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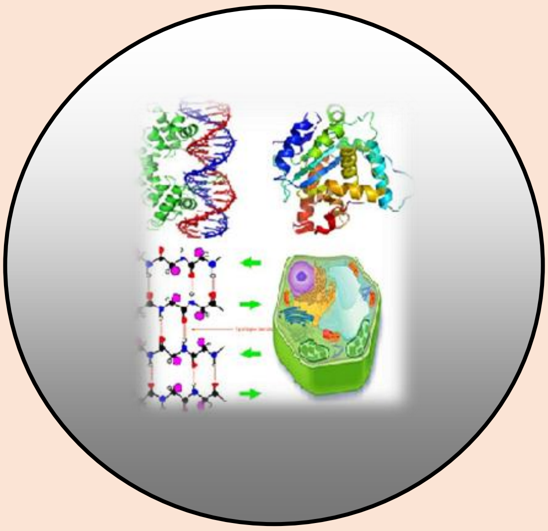

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RESEARCH PAPER

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The Role of Gypsum and KNO_3 of Oder to Induce Flowering in Citrus Plants

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ABSTRACT

Keprok citrus plant (Citrus reticula. L) is a fruit plant that can grow in tropical and sub-tropical tangerines that are very popular in the world. Citrus plants have the nature of seasonal flowering so that it has an impact on the fruit production fluctuation. Efforts to stimulate flowering until the occurrence of fruit can be done by administering growth regulators (ZPT) and administering different doses of gypsum. This study used a randomized block design consisting of 2 factors arranged factorially and repeated three times. The first factor is gypsum dose and the second factor is the type of growth regulator. The results showed that the treatment of 700 grams of gypsum dose per tree showed the fastest flowering time of 215,23 HSP significantly different from the treatment of 350 grams of gypsum per tree namely: 266,17 (HSP) and treatment without gypsum takes the longest time to start flowering, that is: 293,17 (HSP). the KNO3 treatment 2 ml per l liter water per tree showed the fastest flowering time per tree at 218,00 (HSP), significantly different from the KNO_3 treatment 1.5 ml per l liter water per tree with a value 226,33 (HSP),different from the KNO_3 treatment 1 ml per l liter water per tree with a value 262,78 (HSP),and in the treatment without KNO_3 requires the longest time, namely: 295,52 (HSP). The highest number of flowers formed per tree was obtained at a combination of 700 grams of gypsum treatment per tree and the concentration of KNO_3 2 ml per 1 liter of water per tree with a value of 205.00 floret /tree and significantly different from the number of flowers formed per tree obtained at the combination treatment without gypsum and without KNO_3 (0 ml per 1 liter of water) with a value of only 112.33 buds/tree so that seeing the condition dose gypsum 700 g in combination with a concentration of 6 ml per 1 liter of wateris able to produce a higher number of flowers formed/trees 82.80% compared to the number of flowers formed per tree achieved by control.
Key word: Flower, Gypsum, fall, KNO_3 and Dan bloom.

INTRODUCTION

Keprok orange is the most popular fruit commodity in the world, after grapes. Based on the average production, there are five centers of orange production in Indonesia, Bali is one of them. Regencies that are the centers of citrus production in Bali include Jembrana, Tabanan, Badung, Gianyar, Klungkung, Karangasem, Buleleng, and Bangli Regencies. Keprok orange is the most popular fruit commodity in the world, after grapes. Based on the average production, there are five centers of orange production in Indonesia, Bali is one of them. Regencies that are the centers of citrus production in Bali include Jembrana, Tabanan, Badung, Gianyar, Klungkung, Karangasem, Buleleng, and Bangli Regencies. Kintamani tangerine plants in the Province of Bali are in the region of Bangli Regency (Suryana *et al*. 2005). Bangli Regency is the region with the highest citrus production in Propins Bali, which is 119,030 tons per year. The national citrus production in 2013 amounted to 1,548,401 which could not meet the needs of oranges in Indonesia, this was evidenced by the volume of citrus fruit imports which reached 2,594,825 tons in December 2013 (Statistics Indonesia 2014).

The import volume can be said to be still high, therefore Indonesia needs to increase the production of fresh oranges. Meeting the needs of conjoined oranges is still difficult, this is caused by uneven (seasonal) harvests. September to October is the development of the vegetative phase of citrus (Stuckens *et al.*, 2011).

Sulistiawati, 2019 from the results of research conducted, naturally the Siamese orange flowering between November to December. Eight to nine months after flowering oranges can already bear fruit and can be harvested, between July to August which is the peak harvest of Siamese oranges. As per the natural phenology of Siamese from December to July, there is a scarcity of citrus fruit production in Bali.

Flowering on citrus plants generally often experience problems, because it requires special conditions to be able to flower and bear fruit. Flowering in fruit trees is a very complex process that includes many stages of development (Reddy et al., 2014). The flowering process experienced by the Siam orange is an interaction, the influence of two major factors, namely external and internal factors. Naturally Siam fruit blooms between November to December. Eight to nine months after flowering, oranges can be harvested, between July and August which is the peak harvest of Siamese oranges. According to the natural phenology of Siamese in September to June, there is a shortage of production (Purnamasari, 2010).

The addition of growth regulators (PGR) is often done to optimize vegetative growth and reproductive growth. Gibberellins, Paclobutrazol and KNO_3 are types of plant hormones that can accelerate the growth and flowering of Jatropha plants Agus *et al.*, 2013).

Flowering induction aims to regulate the simultaneous process of flowering and fruiting of Jatropha plants, so that in every stretch of Jatropha planting there are planting blocks that are ready for use with uniform fruit maturity and do not need to harvest by selecting those that are economically less profitable and resulting in expensive harvest costs. (Arshaf *et al.*, 2013).

Gypsum is one of the non-metallic minerals, gypsum consists of calcium sulphate dihydrate (CaSO4.2H2O). An example of a mineral that is evaporated with calcium levels that dominate the minerals. The most common gypsum found is a type of calcium sulfate hydrate with the chemical formula CaSO4.2H2O. This is the guideline for reducing the yellow sap in the mangosteen fruit caused by rupture of the yellow gum channel due to weak cell wall structure (Rai *et al.*, 2006).

Based on the phenomenon of the harvest season of tangerines that are not very bad throughout the year, because it causes a surge in prices when the fruit is few and falls in price when the fruit is large.

One of the problems can be overcome by controlling the pattern of production of tangerines. Flowering arrangements out of season can extend or shorten the fruiting period so that there is no significant production fluctuation. Flowering induction can be done by treating water stress, controlling nutrition (Astiari, et al) lighting time, and low temperature, Purnomo (2013), induction of flowering plants can be done by reducing endogenous gibberellins levels in sugar palm snakefruit plants (Rai *et al.*, 2010). According to (Nishikawa *et al*, 2012) one of the stimulants such as gibberellic acid prevents the induction of flowering in oranges during the flowering period

MATERIALS AND METHODS

Research Place and Time

The study was conducted in Banjar Seming, Kerta Village, Payangan District, Gianyar Regency, Bali, which is a center for citrus production, starting in 2018. The research was conducted in the field and the Agricultural Product Technology laboratory of the Udayana University Faculty of Agriculture and the Faculty of Agriculture, Warmadewa University.

Research design

Sub-study II in this study used a Randomized Block Design with a simple allocation using a dose of Gypsum (G) with 3 levels of treatment. AndKNO3, (K) 4 standard of care.

G_0= 0 gram/treeK_0= 0 ml/1 liter of water/tree

G_1= 350 gram/treeK_1= 1 ml/1 liter uf water/tree

G_2= 700 gram/treeK_2= 1,5 ml/ 1 liter of water/tree

K_3= 2 ml/ 1 litter of water/tree

Variables Observed

Variables observed in this study include:

1. Number of flowers blooming per tree,
2. Time of flowering, length of flowering period, number of young shoots per tree and number of deciduous flowers per tree. Cumulatively calculated by counti.
3. The number of flowers that appear on the sample plant branches per tree. Calculated starting after the application of the treatment to stimulate flowering until the first flower appears (HSP).
4. Number of flowers formed per tree on Siam citrus plants.
5. Relative water content of leaves.
6. Chlorophyll content of leaves

Data Analysis

Observation data were tabulated, then analyzed statistically using analysis of variance in accordance with the design used. First the diversity test is carried out in order to obtain diversity. If the treatment has a significant effect, then it is further analyzed to look for a single effect of each factor by a LSD test of 5% and 1%.

RESULTS AND DISCUSSION

Statistical analysis was significant that the interaction between gypsum and KNO_3 (GxK) had no significant effect (P≥0.05) on most of the observed variables, except for the variable number of blooms per tree, the number of flowers formed per tree.

Table 1. Significance of the effects of gypsum (G) and KNO_3 (K) and interaksin (GxK) treatment of the variables observed in the formation of tangerines.

No	Variable	Treatment		
		Gypsum	KNO3	Interaction
		(G)	(K)	(G x K)
1	time starts to flower	**	**	ns
2	Length of flowering / tree period (days)	**	*	ns
3	Number of young shoots formed (strands)	**	**	ns
4	Number of flowers formed / tree (florets)	**	**	ns
5	Number of flowers in bloom / tree(florets)	ns	**	*
6	Number of deciduous flowers/ trees (florets)	ns	ns	ns
7	Relative leaf rate (%	**	*	ns
8	Leaf chlorophyll content (SPAD)	**	**	ns

Keterangan: * = have a real impact (P<0,05)
** = very real effect (P<0,01)
ns = no real effect (P ≥0,05
G = Dosis gypsum
K = KNO_3

Total Flowering Blooms

In the largest number of blooming flowers per tree obtained in combination gypsum dosage treatment level and KNO3 concentration level with a value of 295.00 florets / tree and significantly different from without KNO_3 (0 ml / lt per tree) the lowest obtained at a combination of gypsum dose of 0 grams / tree and a concentration of 1.5 ml / 1 liter of water per tree KNO_3 with a value of only 4.60 buds / tree. So seeing the condition is able to produce a higher number of blossom / tree flowers 37.85%. When compared to the control (Table 3.2)

Table 2. Interaction between gypsum dose factor and KNO_3 concentration on the number of blooms per tree (bud) on Keprok orange.

Gypsum (G)[1)]	KNO_3 (K)			
	K_0	K_1	K_2	K_3
G_0	214,6 a	263,22 a	266,67 b	270,30 a [2)]
G_1	253,0 a	263,67 a	267,67 b	276,67 b
G_2	259,0 a	261,33 a	287,00 ba	295,00 a
BNT	35,62			

Explanation

1). G_0 = 0 gram gypsum dose per tree, G_1 = 350 gram gypsum dose per tree, G_2 = gypsum dose 700 grams per tree, K_0 = concentration of 0 ml / 1 liter water per tree, K_1 = concentration of KNO_3 1 ml / 1 Water level per tree, K_2 = concentration of KNO_3 1,5ml / 1 liter of water per tree, K_3 = concentration of 2 ml KNO_3 / 1 liter of water per tree.

2). Numbers followed by the same letter in 1 variable the same shows no significant effect on the BNT 5% test

Flowering Start Time (HSP), Period of Flowering Period (days), Amount Young Shoots per Tree (strands) and Number of Deciduous Flowers per tr.

Table 3. The average time to start flowering per tree, the length of flowering period and the number of young shoots per tree, and the number of deciduous flowers per tree in the treatment of gypsum (G) and KNO3 (K) on flowering of Keprok orange.

Treatment	time to start Flowering (hsp)	Long flowering period (days)	Number of young hoot/tree	flower of deciduous flower/tree
Gypsum (G)				
G_0	293,17 a	113,17 a	157,17 c	71,95 b
G_1	266,17 b	92,83 a	174,67 b	66,06 ab
G_2	215,23c	73,50 a	188,83 a	57,27 a
BNT 5 %	11,03	23,89	11,03	11.30
KNO3 (K)				
K_0	295,52 a	99,33 a	155,22 c	67,63 a
K_1	262,78 a	80,78 a	172,78 b	66,49 a
K_2	226,33 a	95,98 a	175,33 b	64,17 a
K_3	218,00 a	90,33 a	189,67 a	61,49a
BNT 5 %	12,74	27,58	12,74	12,34

Explanation: The average value followed by the same letter in the same treatment and column means that it is not significantly different at the BNT test level of 5%.

Based on Table 3.3 in the treatment of KNO_3 2 ml per l lt of water per tree shows the fastest time to start flowering per tree is 84.33 (HSP), significantly different from the KNO_3 treatment 1.5 ml per l lt of water per tree (K_1) with a value of 86.67 (HSP) and the treatment without KNO_3 requires the longest time, that is: 88.44 (HSP). The 700 gram gypsum treatment per tree showed the fastest flowering time of 84.44 HSP was significantly different from the 350 gram gypsum treatment per tree, namely: 86.25 (HSP) and treatment without gypsum/control requires time the longest to start flowering is: 87.83 (HSP).

Number of flowers formed/tree (florets) Keprok citrus plants

Table 4. Interaction between gypsum dose factor and KNO_3 concentration on the number of flowers of formed/tree (florets) on keprok citrus plants.

Gypsum (G)[1)]	KNO₃ (K)			
	K_0	K_1	K_2	K_3
G_0	123,00 a	134,30 b	123,16 ab	151,32 a [2)]
G_1	145,33 b	153,33 ab	156,33 a	173,00 b
G_2	176,00 c	163,00 a	182,67 a	275,00 a
BNT	35,62			

Explanation:

1). G_0 = 0 gram gypsum dose per tree, G_1 = 350 gram gypsum dose per tree, G_2 = gypsum dose 700 grams per tree, K_0 = concentration of KNO_3 0 ml / 1 liter water per tree, K_1 = concentration of KNO3 2 ml / 1 Water level per tree, K_2 = concentration of KNO_3 4 ml / 1 liter of water per tree, K_3 = concentration of 2 ml KNO_3/ 1 liter of water per tree.

2). Numbers followed by the same letter in 1 variable the same shows no significant effect on the BNT 5% tes.

The largest number of flowers formed per tree was obtained in the combination of gypsum dose level and KNO_3 (G_2K_3) concentration level with a value of 275.00 buds / tree and significantly different from without KNO_3 0 ml / lt per lowest tree obtained at a combination of gypsum dose and concentration of 0 ml liters per 1 liter of water per tree(G_0K_0) (control) (with a value of only 98.00 buds / tree. So looking at the condition is able to produce the amount of flowers blooms / trees are 55.27% higher when compared to (G_0K_0) (Table 3.4).
The highest number of flowers formed per tree was obtained at a combination of 700 grams of gypsum dose per tree and KNO_3 concentration of 2 ml per 1 lt of water per tree (G_2K_3) with a value of 205.00 buds / tree and significantly different from the number of flowers formed per tree which was the lowest obtained in a combination of treatments without gypsum and without KNO_3 (0 ml per 1 lt of water).

with a value of only 112.33 buds / tree (Table 3.4), so looking at these conditions (G_2K_3) is able to produce a higher number of flowers formed / trees 82.80% compared to the number of flowers formed per tree achieved by (G_0K_0). At level G the number of flowers formed / tree tends to be significantly different between G_2, $G_1$and G_0as well as at the level of KNO_3 administration, the levels K_3, K_2, K_1 and $K_0$for the number of flowers formed / tree tend to be significantly different.

Relative water content of leaves and leaf chlorophyll content per tree

In the variable relative water content of leaves per tree and the largest leaf chlorophyll content per tree obtained in the treatment of gypsum dosage level (G_2), that is 1.35% and 54.54 *SPAD* and the lowest without gypsum namely 0.09%, and (G_0)33.29 *SPAD* (Table 3.5). The 2 ml KNO3 treatment per 1 liter of water per tree (K_3) showed the highest values in the leaf chlorophyll content and the relative water content of the leaves respectively 52.338 *SPAD* and 1.18% and the lowest without KNO3 giving (control) 50.38 *SPAD* and 0.09 % (Table 3.5).
The relative water content of leaves in the treatment of gypsum dosage levels (G_1) was significantly different from (G_1) and (G_0) which were respectively 1.35%, 0.99% and 0.84 %, while leaf chlorophyll content between level (G_2)and level (G_1)is not significantly different, but vice versa with (G_0)shows a significant difference.

Table 5. Average relative content leaves (%) and the chlorophyll content of leaves (*SPAD*) in gypsum (G) and KNO_3 (K) on the flowering citrus Keprok plant.

Treatment	Relative water content of leaves (%)	With chlorophyll leaves *(SPAD)*
Gypsum (G)		
G_0	0,84 c	33,29 b
G_1	0,99 b	48,61 a
G_2	1,35 a	54,54 a
BNT 5%	0,16	1,40
KNO_3 (K)		
K_0	0,90 b	50,28 b
K_1	0,99 b	52,248 b
K_2	1,15 a	52,32 a
K_3	1,18 a	52,38 a
BNT 5%	1,40	1,70

Explanation: The average value followed by the same letter in the same treatment and column means that it is not significantly different at the BNT test level of 5%.

The relative water content of leaves in the treatment of 2 ml per 1 liter of water (K_3) obtained a value of 1.18%, not significantly different from the KNO3 treatment 1.5 ml per 1 liter of water per tree (K_2) with a value of 1.15%, and the treatment of KNO_3 1 ml per 1 liter of water per tree (K_1) with a value of 0.99% but significantly different between the administration of KNO_3 with a concentration of 2 ml per 1 liter of water per tree (K_3) with no KNO_3 (K_0) ie with a value of 0, 96% (Table 3.5). While the leaf chlorophyll content in the 2 ml KNO_3 treatment per 1 liter of water (K_3) obtained the highest value, namely: 53.388 (*SPAD*) was not significantly different from the 1 ml KNO_3 treatment per 1 liter of (K_1) water with a value of 52.38 (*SPAD*) and significantly different from treatment consecutive KNO_3 concentration 1.5 ml per 1 liter of water (K_2) namely: equal to 52.32 (*SPAD*) and treatment without KNO_3 0 ml per 1 liter of water (K_0) namely: with a value of 50.38 (*SPAD*) (Table 3.5). The 2 ml KNO3 treatment per 1 liter of water per tree (K_3) showed the highest values in the leaf chlorophyll content and the relative water content of the leaves respectively 52.338 *SPAD* and 1.18% and the lowest without KNO_3 (0 ml per 1 lt of water) ie 50.38 *SPAD* and 0.09% (Table 3.5). The relative water content of leaves in the gypsum dosage level (G_1) was significantly different from (G_1) and(G_0), which were respectively 1.35%, 0.99% and 0.84 %, while leaf chlorophyll content between level (G_2) and level (G_1) isnot significantly difference but vice versa with (G_0) shows a real difference.
The relative water content of leaves in the treatment of 2 ml per 1 liter of water (K_3) obtained a value of 1.18%, not significantly different from the KNO3 treatment 1.5 ml per 1 liter of water per tree (K_2) with a value of 1.15%, and KNO_3 treatment 1 ml per 1 liter of water per tree (K_1) with a value of 0.99% but very significantly different between KNO_3 with a concentration of 2 ml per 1 liter of water per tree $K_3$with no KNO_3 0 ml per 1 ilert of water (K_0) namely with a value of 0.96% (Table 3.4). While the chlorophyll content of leaves in the 2 ml KNO_3 treatment per 1 liter of water (K_3) obtained the highest value, namely: 53.388 (*SPAD*) was not significantly different from the KNO_3 treatment 1 ml per 1 liter of water (K_1) with a value of 52.38 (*SPAD*) and different

markedly with successive treatments a concentration of 1.5 ml per 1 liter of water (K_2), namely: equal to 52.32 (*SPAD*) and treatment without KNO_3 0 ml per 1 liter of water (K_0), namely: with a value of 50.38 (*SPAD*) (Table 3.5). The data shows that the application of gypsum can improve the status of plant tissue water which is shown by the increased KAR of leaves; this can be caused by increased ability of plants to absorb fruit juice and or reduce transpiration. These conditions cause the plant process to increase. This is related to the opinion of Hanafiah (2007), gypsum on the soil can function as land reclamation which increases soil aggregate, soil percolation (Febra *et al,* 2015), and decreases soil pH. Gypsum can replace Na + ions in the soil with Ca2 +, which can lead to better absorption of potassium.

Gypsum giving 350 grams a month before being given KNO_3 treatment resulted in the number of flowers formed from the fastest flowering time, namely: 84.44 HSP, when compared to without giving gypsum, namely: 87.83 HSP. As it is known that the addition of gypsum to the soil has two main functions, namely raising the pH and increasing the availability of the elements for plant growth. With the presence of calcium ions (Ca +++) in gypsum can encourage fruit formation in plants. This relates to the opinion of Astiari *et al*, (2017). Nitrogen is an integral part of chlorophyll. Photosynthesis will take place quite high, so that growth is active and plants are dark green when nitrogen is fulfilled while nitrogen is also a key element in the structure of cell walls. Nitogen is an essential element of protein, hormones and enzymes and is an important part for fruit production (Liferdi, 2010).

CONCLUSION

1.The 700 gram gypsum treatment per tree showed the fastest flowering time of 215,23HSP was significantly different from the 350 gram gypsum treatment per tree, namely: 266,17 (HSP) and treatment without gypsum requires time the longest to start flowering is: 293,17 (HSP). the KNO_3 treatment 2 ml per l liter water per tree showed the fastest flowering time per tree at 218,00 (HSP), significantly different from the KNO_3 treatment 1.5 ml per l liter water per tree with a value 262,78 (HSP), significantly different from the KNO_3 treatment 1.5 ml per l liter water per tree with a value 226,63 (HSP and in the treatment without KNO_3 requires the longest time, namely: 295,52 (HSP).

2. The highest number of flowers formed per tree was obtained at a combination of 700 grams of gypsum treatment per tree and the concentration of KNO3 2 ml per 1 liter of water per tree with a value of 205.00 florets / tree and significantly different from the number of flowers formed per tree obtained at the combination treatment without gypsum and without KNO3 (0 ml per 1 liter of water) with a value of only 112.33 buds / tree so that seeing the condition is able to produce a higher number of flowers formed / trees 82.80%

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REPERENCES

Ashraf, M.Y., M. Yaqub, J. Akhtar, M. A. Khan, M. Ali Khan and G. Ebert (2012). Control of Excessive Fruit Drop and Improvement in Yield and Juice Quality of *Citrus Nobilis* through Nutrient Management. *Pak. J. Bot.*, 44 (5): 259-265.

Ashraf, M.Y., M. Ashraf, M. Akhtar, K. Mahmood and M. Saleem (2013). Improvement in Yield, Quality and Reduction in Fruit Drop in *Citrus Reticulata* Blanco by Exogenous Application of Plant Growth Regulators, Potassium and Zinc. *Pak. J. Bot.* 45(3): 433-440

Astiari, N.K.A., N.P.A, Sulistiawati, L. and Kartini (2017). Upaya Peningkatan Kualitas Buah dan Memproduksi Buah Jeruk Siam di Luar Musim**.** 27P.

Badan Pusat Statistik (2014). Data ekspor dan impor menurut komoditas. http//bps.go.id. Diakses pada 4 maret.

Febra, N.W.E., Y.A Zaika. A.A.D Munawir, A. Rachmansyah (2015). Perbaikan Tanah dengan enabahkan Serbuk Gypsum dan Abu Sekam Padi Untuk Mengurangi Kerusakan Struktur Perkerasan. Program Studi Teknik Sipil, Fakultas Teknik, Univeritas Brawijaya. *J. Rekayasa Sipil* Vol 3. No3. Hal 251-256.

Hanafiah, K. (2007). Dasar-dasar ilmu tanah Label: 631.4 HAN d Penerbit: Jakarta: Raja Grafindo Persada.

Liferdi (2010). Staus Hara Ntrogen Sebagai Pedoman Rekomendasy Pupuk pada Bibit Manggis. *J. Agrivita* 1(3): 72-82

Nishikawa, F., M. Iwasaki, H. Fukamachi, K. Nonaka, A. Imai, F. Takishita, T. Yano and T. Endo. (2012). Fruit bearing suppresses citrus FLOWERING LOCUS T expression in vegetative shoots of satsuma mandarin (Citrus unshiu Marc.). *J. Japan. Soc. Hort. Sci.* 81 (2): 48–53.

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.

Purnomo, S. and P.E.R. Prihardini (2013). Perangsang pembungaan dengan paklobutrazol dan pengaruhnya terhadap buah mangga (*mangifera indica* L.). *Penelitian Hort*. 27: 16-24.

Rai, I.N., R. Poerwanro, L.K Darusman and B.S. Purwoko (2006). Chang of Gibberellin and Stages of Mangos teen. Hayati Sep.2005 hal 101-106 ISSN, 0854-8587. Vol 13 No 3.

Rai, I.N., C.G.A, Semarajaya, dan I.W. Wiraatmaja (2010). Studi Fenofisiologi Salak Gula Pasir Sebagai Upaya Mengatasi Kegagalan Fruit-set dan Memproduksi Buah di Luar Musim. Jurnal Hortikultura vol 20, N0 3 (2010).ISSN.0853-7097 e-ISSN22502-5120.

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.

Stuckens, J., Dzikiti, S., Verstraeten, W.W., Verreynne, S., Swennen, R. and Coppin, P. (2011). Physiological interpretation of a hyperspectral time series in citrus orchard. *Agricultural and Forest Meteorology*. 151:1002-1015.

epository.ipb.ac.id/ jspui/bitstream/123456789/77632/1/A15mra.pdf. Diakses pada 4 maret 2017.

Sulistiawati, N.P.A. (2019). Fisiologi Pembungaan dan Produksi Buah Jeruk Siam (*Citrus nobilis. Var mocrocarpa*.L) di Luar Musim. Disertasi 195 hal. Universitas Udayana-Bali. 2019.

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