Correlation between carbohydrate content, protein, and fat with compatibility of durian seed grafting (*durio zibethinus*. Murr)

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Abstract. Durian nurseries can be done using generative and vegetative material sources. Both sources of propagation have their respective weaknesses and strengths. To get quality seeds requires a combination of two sources of propagation material that has each of the advantages that can complement each other. The process of merging can be through grafting. The grafting method in durian nurseries can use side grafting and shoot grafting methods. The purpose of this study was to determine differences in levels of protein, carbohydrates, fats, and phytohormones from various sources and storage time of the stem. This study was compiled based on factorial designs in the Randomized Group Design (RCBD). The first factor is the source of the stem (S), which consists of 3 sources, namely the primary branch (S1), secondary branch (S2), tertiary branch (S3). The second factor is the length of storage of the stem (T) which consists of 4 levels of storage time of the scion namely: 0 days (T0), 2 days (T1), 4 days (T2) and 6 days (T3). It was concluded that the carbohydrate content of the scions gave the highest positive contribution to the increase in the number of shoots followed by the number of leaves, percentage of living grafts, leaf area, leaf area ratio, root canopy ratio, shoot length, and stem diameter. The protein content cannot contribute to the growth of grafted seeds even has a tendency to inhibit growth. The fat content in the scion does not contribute to the growth of plant variables.

1. Introduction

Propagation technology recommended in the cultivation of fast time durian is a mini graft, which is a vegetative propagation technique that is carried out as early as possible in the condition of the rootstock, which has made it possible to be connected. The use and selection of good top stem types and knowing when the rootstock is in a good stage of vegetative activity are important considerations for successful grafting integration, so it is necessary to find out the most suitable scion sources to be combined in each variety. Seedling growth after grafting (shoot height and leaf width) is influenced by the source of the scion used.

So far, the use of stems as grafting material is still general in nature, namely the use of stem sources not yet specific from certain branches, so it is not yet clear which stem sources can increase the success of grafting. Potential top stem sources are primary, secondary, and tertiary branches which
contain macromolecules and phytohormones to support the success rate of grafting. One factor that greatly influences the success of the grafting method is the freshness of the top bar. The freshness of the scion is related to the adequacy of food/energy reserves in the form of assimilates for the growth and recovery of cells damaged by injury. The fresher the stems, the more energy reserves. A similar can stimulate cell division, enlargement, and differentiation, which then encourages the linkage process between the upper and lower stem. In addition, storage of durian plant stems also does not have a benchmark for how long it is possible so that the stems can still increase the success of the connection. During the storage of the upper trunk, there will be a decrease in vigor because, during storage, the upper trunk will experience greater transpiration because the longer the upper trunk is stored, the potential of water and food reserves from the trunk is reduced during storage changes in carbohydrate, protein, fat, and auxin content. Therefore, through this study, a correlation was obtained between carbohydrate, protein, and fat content with the compatibility of durian seed grafting (Durio zibethinus. Murr).

2. Methods

2.1. Materials and research tools
The material used in the study was sciots from various branch sources and stored according to treatment, and the analysis material included starch, dextrin, sucrose, lactose, maltose, galactose, fructose, glucose, and arabinose each in 1% solution, Molisch reagent, and H2SO4 is concentrated. The tools used in this study are pruning shears, ladders, test tubes, tube racks, and dropper pipettes, stirrers, mortars, fermentation tubes, glass preparations and test boards, and other supporting tools that will be mentioned in the research procedure.

2.2. Research methods
This study was compiled based on factorial designs in the Randomized Group Design (RCBD). The first factor is the source of the sciots (S), which consists of 3 sources, namely the primary branch (S1), secondary branch (S2), tertiary branch (S3). The second factor is the length of storage of the stem (T), which consists of 4 levels of storage time of the scion, namely: 0 days (T0), 2 days (T1), 4 days (T2), and 6 days (T3). So there are 12 treatment combinations as follows: S1T0 = Primary Branch with Scion without storage, S1T1 = Primary Branch with Scion is stored 2 days, S1T2 = Primary Branch with Scion is stored 4 days, S1T3 = Primary Branch with Scion is stored for 6 days, S2T0 = Secondary Branch with Scion without savings, S2T1 = Secondary Branch with Scion is kept for 2 days, S2T2 = Secondary Branch with Scion is kept 4 days, S2T3 = Secondary Branch with Scion is kept for 6 days, S3T0 = Tertiary Branch with Top stem without savings, S3T1 = Tertiary Branch with Top stem saved 2 days, S3T2 = Tertiary Branch with Top stem saved 4 days, S3T3 = Main Branch with Top stem kept 6 days. Each experimental unit used 10 plants, which were repeated three times so that in total, there were 360 plants.

2.3. Research Implementation

2.3.1. Scion sampling. The scion sample is taken from a durian tree which will be used as a stem source. Scion samples were taken in the afternoon around 3:00 - 18:00 using pruning shears. The scion is taken on the primary branch, secondary branch, and tertiary branch. The sciots taken are sciots with the condition of old leaves, and the last perspective leaves are not active. The length of the stem is about 10 cm (4 sheets).

2.3.2. Scion storage. Scion is stored at room temperature of 20oC with 75% humidity. Scion before being stored using a newspaper that has been sprinkled with water but not too wet and then wrapped again using banana stems. Scion is stored for 6 days, 4 days, and 2 days after collection on the parent tree [1].
3. Results and discussion

3.1. Carbohydrate content
Correlation test results between carbohydrate content and the success and compatibility of transplants in various sources and storage time are presented in Table 1.

| Growth Variable              | Carbohydrate Coefficients (r) | (Prob > r) |
|-----------------------------|------------------------------|------------|
| Percentage of live shoots   | 0.53694**                    | 0.0009     |
| Percentage of dormant shoots| -0.58984**                   | 0.0002     |
| Number of shoots            | 0.63589**                    | <.0001     |
| Long shoots                 | 0.25039ts                    | 0.1468     |
| Number of leaves            | 0.62910**                    | <.0001     |
| Stem diameter               | 0.21646ts                    | 0.2117     |
| Leaf Area                   | 0.46468**                    | 0.0049     |
| Leaf Area Ratio             | 0.39380*                     | 0.0193     |
| Pupus Root Ratio            | 0.32891*                     | 0.0537     |

Information: ** = Very significant, * = significant, ts = non significant

Table 1 shows that carbohydrate content with a percentage of live shoots (r = 0.53), percentage of dormant shoots (r = -0.59), number of shoots (r = 0.64) and number of leaves (r = 0.63), and leaf area (r = 0.46) have a very significant positive correlation and leaf area ratio (r = 0.39), and pupus root ratio (r = 0.33) have a significant positive correlation while long shoots (r = 0, 25) and stem diameter (r = 0.22) have a non-significant positive correlation.

3.2. Protein content
Correlation test results between Protein content and the success and compatibility of transplants in various sources and storage time are presented in Table 2.

| Growth Variable              | Protein Coefficients (r) | (Prob > r) |
|-----------------------------|-------------------------|------------|
| Percentage of live shoots   | -0.56362**              | 0.0004     |
| Percentage of Dormant Shoots| 0.53124**               | 0.0010     |
| Number of shoots            | -0.39993*               | 0.0173     |
| Long Shoots                 | -0.20092ts              | 0.2471     |
| Number of Leaves            | -0.49920**              | 0.0023     |
| Stem Diameter               | 0.06069ts               | 0.7291     |
| Leaf Area                   | -0.17353ts              | 0.3188     |
| Leaf Area Ratio             | -0.27508ts              | 0.1097     |
| Pupus Root Ratio            | -0.45795**              | 0.0057     |

Information: ** = Very significant, * = significant, ts = non significant

Table 2 shows that the correlation of protein content with the percentage of live shoots (r = -0.56), percentage of dormant shoots (r = 0.53), number of leaves (r = -0.50), and pupus root ratio (r = -
0.46) is very significant, for the number of shoots (r = -0.40) the correlation is significant while the long shoots (r = -0.20), stem diameter (r = 0.06), leaf area (r = -0.17), leaf area ratio (r = -0.27) correlation is not significant. Further explained that the percentage of dorman shoots (r = 0.53) and stem diameter (r = 0.06) positive correlation while the percentage of shoots (r = -0.56), number of leaves (r = -0.50), number shoots (r = -0.40), long shoots (r = -0.20), leaf area (r = -0.17), leaf area ratio (r = -0.27), and pupus root ratio (r = -0.46) negative correlation.

3.3. Fat content
Correlation test results between fat content and the success and compatibility of transplants in various sources and storage time are presented in table 3.

| Growth Variable                  | Fat Coefficients (r) | (Prob > |r|) |
|----------------------------------|----------------------|---------|
| Percentage of live shoots        | 0.17589ts            | 0.3122  |
| Percentage of Dorman Shoots      | -0.05334ts           | 0.7609  |
| Number of shoots                 | 0.22571ts            | 0.1923  |
| Long Shoots                      | 0.15762ts            | 0.3658  |
| Number of Leaves                 | 0.14812ts            | 0.3958  |
| Stem Diameter                    | -0.08665ts           | 0.6207  |
| Leaf Area                        | -0.04211ts           | 0.8102  |
| Leaf Area Ratio                  | 0.15471ts            | 0.3749  |
| Pupus Root Ratio                 | -0.00372ts           | 0.9831  |

Information: ts = non significant

Table 3 shows that the correlation between fat content and Percentage of live shoots (r = 0.17), Percentage of Dorman Shoots (r = -0.05), number of shoots (r = 0.22), long shoots (r = 0.16), number of leaves (r = 0.15), stem diameter (r = -0.09), leaf area (r = -0.04), leaf area ratio (r = 0.15), and pupus root ratio (r = -0.004) shows an insignificant correlation.

The results of the study in table 1 prove that the availability of carbohydrates in the upper stem will increase the success rate and compatibility of grafting in durian plants. Based on these data, the carbohydrate content in the upper trunk provides the highest positive contribution to the increase in the number of shoots followed by the number of leaves, the percentage of live shoots, leaf area, leaf area ratio, pupus root ratio, shoots long, and stem diameter. Contributions are positive, which means carbohydrates in the upper stem can spur growth, while negative contributions mean that they will inhibit growth [2]. This is in line with the role of carbohydrates as an energy source for plant growth, especially the formation of shoots and leaves in plants. At the beginning of plant growth is limited by the availability of food reserves in food. If the plant material comes from cuttings, the organic ingredients in it are the food reserves. Growth takes place through a series of events, which include the formation of carbohydrates (photosynthesis), absorption processes, translocation, metabolism, respiration [3–6]. The success of the grafting which is characterized by a high percentage of live shoots and a low percentage of dormant shoots, depends on the formation of joints caused by the formation of callus. The process of formation of callus is highly influenced by the carbohydrate content contained in cuttings because these compounds are a source of energy in the formation of callus. Carbohydrates play a key role in all aspects of plant life. Carbohydrate deficiency will have an impact on the metabolic process and plant development [3,4,7].

The existence of protein cannot contribute to the growth of grafting seedlings even has a tendency to inhibit growth, as shown in Table 2 that growth variables are negatively correlated to proteins. Percentage of survival is the highest growth variable, which is inhibited by the presence of protein.
followed by variable number of leaves, absent root ratio, number of shoots, leaf area ratio, shoot length, and leaf area [2].

Table 3 shows that the fat content in the upper stems did not contribute to plant growth variables. If observed from the correlation coefficient, there are several growth variables whose values are negative, which means that the presence of fat will interfere with plant growth, especially the observed variables, namely the percentage of shoot dormancy, stem diameter, leaf area, and pupus root ratio [2].

4. Conclusion
The carbohydrate content on the upper stems gives the highest positive contribution to the increase in the number of shoots followed by the number of leaves, the percentage of living grafts, leaf area, leaf area ratio, pupus root ratio, shoot length, and stem diameter. Protein content cannot contribute to the growth of grafting seedlings even has a tendency to inhibit growth. The fat content in the upper stems does not contribute to plant growth variables.

References
[1] Wardiana S dan 2014 The Influence of Period and Top Stem Storage Media on Green Grafting Success and Top Stem Water Content in Rubber Plants, Research Institute for Industrial Plants and Freshener Sukabumi. TIDP Journal 2 (1) 13-20
[2] Suharjo, Bahrun A S L and M S 2017 Effect Of Source And Storage Times Of Scion To Carbohydrate, Protein, Lipids, And Auxin Content At Durian Nursery (Durio Zibethinus. Murr). International Journal of Recent Advances in Multidisciplinary Research ISSN 2350-0743, 04(9): 2819-2824
[3] Shipley B 2006 Net assimilation rate, specific leaf area and leaf mass ratio: which is most closely correlated with relative growth rate? A meta- analysis Func. Ecol. 20 565–74
[4] Gardner F P, Pearce R B and Mitchell R L 2008 Fisiologi Tanaman Budidaya (translate by Herawati Susilo) UI-Press. Jakarta
[5] Ainsworth E A and Bush D R 2011 Carbohydrate export from the leaf: a highly regulated process and target to enhance photosynthesis and productivity Plant Physiol. 155 64–9
[6] Purnobasuki H and Utami E 2017 Seed germination of Avicennia marina(Forsk.) Vierh. by pericarp removal treatment Biotropia (Bogor). 23 75–84
[7] Li C Y, Weiss D and Goldschmidt E E 2003 Effects of carbohydrate starvation on gene expression in citrus root Planta 217 11–20