reduce the growing point on the lateral part which requires the supply of assimilating and nutrients, thus the competition for the supply of assimilates and nutrients is reduced, the sink organ in the form of fruit gets more adequate supply [11].

The quality of 'Crystal' guava fruit can also be assessed chemically based on the ratio of total dissolved solids (TDS) and total titrated acid (TTA). TDS and TTA are two important variables that determine the quality of fruit flavor. TDS is a measure of sugar and carbohydrate content in fruit juice, therefore the higher the TDS value, the fruit tends to get sweeter. On the other hand, TTA is a measure of the acid content in fruit juice, thus the higher the TTA value, the fruit tends to be more acidic. This is consistent with the results of [12] study which states that a high TDS/TTA ratio is associated with a better taste of tangerine citrus fruit.

Table 5 Effect of different pruning times application on the chemical quality of 'Crystal' guava fruit

Treatment	TDS (° brix)	TTA (%)	The ratio of TDS/TTA
Pruning in April	8.83a	0.22a	40.54a
Pruning in May	8.91a	0.23a	40.04a
Pruning in June	8.76a	0.24a	37.26a
Without pruning	8.20a	0.22a	31.19a

Description: the numbers followed by the same letters are not significantly different based on BNT at the level of 5%.

The results of this experiment showed that there were no significant differences in the TDS, TTA and TDS/TTS ratio of 'Crystal' guava fruits related to the time differences in pruning application (Table 5). The TDS and TTA value of fruit are influenced by the stage of fruit maturity [13, 14]. According to [15] during the process of fruit ripening, the process of starch hydrolysis into sugars results in increased fruit dissolved solids content, whereas acid levels decrease. The occurrence of a decrease in total acid during the fruit ripening process can be due to organic acids are used as energy in the process of fruit respiration [16]

4. Conclusion

Pruning has been proven to improve and regulate flowering and harvest of 'Crystal' guava fruit. This was supported by the high ratio of C/N plant leaves that were pruned compared to controls. When compared with the control, canopy pruning on 'Crystal' guava plants can increase the total shoots by 49%, generative shoots by 94%, the number of flowers 92%, the number of fruits 99%, the appearance of flowers up to 14 days earlier and the number of fruits 8%. Pruning can also reduce the growth of vegetative shoots by 36%. The time differences in pruning applications in April, May, and June can shift the harvest peak. There is no difference in the chemical quality of fruit, in terms of TDS, TTA and the ratio of both of them related to pruning treatment.

5. References

- [1] Rahmat P 2011 *21 Jenis Tabulampot Populer* (Jakarta: PT. Agro Media Pustaka)
- [2] H. A. Sahar AF 2014 Effect of pruning on yield and fruit quality of guava tress," *IOSR J Agric Veterin Sci.* **7** 12 41–44
- [3] Balai Penelitian Tanaman Tropika (Balitbu) 2015 *Budidaya Jambu Biji Holtikultura Litbang* <http://hortikultura.litbang.pertanian.go.id/downloads/budidayajambubiji.pdf>
- [4] Susanto A 2013 Respon pertumbuhan dan hasil tanaman jambi biji getas merah terhadap pemberian campuran pupuk kandang dan NPK serta pemangkasan Universitas Jendral Soedirman
- [5] Fitria L 2016 Kajian pertumbuhan, produksi dan kualitas jambu biji (*Psidium guajava* L.) var. kristal pada asal bibit dan pemangkasan berbeda *tesis*
- [6] William S 1984 *Official methods of analysis of the association of official analytical chemist. 14th. Ed. Assoc. Off Anal. Chem. Inc. Va.* 16-17

- [7] Hidayati Y 2009 Kadar hormon auksin pada tanaman kenaf (*Hebiscus cannabinus* L.) bercabang dan tidak bercabang *J Agrivigor*. **2** 2 1979–5777
- [8] W. M. Lauri PE, Sinoquet H 2004 Light interception in apple trees influenced by canopy architecture manipulation *Tress* **18** 705–713
- [9] Darmawan M 2014 Induksi pembungaan diluar musim pada tanaman jeruk keprok (*Citrus reticulata*) *Institut Pertanian Bogor*
- [10] S. S. Minten S & Mursyada A Pengaruh strangulasi terhadap pembungaan jeruk besar (*Citrus grandis* (L.) Osbeck) kultivar Nambang *J. Agrotropika*. **7** 1 34–37
- [11] Susanto S & Pribadi EM 2004 Pengaruh pemangkasan cabang dan penjarangan bunga jantan terhadap pertumbuhan dan produksi gherkin dengan budidaya hidroponik *Bul. Agron*. **32** 1 1–5
- [12] Kays SJ 1991 Postharvest Physiology of Perishable Plant Products,” *Van Nostrand Reinhold*. New York (US)
- [13] H. N. Suketi K & Poerwanto R 2011 Degreening buah jeruk siam (*Citrus nobilis*) pada berbagai konsentrasi dan durasi pemaparan etilen *J Hort Indones*. **7** 2 111–120
- [14] D. D. Bakshi P, Gupta M, Wali VK, Kumar R, Hazarika TK & Kher D 2017 Biochemical changes in guajava (*Psidium guajava*) fruits during different stages of ripening *India J. Agric. Sci*. **87** 2 257–260
- [15] Yahia EM, Jiang Y & Sivakumar D 2011 Maintaining mango (*Mangifera indica* L.) fruit quality during the chain *Food Res. Int*. **44** 1254–1263
- [16] S. F. marpaung AE & Hutabarat Rc 2007 Pengaruh sistem lanjaran dan tingkat kematangan buah terhadap mutu markisa asam *J. Hort*. **17** 1 43–51