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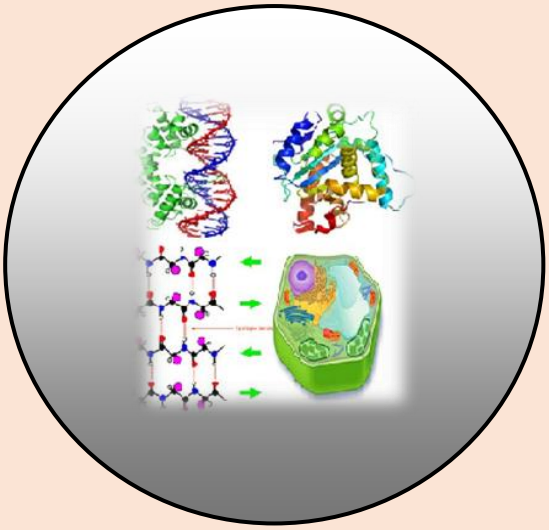

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Fenology of the Revenue of Siam Orange Plants at the time of the Function Phases in the Period

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ABSTRACT

This study aims to determine the period of development of leaf sprouting, in order to determine the different phases of the stages of growth and development of Siam citrus plants. Shoots are produced from the results of vegetative plant breeding, ie without going through the marriage process because it comes from one parent. The critical point of growth and development of Siamese citrus plants is largely determined by the formation of prospective primodia shoots, one of which is determined by nutritional factors in plants. As well as environmental factors. The study was conducted from Mart 2017 to September 2018, in Seming Village, Kerta District, Giayar Regency, Bali Province. The research is descriptive so that no special treatment is given to the sample. research carried out by descriptive method, namely continuous research so as to obtain comprehensive knowledge about the problem of tropical fruit horticulture, especially Siamese citrus fruit, so that the science of physiological reproduction order to obtain fruit harvest. The orange varieties used in this study were Siamese orange varieties which were 6 years old. The number of samples observed were 10 plants with observations on the period of bud formation by observing every two days, the percentage of leaf shoots, the period of growth of leaf buds, and observations on carbohydrate and chlorophyll content of leaves and KAR leaves. There are 4 stages of the growth period, namely 1). Early engagement, 2), full engagement, 3) adult engagement and 4) maturity dormancy period. The time needed for the development of shoots does not have a significant difference between the on-season and off-season periods, but between periods of growth phases there is a very significant difference, where each time is needed for the off-season period as long as 217.13 day and on-season period for 193.00 days, this is due to the presence of less water content during the off-season period.
Key words: Early shoots, Full buds, Adult shoots and Dormant shoots.

INTRODUCTION

Plant phenology is the science of the periods of phases occurring naturally in plants. The ongoing period is strongly influenced by the state of the surrounding environment such as the duration of irradiation, air temperature, air humidity (Feewlees, 2006). The penology phase of the period of the growth of a type of plant is one character is very important for the life cycle or development of plants, because in that period an initial process occurs for a plant that will multiply. Between species one another has different behaviors in the pattern of the period of the growth phase. But initially it starts from the emergence of a period of appearance of primodia buds, and subsequently develops from flower induction, flowering, *fruit-set* formation to physiological ripe fruit (Tabla and Vargas, 2014).

Morphologically flowering is the occurrence of a change from the vegetative phase to the formation of flower organs, where flowering is a very complex event. The success of plants transitioning from the vegetative phase to the reproductive phase depends on the ability of plants to induce interest (1999, Koshita*et al*., 2009). Flowering induction is a process where stimulation occurs from the outside to the point of growth and it induces flower primordial (Hempel *et al.,* 2000). Reproductions linkage or the growth and development of shoots in plants in order to be able to occur according to flowering (Rai, 2010), leaves must be able to produce flowering supporting substances needed by the apex or inhibitor of inhibitor production. Likewise the ability of the apex to receive a response and receive enough flowering stimulus and stop receiving inhibitors from any part of the plant and then proceed to flower organ formation in the appropriate order. Therefore the length of the juvenile period depends not only on the inability of the leaves to produce flowering stimuli, but also depends on the inability of the apex to receive the stimulus. Physiologically the flowering process is the occurrence of a change from the vegetative phase to the formation of flower organs, where flowering is a very complex event. The success of plants transitioning from the vegetative phase to the reproductive phase depends on the ability of plants to induce interest (Reddy *et al*., 2014). The flowering process experienced by Siam oranges is an interaction, influencing two major factors, namely external and internal factors. Naturally Siamese oranges flower between November and December. Eight to nine months after flowering oranges can be harvested, between July and August which is the peak of the Siamese orange harvest. As per the natural phenology of Siamese oranges in December to July there is a scarcity of Siam citrus fruit production (Purnamasari, 2010). The import volume can be said to be still high, in 2013 Indonesia is the second largest citrus supplier after Malaysia (BPS, 2014), therefore Indonesia must increase the production of fresh orange. As for the fulfillment of the needs of fresh citrus fruits, this is due to uneven harvesting of fruits (seasonal) due to endogenous and exogenous influences (Gene, 2007), where Siamese citrus plants are cultivated and quality is also low. Besides being seasonal, one of the problems faced in the development of Siamese agribusiness is that when the harvest season arrives, the harvest period is relatively very short and at the same time as the harvest of other topics, this will cause the price of citrus fruit to decline left it will have an impact on farmers, who will experience difficulties in marketing Siamese citrus fruits. The impact is very detrimental to farmers in every harvest season, because farmers will sell their oranges at very cheap prices. To overcome these problems, it is necessary to determine the marketing strategy by working on the sustainability of the results of each season throughout the year by arranging plantations to produce interest by manipulating cultivation technology. If the orange plant does not produce fruit together, then strategic marketing will be easy to run. To do this, there is a need for basic information about the periods of Siam orange leaf growth phases. Based on these problems, it is necessary to do research that aims to determine the period of leaf growth phases in order to get the desired flowering on Siam citrus plants.

MATERIAL AND METHODS

Place and time

The study was conducted in Blancan Village, Kintamani District, Bangli Regency from March 1917 to September 2018.

Materials and tools

The citrus plants studied were those that were 10 years old, as many as 10 plants from the vast expanse of farms owned by farmers. Citrus plants have been kept in accordance with farmers' cultivation methods, which are in accordance with the actual conditions in the field. The way of cultivating farmers is that plants are fertilized with organic fertilizers and irrigation only from rainfall. Routine maintenance is only in the form of eradicating fungal diseases on the bark of citrus plants by using Alika disease prevention ingredients with a dose of 1-2 ml / liter of water and for prevention of pests, Syngenta is usually used at a dose of 0.2 - 0.4 ml / liter of water, cleaning weeds around the tree, and pruning the dried branches, the branches are burned and then immersed.

Research Procedures

The implementation was carried out in the field on 10 citrus plants randomly taken from 36 plants which were used as research.

Research Methods

Using a descriptive method on an ongoing basis, where research is carried out continuously or continuously so that a thorough knowledge of leaf phenomena is obtained so that it will produce knowledge about the growth of Siam citrus leaves in order to obtain fruit sustainably. This study does not use certain treatments, only focused on the description of the development of leaf growth on Siam citrus plants.

Variables Observed

Observations in the field are leaf sprouting, the observed flower growth includes: Periods starting from the appearance of shoots / shoots until the appearance of the first flower candidates Morphological observations of shoots / shoots are carried out visually to see leaf color changes then documented with photographic tools, and laboratory observations look for carbohydrate content (Apriantono, 1994), and KAR leaves on Siam citrus plant.

RESULTS AND DISCUSSION

Table 1. Average stage growth period (P) with shoot type at (T) in Siam citrus plants.

1. Variable	period of bud development	
	P_1	P_0 [1)]
Dormant to early shoot (day)	72,51 a	65,56 a [2)]
early shoots to full shoot (day)	36.55 b	35,14 b
full shoots to adult shoots (days)	68,13 b	58,14 b
Adult shoots to dormant shoots (days)	49,12 b	34,16 b
BNT:	6,32	7.34,
Difference in the timing of shoot top growth	217,31 a	193,00 a
T Count< T table 1,191 <2,451912		

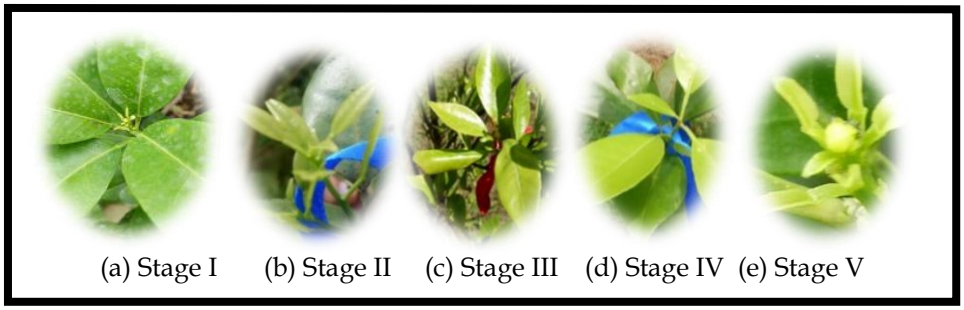
Explanation

1). The shoot growth period on Siamese citrus plants takes a long time to be needed faster in the *on-season* period (P_0) than in the *off-season* period (P_1).

2). The numbers followed by the same letters in the column show the effect that is not significant at the 5% level with the 5% BNT test.

The results of statistical analysis between the *on-season* and *off-season* periods were not significantly different during the development of shoots on Siamese citrus plants, however, in the *off-season* period it took longer than the *on-season* period, respectively: 217 , 31 days and 193.00 days (Table 3.1). At each shoot stage the time needed for shoot changes showed a noticeable difference, the longest time needed was a dormant shoot to the initial shoot for 72.51 days, from the initial shoot to full shoots 36.55 days, from full to adult shoots for 68 , 13 days, from adult shoots to dormant shoots for 40.712 days in the *off-season* period, while the phases of budding development phases in on-season grow faster, namely: dormant shoots to the initial shoots for 65.56 days, from the initial shoots to full shoot 35.14 days, from full to adult shoots for 58.14 days, from adult shoots to dormant shoots for 34.16 days (Table 3.1). The results of growth analysis from dormant shoots to the initial shoots, there were significant differences both in the *off-season* period and in the *on-season* period, but in the development of full shoots to adult shoots, from adult shoots to dormant shoots did not show a significant effect, in the period on-*season* and *off-season*, but it appears that the time needed for the emergence of each in the *off-season* period takes longer than the *on-season* period (Table 3.1).

Development of Siam Citrus Plant Periods: Observations on the development of the growth phases of the Siam citrus plants morphologically starting from the occurrence of dormant shoots to primordial emergence of the development of shoots / plush leaves on Siam citrus plants (stage I), the color of the leaves is dark old becomes primordial buds whose color is very transparent and then the initial shoot development in stage II here has begun to develop leaves from plush until the leaf size of 1.05 cm has begun to develop, then the third stage of adult shoots, and finally the bud development is full shoot and this development has begun to change which cannot be detected by naked eye, but after the induction of flowers can only be detected starting the appearance of flower buds (Figure 3.1).



(a) Stage I (b) Stage II (c) Stage III (d) Stage IV (e) Stage V

Explanation
(a) Dormant shoots, (b) Early shoots, (c) Adult shoots, (d) Full shoots, (e) Flower induction

Figure 3.1. Stages of development of Siam orange shoots.

The Role of Endogenous in the Development of the Growth of Siamese Citrus Plants

Table 2. Significance of the effect of the growth period (P) and the growth phases (T) of plants Siam orange.

No	Variable	Observations		
		P [1)]	T [2)]	P x T [3)]
1	Observation total leaf sugar content (%)	*	**	**[4)]
2	Leaves reducing sugar content (%)	*	**	**
3	Leaves sucrose content (%)	**	ns	**
4	Clorophyll leaf content (*SPAD*)	ns	**	**
5	Relative leaf wáter content (%	**	*	**

Explanation:
1) P = Shoot growth
2) T = Phases of bud development
3) P x T = Interaction shoot growth with phases of bud development
4) **= Very teal effect (P<0,05)
* = Have a real effect (P<0,01)
ns = no realeffect (P ≥0,05).

The results of statistical analysis between the on-season and *off-season* periods were not significantly different during the development of shoots on Siam citrus plants, however, in the *off-season* period it took longer than the *on-season* period, respectively: 217, 31 days and 193.00 days (Table 3.1). At each shoot stage the time needed for shoot changes showed a noticeable difference, the longest time needed was a dormant shoot to the initial shoot for 72.51 days, from the initial shoot to full shoots 36.55 days, from full to adult shoots for 68 , 13 days, from adult shoots to dormant shoots for 40.712 days in the off-season period, while the phases of budding development phases in on-season grow faster, namely: dormant shoots to the initial shoots for 65.56 days, from the initial shoots to full shoot 35.14 days, from full to adult shoots for 58.14 days, from adult shoots to dormant shoots for 34.16 days (Table 3.1). The results of growth analysis from dormant shoots to the initial shoots, there were significant differences both in the *off-season* period and in the *on-season* period, but in the development of full shoots to adult shoots, from adult shoots to dormant shoots did not show a significant effect, in the period on-season and *off-season*, but it appears that the time needed for the emergence of each in the *off-season* period takes longer than the on-season period (Table 3.1).

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in stage I the color of the leaves is dark old becomes primordial buds whose color is very transparent and then the initial shoot development in stage II here has begun to develop leaves from plush until the leaf size of 1.05 cm has begun to develop, then the third stage of adult shoots, and finally the bud development is full shoot and this development has begun to change which cannot be detected by naked eye, but after the induction of flowers can only be detected starting the appearance of flower buds (Fig.3.1).

Total leaf sugar content, Leaves reducing sugar content and Leaves sucrose content

From the results of statistical analysis shows that there is a very real interaction with the total leaf sugar content (%), reducing sugar content (%), sucrose content (%), chlorophyll content (*SPAD*), and relative leaf water content (%).

When seen in the phases of development of shoots, adult shoots of total sugar content, redusk sugar and leaf sucrose with values of 14.02%, 12.02% and 3.88% were significantly lower than total sugar, reducing sugar and leaf sucrose in the adult bud phase, shoot awa; namely 18.23%, 13.98% and 4.25%, respectively (Table 3.4). This suggests flowering in Siamese citrus plants requires total sugar, reduced sugar, and higher sucrose leaves for the flowering development process.

Table 3. Interaction between the growth period and the developmental phases of buds to the total leaf sugar content (%) in Siam citrus plants.

Tipe of shoot (P)[1)]	Phase of bud development (T)			
	T_1	T_2	T_3	T_4
P_0	17,58 a	18,83 a	34,07 a	24,54 a [2)]
P_1	13,41 a	17,63 a	23,03 a	23,03 a ab
BNT	1,76			

Information:

1). P_0 = *On-season* period, P_1 = *Off-season* period, T_1 = dormant shoots, T_2 = shoots beginning, T_3= full shoot, T_4= adult buds

2). The number followed by the same letter in the same variable shows no significant effect on the 5% BNT test.

Table 4. Interaction between the growth period and the developmental phases of buds to the reducing sugar content (%) in Siam citrus plants.

Tipe of shoot (P)[1)]	Phase of bud development (T)			
	T_1	T_2	T_3	T_4
P_0	12,88 a	14,33 a	14,33 a	16,04 a [2)]
P_1	11,16 b	14,63 b	14,03 b	13,00 b
BNT	1,60			

Explanation:

1). P_0 = *On-season* period, P_1 = *Off-season* period, T_1 = dormant shoots, T_2= shoot beginning, T_3= full shoot, T_4= adult buds

2). The number followed by the same letter in the same variable shows no significant effect on the 5% BNT test.

Table 5. Interaction between the growth period and the developmental phases of buds to the Sucrose content (%) in Siam citrus plants.

Tipe of shoot (P)[1)]	Phase of bud development (T)			
	T_1	T_2	T_3	T_4
P_0	12,88 a	14,33 a	14,33 a	16,04 a [2)]
P_1	11,16 a	14,63 a	14,03 a	13,00 a ab
BNT	1,60			

Explanation:
1). P_0 = On-season period, P_1 = Off-season period, T_1 = dormant shoots, T_2= shoot beginning, T_3= full shoot, T_4= adult buds
2). The number followed by the same letter in the same variable shows no significant effect on the 5% BNT test.
The highest variable of leaf sucrose content was obtained in the combination of on-season period with adult shoots / shoots with their respective values of 16.04% and the lowest obtained in the combination of off-season periods with dormant shoots / shoots only 11.16% (Table 3.5).

Leaf Chlorophyll and Relative Moisture Content of Leaves
The interaction between shoots with the highest growth period in the variable relative water content of leaves is 0.87% / tree and the lowest obtained in combination on-season period in the development phase of dormant shoots is only 0.07% / tree. (Table 3.6).

Table 6. The interaction between the growth period and the growth phases of shoots / shoots against the relative moisture content of leaves (%) in Siamese citrus plant.

Tipe of shoot (P)[1)]	Phase of bud development (T)			
	T_0	T_1	T_2	T_3
P_0	0,87 a	0,65 a	0,29 a	0,80 a [2)]
P_1	0,07 a	0,07 a	0,07 a	0,25 ab
BNT	0,31			

Information:
1). P_0 = On-season period, P_1 = Off-season period, T_1 = dormant shoots, T_2= shoot beginning, T_3= full shoot, T_4= adult buds.
2). The number followed by the same letter in the same variable shows no significant effect on the 5% BNT test.

Table 3.7 shows the highest leaf chlorophyll content obtained shoots at the flower development phase before induction i.e. 53.66 SPAD and the lowest at shoots not flowering in the development phase flower bloom which is 5.75 SPAD. The high water content shown in the on-season period in combination with the developmental phases of adult shoots or shoots is also seen in the leaf chlorophyll content contained in these periods and phases. This proves that plants in performing the physiology of the development of shoots or shoots really need water when the growth occurs. This is in accordance with the opinion of Tabla and Vargas (2004), a plant will have different behaviors in carrying out its physiological process, but in general it will start from the appearance of shoots or shoots on plants, and this is very closely related to the environment around which plants cultivated. One such environment is a microclimate such as rainfall.

Table 7. The interaction between the growth period and the growth phases of shoots against leaf chlorophyll (SPAD) content in Siam citrus plants.

Tipep of shoot (P)[1)]	Phase of bud development (T)			
	T_0	T_1	T_2	T_3
P_0	0,87 a	0,65 a	0,29 a	0,80 a [2)]
P_1	0,07 a	0,07 a	0,07 a	0,25ab
BNT	3,09			

Explanation:
1). P_0 = On-season period, P_1 = Off-season period, T_1 = dormant shoots, T_2= shoot beginning, T_3= full shoot, T_4= adult buds
2). The number followed by the same letter in the same variable shows no significant effect on the 5% BNT test.

Table 8. Average rainfall and humidity in the research location of Blancan Village, Kintamani.

Climate Micro	2014-2015											
	Ma	Ap	M e	Jun	Jul	Au	Se	Ok	No	De	Jan	Feb
Humidity	77	76	7 4	72	61	70	65	70	68	65	67	70
Rainfall	201	69	3 4	18	8	4	5	102	145	212	208	202
Rainy Day	30	12	9	5	1	0	1	23	20	10	25	29

Station BMKG Blancan Village, Kintamani

The ongoing period of shoot growth or shoots on fruit plants is highly influenced by endogenous plants, besides being supported by the surrounding environment such as one of them is rainfall (Feewless, 2006) where the fruit plants are cultivated. Phenology stage of the growth of a type of fruit plant is one of the natural processes that must be passed perfectly, and is an important character in the activities of physiological processes of growth and development, because the process of growth or shoot development is the initial process that will determine the next growth.

CONCLUSION AND SUGGESTIONS

The growth period of Siam shoot buds in Blancan Village, Kintamani is strongly influenced by the endogenous content contained in the leaves of Siamese citrus plants, this is shown by the high carbohydrate content and leaf water content shown in the stages of shoot development in the *on-season* period when the plants experience growth. There are differences in budding development in the on-season period with off-season in Blancan Village where in the *off-season* period it takes a longer time for 24.31 days, this is related to the high relative water content of the leaves.

Suggestions

To get the maximum development of Siam citrus plants in the context of flowering induction, it is necessary to do regular watering during the dry seasons.

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REFERENCES

Apriantono, A., D. Fardias, N.L. Puspitasari, Sedarnawati and S. Budiyanto (1994). Petunjuk Laboratorium Analisis Pangan. Institut Pertanian Bogor, Fakultas Teknologi Pertanian.

Badan Pusat Statistik (2014). Data eksporee. G. 2006. Denim pormenurutkomoditas. http//bps.go.id. Diaksespada 4 marett 2017.

Feewless, G. (2006). *Phenology*. Diunduj 3 Mei 3019. (http://www.uwgbedu/biodiversity/Phenology.indexhtm.

Gene, A.J. and I.L. (Valiente) 2007. Flower Bud Induction of Sweet Orange Trees (Citrus sinensis (L) Osbeck Effect of low temperatures, Croop Load Bud age. Horticultural science university of Florida FAS citrus Research and Education Center 700 Experiment Station Road Coke Apred FL 33850.

Hempel, F.D.R., Welch and L.J. Fieldman (2000). Floral Induction and Determination Where is Flowering Controlled ?. *Trends in Plant Science* 5(1):17-21.

Purnamasari, I.A. (2010). Analysis of citrus marketing in Bangli Regency [thesis]. Surakarta (ID): Universitas Sebelas. www.epository.ipb.ac.id/jspui/bitstream/ 123456789/77632/1/A15mra.pdf Retrieved on March 4, 2017.

Rai, I N., Semarajaya, C.G.A. and dan Wiraatmaja, I.W. (2010). Studi Fenofisiologi Salak Gula Pasir Sebagai Upaya Mengatasi Kegagalan Fruit-set dan Memproduksi Buah di Luar Musim. *J. Hort.*

Reddy, Y.N. and Bagwan (2014). Induction of Flowering in Fruits Crop-Physiological and Plant Architectural Implications. The Society for Development of Subtropical Horticulture (SDSH) Central Intitute for Subtropical Horticulture (ICAR) Rhemankhera, Lucknow – 226 101, Uttar Pradesh. hal 24 – 47.

Tabla, V.P. and C.F Vargas (2004). Phenology and Phenotipic natural selection on the flowering time of a deceit pollinated tropical orchid Myrmecophilachris. *Annals of Botani*, 94(2): 243-250. diunduh 5 Mei diunduh 23 Mei 2019. http://aob.oxfordjournals.org/cgi/content/full/94/2/

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