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## Study Phenophysiology of The Reproductive Periode in Terms of Flowering Induction

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### Abstract

*The aim of research to determine the period of leaf repopulation, in order to form the flowering of Siam citrus plant. The study was conducted from March to December 2016, in Catur Village, Kintamani District, Bangli Regency, Bali Province. The research is descriptive so there is no special treatment given to the samples. The research is done by descriptive method, that is continuous research so that there is a thorough knowledge about the horticultural cultivation problem of tropical fruit, especially the citrus fruit, so that the physiology science of flowering and flowering is obtained in relation Get the fruit of the harvest. The citrus varieties used in this research are Siam citrus plant varieties that have been 6 years old. The number of samples observed as many as 10 plants with the observation of the period of bud shoots with observations every two days, the percentage of leaf buds, the period of shoots The period of leaf shoots, the number of shoots growing. The results showed that the cultivated Siam plants in Catur village Kintamani experienced a period of shoot growth during one period of growth 3 times in one period of growth. There are 4 stages of the period of replanting, ie 1). early shoot, 2), full shoot, 3) adult shoot and 4) dormancy shoot. The observation of the length of time required for early reproduction of approximately 12 weeks from the dormancy shoot, from early shoot to a full-time shoot period of approximately 3 weeks, furthermore for full-time shoot growth of approximately 4 weeks, to The time required adult shoots is approximately 8 weeks. For the amount of repayment during one period of growth of the Siam citrus plant for the period of replanting is the average number of developing is: 6.87 shoots/tree 2 weeks from the emergence of early buds, 15.5 shoots/tree weeks from the appearance of early buds, 26.78 shoots/trees from the emergence of early buds, 38.87 shoots/trees 8 weeks from the appearance of early shoots and 57.09 shoots/trees 12 weeks shoots/trees from the appearance of early shoots. The interest generated during the growth phase during the study was 2 times, with interest yielding an average of approximately 1985 flowers/trees.*

*Keywords: flowering, period shoots, Siam citrus plant*

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### 1. Introduction

One of the important sectors that become the mainstay of Indonesia is the agricultural sector, considering Indonesia is an agrarian country that has a wealth of nature and biodiversity that is very potential to be developed. The agricultural sector that plays an important role is horticulture. Fruit is one of the horticultural commodities that became the flagship of Indonesia. The types of fruits that continue to increase their need for consumption are citrus fruits, such as orange Siam (*Citrus nobbilis* Var, *microcarpa* L) which is the most important fruit commodity in Indonesia after mango and banana Citrus is highly favored by the community, because it tastes sweet, tasty, fresh, and peel easily peeled, as well as a source of nutrients and sources of vitamin C.

The market opportunities of citrus fruit are still quite large, this is due to the increase of population growth, increase of income, increasing of tourism world, public awareness of the importance of nutrition, besides the development of agroindustry. Citrus plants can grow and cultivated farmers in the highlands to the lowlands [4] Judging from the level of consumption and orange trade is one of the strategic fruit commodities to be developed Citrus is very popular by the community seen from the level of consumption about 5.1 kg/capita/year. Currently, Indonesia is the second largest source of ASEAN after Malaysia [5].

The high volume of citrus import due to the difficulty of the fulfillment of the national orange requirement, one of the causes is faced with the problem of the absence of continuity of production due to the conjoined naturally flowering and fruitful seasonal (alternate bearing) that is flowering and fruitful abundance in one season (on-season) and flowering And fruiting slightly in the next season (off-season), thus affecting price fluctuations. Alternate bearings are influenced by environmental factors, especially microclimate and plant endogenous factors [10]

The most influential environmental factors are air temperature, humidity, rainfall and light intensity [15]. Flowering of citrus plants often has constraints, because it requires special requirements to be able to sprout, flowering and fruiting [16]. The growth of shoots in the plant will determine how much the flowers will be able to emerge and can grow, and this is supported by the endogenous and exogenous factors of the citrus plant. Flowering citrus plants are flowering compound where the flower emerges from the leaf's armpit or on the tip.

The leaves are oval-shaped and the head of the flower is generally five pieces. Short flower petals with small protective flower petals. Clubs 5 - 8 cm, with the shape of oval round flowers towards the base of the uniform and smell nice [4]. Flowering on fruit trees is a very complex process that includes many stages of development [18].

Siam citrus plant cultivation period of flowering period there are four periods namely: 1) induction, 2a) end of induction or early deffrensiasi , 2b) Deffrensiasi, 3) Flowering organ flower and 4) flower bloom [15], Flowering process is the interaction of the influence of two major factors namely external and internal factors. Arranging flowering there are several ways that can be done, among others: water stress, root pruning, air and soil temperature settings, strangulation stem, and the use of growth regulators. Temperature manipulation to regulate flowering is expensive and difficult to implement in the tropics. During the flowering period not all the armpits or buds of the citrus plants can flower, this is because not all the armpits or shoots can be induced and transition from the vegetative phase to the reproductive phase so that not the whole armpit/bud produces flowers, in other words on one plant at the same time /Buds that flower and there are armpits buds that are not spongy.

Flowering is a complex occurrence is a complex occurrence, where morphologically, there are changes between the vegetative phase and the reproductive phase. The start of flowering is characterized by the transition from relatively simple leaf structure to more complex flower structure. The incident begins with the cessation of meristem to form a leaf candidate and begin to produce the organ of interest [16].

The process of replanting that begins when the dormant bud on shoots or shoots is induced for flowering often does not occur in all buds/buds present in citrus plants. In the flowering season, often shoots or fruit buds that have been fruitful in the season of abundant fruits (on-season) can not be flowering in the next season (off-season). In the flowering season is often shoots/buds that have been fruitful in the fruiting season of last year, can not bloom in the following year.

## **2. Material and Methods**

Prior to the study carried out assessments in advance to determine the location to be chosen as a place to study. After that set the location of the center of citrus production in the village of Chess located 12 km northwest of the city Kintamani district, which is located amongst the middle between Mountains Writing, Batur, Chess, and Mountains Mangu that either side of the three districts in Bangli namely Badung, Buleleng and Bangli. Chess village location situated at an altitude 1450 meters above sea level (asl) with an area of 746 hectares of land which is divided into 630 fields, 25 hectares, an area of 320 ha people's plantation and forest area of 60 hectares. Namely the commencement of research activities from March to December 2016. Materials and equipment observed citrus crop that is already 10 years old, as many as 5 plants of a broad expanse of the garden owned by farmers. Citrus crop has been maintained in accordance with the way the farmers farming, in accordance with actual conditions in the field. The way farmers are cultivating crops fertilized with organic fertilizers and irrigation only from rainfall Citrus crop has been maintained in accordance with the way the farmers farming, in accordance with actual conditions in the field. The way farmers are cultivating crops fertilized with organic fertilizers and irrigation only from rainfall Routine maintenance is only in the form of, eradication of fungal disease on citrus bark of citrus plants using Alike disease exterminator with dose of 1-2 ml/liter of water and for pest prevention usually used Syngenta with dose 0.2 – 0.4 ml/liter of water, cleaning weeds around the trees, and pruning of twigs that have drifted, twigs burned and then buried research methods Using continuous descriptive method, where the research is done continuously or continuously so as to obtain a comprehensive knowledge about the phenomenon of leaf perforations and flowering so it will produce science about the leaf repopulation and flowering of conjoined orange plants in relation to get fruit in a sustainable manner. This research does not use a particular treatment, only focused on the image of the development of leaf blossom and the development of flowering organs on the conjoined orange plants variable observed Field observations were leaf repayment, observed flower growth included: (1) The period begins to appear buds until the appearance of the first interest candidate, (2) The length or length of the flowering period, this is calculated since the first flowers appear on the tree until the appearance of the last flower, (3) The amount of interest includes the amount of interest formed and the number of flowers per fall.

## **3. Results and Discussion**

The research was conducted in Catur Village, Kintamani District, Bangli-Bali which was implemented in one farmer's field. The study sites are 1450 meters above sea level with hill topography to hilly with a slope of 15 to 39% until the parent rock from volcanic ash, regusol soil type, sandy clay clay texture. Rainfall averages 2800 mm/year with wet months between April and October. Soil acidity (pH) was 5.5- 6.5, average humidity 77-90 % average daily temperature 15.0-30.5°C (Village Profile Kintamani, 2013), observation of the results and discussion of morphological reproduction. Observation of shoot growth was done on shoots that grew from shoots of apical citrus plants examples of shoots observed were shoots given each mark and a healthy pick was measured continuous. From the observations made in the field of shoot growth experienced by Siamese citrus plants are divided into four stages of repayment namely: (1) Initial shoot, (2) full shoots, 3) adult shoots, and 4) buds dormancy. From the observations made on the leaf changes experienced by citrus plants during a period of development in the Siam citrus plant. citrus cultivation plants have two periods, namely on-season and off-season. In observation of the observed preniarity is at one period of the off-season period. Stipulation for citrus seedlings is four stages Early shoots, full buds, adult shoots and dormant buds, Examples of each: Based on observations during one growth cycle that is observed in the off-season period there are four stages of reproduction. This is in accordance with opinion [18]

which takes time since its inception. In the early buds on (Figure 1), it shows the earliest growing bud shapes on the development of buds in the conjoined orange plants. The signs shown in early repayment are from the period when the base of the terminal leaf pair at the end of the branch begins to rupture and then the bud leaves with the unopened candidate until the leaf pair has opened with a very transparent green color.

Observation on shoot growth is done every 2 days. The signs shown in early repayment are from the period when the base of the terminal leaf pair at the end of the branch begins to rupture and then the bud leaves with the unopened candidate until the leaf pair has opened the time required for the initial repayment period is the average amount 6.87/tree observation at 2 weeks, 15.58 shoots/tree, 26.78 shoots /tree, 38.87 tree shoots and 57.09 shoot/tree. observation tree 4 weeks. The second morphological character is characterized by periods ranging from color Leaves are light green transparent long period of time required is yellowish on shoots then turns to light green with long transparent green leaf the period of time required is during observation tree 12 weeks (Figure 2).



Figure 1. Initial shoots



Figure 2. Full shoots

The third phase of shoot growth in conjugated jeans is the phase of adult shoots, with the marks being fined from the leaves originally yellowish green, then turning dark green, the time taken.



Figure 3. Adult shoots



Figure 4. Shoots dormancy

The flowering period of citrus plants is characterized by morphological features, among others: the change of leaves is from dark green leaves, then there is a change in the color of light green leaves transparent, then followed by changes in the start of the candidate will flower with signs of bulging on the surface of leaf bud . The development of citrus flower shoots consists of four phases when viewed morphologically include: 1) induction phase, visual observation has not occurred changes in the shoots or armpits of plants, 2) defferensation, marked by the emergence of buds on the armpits, 3) began to appear flower nipple on shoots and flowers begin to blossom (Figure 5). Morphology of the development of orange plant flowers). Flowering process that begins when the armpits/shoots of dormant leaves to be induced into flowers, often do not occur in the whole armpits/buds flowering process contains a number of important stages, all of which must be successfully held to obtain fruit. In accordance with the opinion of [7] the stages of the development of flowers include the induction of flowers (avocation), the initiation of flowers, the development of flower buds to an-

thesis, and anthesis. The achievement of the stage of reproductive development of the plant is marked on some or all of the apical meristems of buds on the leaf stop branch, and the flower begins to form in accordance with the typical sequence according to the species of the plant. Flowers are branches with deformed leaves, whose growth is limited, short-circumscribed, and the leaves have changed shape. The lowest leaves are called green calyx, the next is called the crown or crown (corolla) of the more beautiful colors, the third leaf series is called the stamens (statements) the circumstances are all rolled up and the uppermost one or the most end of the state attached to one is called with a pistil. The flower stalk (pedicle) is located under the flower. The seat of the flower is at the base of the flower called receptaculum with the end of the flower stalk that is usually widened [11].

Growth in shoot apical meristem during the vegetative phase forms a shoot architecture with primordial which later develops into leaves / or shoots or vegetative branches. After the transition to generative growth, most or all of the apical meristems make up the flower, suggesting that the development of flower buds is different from the development of vegetative buds in some very dramatic terms: (1) unlike most vegetative buds, the flower buds are determinate and Its growth stops after the last reproductive organs have been formed, (2) the initiation and development of the lateral buds are very depressed when flower buds are formed, and (3) the number, arrangement and morphology of the flower organs are very specific depending on the species [2]. Specific changes to the apex occur during flowering, this occurs on the shoot, in the shesh meristem and in the flower. Changes that occur in the buds include precocious maturation of axillary shoots that cause changes in branching, leaf shape changes and changes in phyllotaxis. Likewise in apical shoot meristem changes, such as the occurrence of a temporary increase in growth rate, apex increase, the increase of primordial initiation rate and occasional changes associated with induction, such as RNA synthesis and the formation of new proteins, as well as an increase in the number of Mitochondria and respiratory rate have increased. According to the development of interest in changes, among others: (1) relatively smaller size of primordial flowers against apical dome when compared to the size of leaf primordial against the apical dome, (2) the change of the angle of the divergence primordial so that the arrangement of primordial forms whorls, (3) internodes depression, (4) primordial covering the peak of meristem, and (5) miosis occur. According to [16] of the increasing rate of growth temporarily in the apex is the transitional characteristic of leaf formation to flower formation. Reduced primordial interest rates cause the number of tissues associated with each primordial is also reduced, so as not to form an internodes on the flower. Thus the cells that normally develop form the vegetative internodes, do not form on the development of flowers.

The seasonal nature of fruit plants occurring in tropical climates is caused by several things: (1) flowering induction naturally occurs only in the highlands or lowlands with specific air temperature and long dry periods; and (2) flowering efficiency and fertilization is low, because the beginning of fruiting is uncertain and the nature of biennial bearing. according to [3] annual biennial bearings are flowering and fruiting nature that is unstable or fruitful in one year (on year) and fruitless the next season. The picture of flowering process on Siamese citrus plant during one period of its growth in Catur Village, Kintamani District, Bangli 2016.



Figure 5. Picture of the flowering of the Siam citrus plant

Flowering morphology 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 flowers, flowering induction is a process whereby external stimuli go to the growing point and it induces the primordia flower. Factors affecting flowering and fertilization are environmental, genetic, hormonal, and nutritional factors [1]. Environmental factors that are very influential on the appearance of interest among others: air temperature, air humidity, rainfall, and light [15]. In fruit crops naturally induced flowering occurs during the dry season, due to water stress and flowers appearing before the rainy season.

Table 1  
Average daily temperature at the study site (<sup>0</sup>C)

Month	Seming, Kerta Village		
	Morning	Afternoon	Average temperature
March 2016	25.0	27.0	26.0
April 2016	27.0	29.0	28.0
May 2016	25.0	29.0	27.0
June 2016	29.0	30.0	29.5
July 2016	29.0	30.0	29.5
August 2016	29.0	30.0	29,5
September 2016	28.5	30.5	29.5
October 2016	16.0	18.0	17.0
November 2016	16.0	17.0	16.5
December 2016	15.0	16.0	15.5

Naturally citrus is an annual crop that has seasonal fruiting properties, ie flowering only once a year or twice a year if it has a long dry period. The circumstances caused an abundance of production in the fruitful season and declining prices. In addition, orange fruit in Indonesia is very short, about 4 months starting from April to July [17]. Initiation of flowers on citrus plants occurs when the buds on the armpits of terminal leaves begin to enlarge. Plant citrus that are in the same environmental conditions but exhibiting different flowering behavior may be due to the presence of endogenous conditions and genetic information on plants that repress (depression) and the appearance (depression) of interest induction. For flowering according to [12], the leaf should be capable of producing the flowering stimulant substance required by the apex or the inhibitor production stopper. So is the apex's ability to receive a response and receive sufficient flower stimulus and stop receiving inhibitors from any part of the plant and then proceed to the formation of the flower organ in the appropriate order. Therefore the length of the juvenile period depends not only on the inability of the leaves to produce a flowering stimulus, but also depends on the inability of the apex to receive the stimulus.

The process of budding that begins when the dormant bud on the shoots or shoots is induced for flowering often does not occur in the overall shoots/buds present in the citrus plant. In the flowering season, often buds or fruit buds that bear fruit during the season of abundant fruits (on-season) can not be flowering in the next season (off-season). Specific changes to the apex occur during flowering, this occurs on the shoot, in the shesh meristem and in the flower. Changes that occur at the shoot include precocious axillary buds that cause changes in branching, leaf shape changes and changes in phyllotaxis. Likewise, in the case of aquatic meristems, there are changes, such as the occurrence of temporarily increased growth rates, apical expansion, increased primordial initiation rates and occasional changes in induced induction synthesis.

Specific changes in the apex occur during flowering, this occurs at the shoot (shoot), on the shoot meristem (in the shoot) meristem and in the flower (in the flower). Changes that occur at the shoot include precocious axillary buds that cause changes in branching, leaf shape changes and changes in phyllotaxis. Likewise in meristem apical shoot changes occur, among others, growth rate growth is

increased temporarily, apex magnitude, speed of initiation rate of primordial and occasional changes related to induction [19].

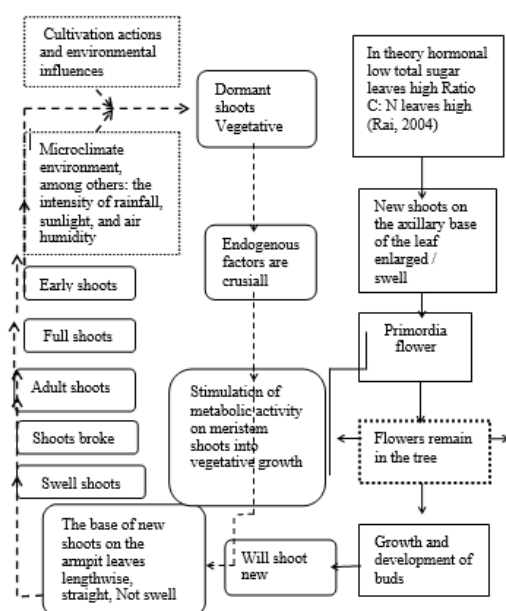
Table 2  
Air humidity data during the study (%)

Month	Seming, Kerta Village		Average Humidity
	Morning	Afternoon	
March 2016	90.0	82.0	86.0
April 2016	80.0	80.0	80.0
May 2016	78.0	76.0	77.0
June 2016	78.0	77.0	77.5
July 2016	78.0	77.0	77.5
August 2016	78.0	77.0	77.5
September 2016	95.0	76.5	85.8
October 2016	95.0	85.6	90.3
November 2016	95.0	94.7	94.8
December 2016	97.0	95.0	96.0

Flower development undergoes changes, among others: (1) relatively smaller size of primordial flowers against apical dome when compared to the size of leaf primordia against the apical dome. (2) the change of the angle of the divergence primordial so that the arrangement of primordial forms whorls, (3) internodes depression, (4) primordial covering the peak of meristem and (5) Miosis occur. According to [13] Of the increasing rate of growth temporarily in the apex is the transitional characteristic of leaf formation to flower formation. Reduced primordial interest rates cause the number of tissues associated with each primordial is also reduced, so as not to form an internodes on the flower. Thus the cells that normally develop form the vegetative internodes, do not form on the development of flowers.

Environmental factors are easily controlled and some are difficult to control. Light and temperature are difficult to control, while humidity and soil or land properties are very relative in control. In certain cases difficult to control such as flooding, excessive rainfall or very low swampy land and so on. Factors affecting flowering are environmental, genetic, hormonal and supply factors nutrition. The environmental factors that influence flowering according to [14] on Siam citrus plant are: (1) Temperature factor [8], high and low temperature becomes one of the factors that determine the growth and reproduction of the survival of the plant. A good temperature for plants, in general is between 22 OC and 37 OC temperatures more or less than normal limits can lead to slow growth and stopping, (2) Moisture factors, moisture content and air can affect the growth and development of plants. A moist place is advantageous where plants can get water more easily and less evaporation will have an impact on faster cell formation. Results of research by [7].

The description of perennials on the Siam citrus plant



Description Image:

- - - Plant growth leads to vegetative development

\_\_\_\_\_ Plant growth leads to growth reproductive

Water stress treatment from groundwater content of 42% to 18% proved to produce more flowering plants compared with plants given root pruning treatment, ring rings.3. Factors of sunlight, sunlight is needed by plants to be able to perform photosynthesis. Photosynthesis plays an important role in flowering because it deals with the carbohydrate content needed as a source of energy for flowering induction, diffrensiasi, and initiation of interest. The important role of photosynthesis is, among others, in the provision of ATP and carbon framework in the respiratory trajectory. Furthermore, the researchers suspect that changes in assimilate transport to the tip shaft tissue are an important component in flowering induction [7].

#### 4. Conclusion

Observations made on the growth of shoots in citrus crops in Banjar Seming, Kerta Village, Payangan District, Gianyar Regency during the period of growth experienced 4 phases of shoot growth, namely a) Early shoots, b) Adult shoot, c) Full shoots, and d) Dormant shoots.

Flowering is one of the developmental processes that must be timely. Siamese citrus plants have four flowering periods namely; a) initiate, b) defferentiation, 3) flowers bloom and 4) fall of flower jewelry. Growth and development in winter will stop. In the next season will be flowering, the number of flowers that can grow as many as 1917 flowers/trees. Generative plants include among others the total interest is formed, the initiation of flowering, defference and flowering in plants is the influence of interaction between environmental.

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