Phenophysiology of the formation and fall of flowers in overcoming efforts fruit-set failure in siam citrus plants

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Abstract. Flowers are the critical point of fruit formation. In this study the design used was a randomized block design, taking into account the position of the stem and the season affecting the fall and making flowers. The average value between intervals and Gadu does not show a significant difference with the number of falling flowers, namely: 152.57 florets and 151.44 (florets). The percentage of fruit set at the top, middle and bottom stems produce a difference, 92.75% followed by the middle stem, namely: 92.52%. The average value between intervals and Gadu does not show a significant difference with each percentage of fruit sets formed, namely: 93.30% and 93.07% Percentage formation of fruit sets in the upper stem supported by high leaf chlorophyll content Nutrient content of N, P, and K in the upper stem is 25.82%, 1.40%, 0.74% 3.42% when compared to rootstock, which are: 18.64%, 1.16%, 0.13% and 2.17%.

1. Introduction

The globalization era was marked by the increasingly open commodity trade between countries, including fruit commodities. This condition can be used as a challenge as well as a threat due to the lagging of fruit development technology in Indonesia. Opportunities for leading tropical fruits are wide open but Indonesia's role is very small, with high domestic demand, also due to a lack of continuity, and quality that is still low and not guaranteed. National fruit development is very potent because the consumption of fruit per capita in Indonesian society is still relatively low (40.06 kg/capita/year) compared to FAO recommended consumption (65.7 kg/capita/year) [1].

Fruits have a very important role in people's lives. The development of fruit commodities is expected to be able to provide added value for producers and industrial users, while for consumers it will be very beneficial to improve nutritional balance in their diet. Citrus plants are one of the national superior fruits. This commodity holds a strategic role in the trade of agricultural products, especially fruits in Indonesia. The role of oranges as a horticulture plant is increasingly important for farmers because it has high economic value. Besides oranges are also the main complementary ingredients in supporting daily family nutrition because oranges contain lots of vitamin C, which is useful for the human body because it has many benefits such as lowering blood pressure, preventing cancer, preventing skin damage and treating sprue. Every 100 g of orange contains 28.00 calories, 0.5 g protein, 0.1 g fat, 7.20 g carbohydrate, and 500-1,000 g vitamin C [2].

Siamese oranges (Citrus nobilis, var macrocarpa L.) are plants that have seasonal flowering and fruiting properties. Citrus plants are known to have very short flowering periods so they have a juvenile period or a plant to produce long flowering. Flowering often has problems because it requires special
conditions to be able to induce flowering and fruiting [3]. Orange plants emerge from the shoots/armpits which have previously experienced dormancy. In general, most plants, after the development of flowers have pollinated, the ovary begins to grow and begin to develop. This usually coincides with the wilting and fall of the flower jewelry like petals. The occurrence of these changes indicates the transition from flowers to young fruit according to Rai et al. referred to as fruit-set [4], while according to Parvathi et al. fruit-set is the proportion of the fixed amount of interest survive after the petal falls [5].

Flower loss in plants is a common occurrence and this is one of the physiological processes in plants. In dicotyledonous plants generally, the loss of flowers which is a reproductive organ is more caused by many factors, as well as in conjoined plants [6]. The number of flowers produced by citrus plants is determined by shoots per plant because of the flowering properties of terminals citrus plants, ie flowers grow and appear only from the tips of shoots. Furthermore, the intensity of pollination and fertilization does not affect the amount of fruit that can be harvested. So the number of fruit harvests in citrus plants is largely determined by the number of shoots and the ability of plants to keep the flowers and fruit from falling out.

The fall physiology of flowers or fruit correlates with the limited supply of photosynthesize and nutrient adequacy in fruit plants [5], as well as the occurrence of hormonal regulation in the absent zone [6], this is in line with the results of research conducted on plants Cashew nuts [6], the fall of flowers and fruit is largely determined by the low supply of photosynthates. From the observations made in Catur Village, the number of fruits that can be harvested is very small because of the large number of deciduous flowers, and orange plants can form flowers and flower blooms but the phenomenon that occurs after the fruit-set flower changes miscarriage before it becomes the fruit of the harvest. The incident experienced by the Siamese orange plant is not yet known exactly why there are no control recommendations that can be submitted in the field.

These important problems are often faced by siam orange farmers so that the continuity of the product produced is not guaranteed. Fanomene that occurs in the orange plant can be drawn the problem, namely:

1. How is the endogenous content of flower plants formed and deciduous flowers occur on Siamese orange plants? 2. What causes factors that affect so that there are flowering citrus plants that can continue to be fruit-set and form flowers but cannot become fruit-sets. 3. How can the effect of different endogenous content on plants determine the development of flowers can last until they can form fruit-sets in Siamese citrus plants.

Based on the above problems, the objectives of this study are the general objective of finding a science and technology model is to maintain the interest until fruit-sets can be formed in order to develop the added value of the production of quality and sustainable citrus fruits. Special Purpose are get science and technology differences in changes in the content of endogenous substances that cause flowers to survive on Siamese citrus plants. The formulation of a model of the causes of interest is created by deciduous oranges and flowers that can survive until a fruit-set is formed. Obtaining science and technology causes flowers can become fruit-sets and biased flowers are formed into fruit-sets.

2. Materials and methods

The research plan was carried out in Catur Village, Kintamani District, Bangli Regency in 2018. 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. Routine maintenance is only in the form of eradicating fungal diseases on the bark of citrus plants using.

The study was conducted in two stages, namely, in the initial study (first year), the study was carried out identifying flowering shoots that fell and survived in trees, until fruit-sets were formed, the second stage: how plants can maintain fruit-sets in trees until fruit harvest. a). Collection of samples and direct observation of morphological aspects of deciduous flowers and flowers do not fall. Flowers are categorized as having a fruit-set if it falls off, the flower still stays on the tree in other words not having a miscarriage. For the size of the fruit is limited, namely the size of the nipple when it is approximately 1 cm. Observations were made on aspects of flower growth and nipples. Research in the Laboratory to
observe changes in endogenous content in shoots of flowers and deciduous fruits and shoots of flowers remained in the tree through analysis of endogenous content contained [7]. b) Further research, ie flowers are formed until the fruit-set is formed in the tree

This study uses a randomized block design with one non-free variable with 15 replications (of 10 plants). The factor as a non-free variable is the surviving flower and the fall flower consists of two levels, namely: This initial study did not use certain treatments, only focused on identifying the endogenous content and development of flower organs in Siamese citrus plants and the role of environment in flowering.

3. Results and discussion

Table 1. Average relative water content of leaves (%) and leaf chlorophyll content (SPAD) at stem position and the flowering season for Siamese citrus plants.

| Position and flower development season | The relative water content of leaves (%) | Leaf chlorophyll content (SPAD) |
|----------------------------------------|----------------------------------------|--------------------------------|
| Upper stem                             | 46.78 a                                | 25.82 a                        |
| Model stem                             | 41.26 b                                | 22.34 b                        |
| Botton stem                            | 41.96 b                                | 18.64 c                        |
| LSD                                    | 3.63                                   | 1.77                           |
| Year season                            | 50.04 a                                | 27.66 a                        |
| Interval season                        | 36.62 a                                | 16.94 a                        |
| LSD                                    | 4.44                                   | 2.16                           |

Information:
- The average value followed by the same letter in the same row and column shows a non-significant difference (P>0.05).
- The mean values followed by different letters on the same row and column show significant differences (P<0.05) to very significant (P<0.01).

3.1. Percentage of the relative water content of leaves (%)
The results of statistical analysis show that the position of the upper, middle and lower stem shows a very significant influence (P<0.01), between the Gadu season and intervals showing a non-significant effect (P>0.05), the interaction between stem position and season (B×M) shows a significant effect (P<0.05) on the relative water content of the leaves (Table 2). The average percentage of the relative water content of leaves in the position of the upper, middle and lower stems shows a very significant difference, most of the upper stem, rootstock and middle stem are 46.78%, 41.96%, and 41.26% respectively. The average value between intervals and Gadu shows no significant difference with each percentage of the relative water content of leaves, namely: 50.04% and 63.62% (Table 1).

3.2. Chlorophyll leaf content (SPAD)
The results of statistical analysis showed the position of the upper, middle and lower stem, as well as the interaction between stem and season position (B×M) showed a significant effect (P<0.05), while the season showed an unrealistic effect (P>0.05) (Table 1).

The average leaf chlorophyll at the top, middle, and bottom stems shows a very significant difference, most of the upper stem, rootstock, and middle stem are 25.82 SPAD, 22.45 SPAD and 18.64 SPAD, respectively. The average value between intervals and Gadu shows significant differences with each leaf chlorophyll content, namely: 27.66 SPAD and 16.94 SPAD (Table 1). Percentage of the nutrient content of N leaves (%), According to Kowalska, the stages of flower development include flower induction (avocation), flower initiation, development of flower buds toward anthesis, and anthesis [8]. Achievement of the stage of the phase of reproductive development in plants is marked on some or all
of the shoot apex meristems on the twigs stop producing leaves, and flowers begin to form in accordance with the typical order according to the plant species.

The average percentage of N leaf nutrient content in the position of the upper, middle and lower stems shows a very significant difference, at most the upper stem, lower stem and middle stem are 1.40%, 1.22% and 1.16% respectively. The average value between intervals and Gadu shows no significant difference with each percentage of N leaf nutrient content, namely: 1.37% and 1.15% (Table 2). When plants reach their reproductive development stage, then some or all of the buds/axillary meristems on the twigs stop producing leaves and begin to form part of the flower in the order that is typical for the species concerned [3].

Table 2. Average nutrient percentage of nitrogen (N) and phosphate (P) in stem position and flowering season in Siamese citrus plants.

| Position and flower development season | Nitrogen (N) (%) | Phosphate (P) (%) |
|---------------------------------------|-----------------|-----------------|
| Upper stem                            | 1.40 a          | 0.74 a          |
| Middle stem                           | 1.22 b          | 0.39 ab         |
| Botton stem                           | 1.16 b          | 0.19 b          |
| LSD                                   | 0.15            | 0.32            |
| Year season                           | 1.37 a          | 0.52 a          |
| Interval season                       | 1.15 a          | 0.36 a          |
| LSD                                   | 0.18            | 0.40            |

Information :

- The average value followed by the same letter in the same row and column shows a non-significant difference (P>0.05).
- The mean values followed by different letters on the same row and column show significant differences (P<0.05) to very significant (P<0.01).

Table 3. Average percentage of Potassium nutrient (%), leaf total sugar (%) and leaf reduction sugar (%) in stem position and flowering season in Siam citrus plants.

| Position and flower development season | Potassium nutrient (%) | Leaf total sugar (%) | Leaf reduction of sugar (%) |
|---------------------------------------|------------------------|----------------------|-----------------------------|
| Upper stem                            | 3.42 a                 | 43.57 a              | 18.20 a                     |
| Middle stem                           | 2.70 b                 | 36.68 b              | 15.68 b                     |
| Bottom stem                           | 2.17 c                 | 29.64 c              | 14.52 c                     |
| LSD                                   | 0.23                   | 3.93                 | 3.08                        |
| Year season                           | 2.52 a                 | 47.82 a              | 1.77 a                      |
| Interval season                       | 2.01 a                 | 26.77 a              | 2.13 a                      |
| LSD                                   | 0.41                   | 4.82                 | 3.77                        |

Information :

- The average value followed by the same letter in the same row and column shows a non-significant difference (P>0.05).
- The mean values followed by different letters on the same row and column show significant differences (P<0.05) to very significant (P<0.01).

3.3. Percentage of P nutrient content of leaves (%)
The average percentage of leaf P nutrient content in the position of the upper, middle and lower stems shows a very significant difference, most of the top stem, rootstock and middle stem are 0.64%, 0.39%
and 0 respectively 32%. The average value between intervals and Gadu shows no significant difference with each percentage of leaf P nutrient content, namely: 0.52% and 0.36% (Table 3). The factors that influence flowering are genetic, nutritional supply and carbohydrate content according to Rai et al. [4]. The physiology of flowering in fruit trees according to Ahmad et al., when viewed from the perennial climate that flowers can be seen as a branch with limited growth [9].

3.4. Percentage of the nutrient content of K leaves (%)
The results of statistical analysis showed the position of the upper, middle and lower stem and the interaction between flowering season and stem position (MxB showed a significant effect (P <0.05) on the percentage of K content, whereas the flowering season had no significant effect (P >0.05) on the percentage of K leaf nutrient content (Table 2). The average percentage of the nutrient content of leaf K in the position of the upper, middle and lower stem shows a significant difference, most of the stem, rootstock and middle stem are 3.42%, 2.70% and 2.17 respectively, %.

The average value between intervals and Gadu shows no significant difference with each percentage of leaf K nutrient content, namely: 2.52% and 2.01% (Table 3). In most types of fruit plants, the order of formation of parts of the flower takes place from the outside inward starting from sepal (calyx), petal (corolla), stamens (stamen) and pistil (pistil). There are two conditions for flowers or fruit miscarriages, namely: (1) flowers and fruit under normal conditions, when they fall do not show symptoms of damage to the base and (2) deciduous flowers or fruit damage to the base caused by physiological or genetic influences and miscarriages which is accompanied by damage to the base caused by a disturbance from the disturbing organisms [10].

4. Conclusions
The interaction between the position of the stem and the observation of the growing season shows a non-significant effect on the formation of the number of flowers and the influence of the percentage of fruit-set formation on the Siamese citrus plants. The highest fruit-set formation is obtained in the upper stem, which is equal to 92.75% and the lowest in the lower stem 91.30%.

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