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APPROACH GRAFTING OF DURIAN SEEDLING WITH VARIATION OF MULTIPLE ROOTSTOCK

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Abstract

Yuniastuti, E., B. A. Annisa, Nandariyah and Sukaya, 2017. Approach grafting of durian seedling with variation of multiple rootstock. *Bulg. J. Agric. Sci.*, 23 (2): 232–237

Increasing of durian productivity can be done by provision of quality seeds. The techniques to get quality seed can be done by using local superior durian by grafting method. We represent the use of another species of Durian as double rootstock and approach grafting method to accelerate the growth and the availability of durian seedling. The experiment was conducted in Girirejo, Ngawi, East Java during November 2015 to February 2016, and arranged in a 3x4 factorial design with 3 replications. The first factor was related to species of durian which consisted of Petruk, Brongkol, and Sapuan, while the second factor was rootstocks number i.e. dual rootstocks, triple rootstocks, four rootstocks, and five rootstocks. The variables observed were percentage of successful grafting, plant height, leaf number, leaf area, stem diameter, shoot diameter, shoot number. The results showed that the growth of durian seedling with multiple rootstock was better than durian seedling with single rootstock, meanwhile, approach grafting with combination Otong and Sapuan was better than Otong-Petruk grafting in accelerating the growth of durian seedling.

Key words: linkage, compatibility, grafting

Introduction

Durian is a tropical-specific plants that have economic value high enough to increase farmer's income, foreign exports, and the needs of agribusiness. Productivity developments durian in Indonesia during the period 2009-2013 fluctuate, the average production in the year 2009-2013 are as many as 764 thousand tons, but showed a decrease of -22.34% in 2013 against 2012 (Indarti et al., 2014). Increased productivity is still necessary because of the increase in population and income per capita allows durian needs will increase.

Increased production cannot be separated from the various problems in aspects of cultivation, especially in the provision of quality seeds of durian durian, but crops have long breeding years. According to Lim and Luders (2009), there are many ways to reduce long juvenile period like using synthetic growth hormones or manipulation of cultivation using various forms of grafting before adulthood, dwarfing rootstock, interstocks, and using some rootstock.

Grafting used for a long time ago to increase uniformity, vigour and resistance to biotic and abiotic stresses of vegetatively propagated plants (Yassin and Seid, 2015). The use of more than one rootstock grafting is technique that has more than one root system. This technique has been applied extensively by many farmers in Thailand's to produce monthong with large fruit size. Application of double root is expected to accelerate the growth of seedlings of durian because it has two root system so that the number of roots and increases its reach.

Grafting to form two or more of the root system can be done with some models, one of which is an approach grafting model. The success rate of these grafting models in making multiple rootstock of durian seedlings not known

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certainly. But in general, grafting techniques propagation of fruit plants, methods of approach grafting usually provide a higher success rate compared with other grafting models. Based on this it is necessary to study to get a technology of durian seedling that growing rapidly with a multiple rootstock grafting techniques through the utilization of relatives durian species as a double stem so that the problem of availability of quality seeds can be solved.

Materials and Methods

Experimental site

This research was conducted from November 2015 until February 2016 in Ngawi, East Java at latitude 7°33′ S and longitude 110°51′ E, 409 m above sea level. This area has a tropical climate with temperature of 26-32° C and 50% mean annual humidity.

Planting materials

The tested scion was the "otong" cultivar of durian, established in 2014 with 50 cm height of plant in a year old. The tress were grafting on three additional rootstocks, namely Petruk, Brongkol, and Sapuan as the tested rootstocks. Seed of all rootstock were collected from agricultural research centre in some location in Indonesia.

Grafting methods

Make a multiple stem of durian seedlings with approach models done by cutting the shoots from the additional stem (rootstock), one cotyledon was cut off 15 cm height, then both sides of the tip of the stem was cut at the two opposite sides to form a wedge with two symmetrical sections. On the stem of scion was cut off for each of the rootstocks with a blade from the bottom up to form a gap. Part of wedge under the additional rootstock was inserted into the slit on scion. All sections of the rootstock and scion were aligned and fit together, such that the sections of the two rootstock plants and two sections of scion plant were close together. A 1 cm wide plastic sheet was used to bundle both rootstocks and scion together, which was fixed in place with grafting plastic.

Experimental design

The research used randomized complete block design (RBCD) with two factors. The first factor is the number of stems which are grafted consists of five treatment, namely: stem 1 as a control; stem 2 ; stem 3, stem 4, and stem 5. The second factor is the type of durian grafted consisted of three treatments, namely: Petruk, Brongkol, and sapuan. Each of treatment was performed with three replications.

Data collection

Data were collected for the last 3 months after grafting. The plant height was measured and calculated according to the difference of the last height of plant with initial height of plant. The diameter of stem and shoot of scion as determined by measuring the stem at the 2 cm up to linkage point and the initial height of plant with a manual caliper. The leaf area was measures with gravimetric method, leaf area:

$$\text{leaf area} = \frac{\text{weight of leaf replika in sheet}}{\text{weight of one sheet}} \times \text{area of onr sheet}$$

Statistical analysis

Observational data obtained were analyzed using analysis of variance using SPSS version 16 (SPSS Inc., Chicago) for Windows and the ratio between the mean compared by Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Results and Discussion

Percentage of successful grafting

The success rate of grafting several varieties of durian is quite varied. Brongkol and sapuan tend to have a success rate of grafting with montong quite high, namely 83.3%. Both of these treatments were higher than the double of the seeds of durian Petruk who have percentage of 66.7%. The success rate of each treatment is presented in Figure 1.

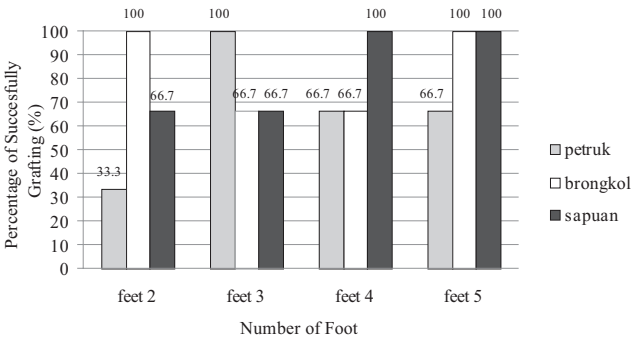

Fig. 1. Histogram of Successfully Grafting Percentage in 3 months old

Results of analysis of variance percentage of successful grafting at 3 months showed that each treatment and interaction between the foot and the type of adding stem not a significantly effect on the percentage of success, but the grafting with the combination Otong-Sapuan tend to be higher and the number of feet 5 likely to provide the success of grafting is higher than the other number of stem because based on visual observations of seedlings look more compact and

strong. Voutsela et al (2012) said that the root system of the plants affects vegetative growth and yield and as such, the effects of grafting recorded in most research papers are obviously related to the differences in the root system between grafted and non-grafted plants, that is, to the efficiency of water and nutrient uptake by the roots, or even to the distribution of growth regulators.

Linkage to the plant parts to be joined is more determined by the anatomical structure, physiological and biochemical properties (Lukito et al., 2004). Thus, in order to form a strong linkage rod and then entres to be suitable is to have family relationships (taxonomy) that is close.

Addition of Plant Height

Durian seedlings with double rootstock tend to give a higher value than a single stem durian. Grafting Otong with sapuan can produce durian seedlings feet 5 tends to be higher than the double stem durian seeds are grafted with Petruk. Added heights of each treatment are presented in Figure 2.

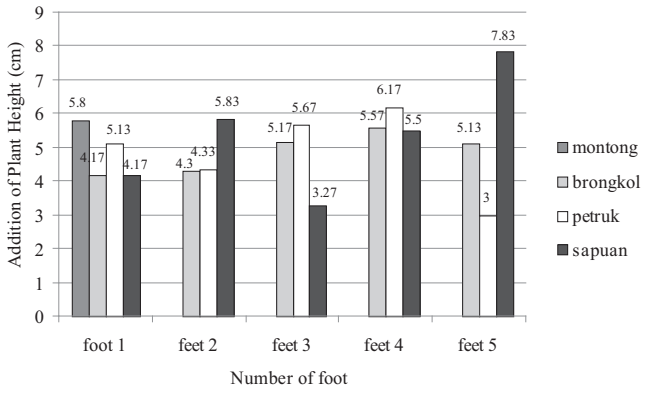

Fig. 2. Histogram of Addition of Plant Height

Based on the results of analysis of variance increase plant height at 3 months showed that the addition of the stems and type varieties on montong not a significant effect on plant height increment. The high growth of plants greatly influenced by genotypes obtained from the elders so as not seen a noticeable difference in the treatment of variety though connected by rods whose numbers vary. Likewise, the number of stems which is added not looks real effect on a variety. According to Rahmatian et al 2014, there were no significant differences in stem length among grafting treatments, whereas training method had different effect in variable so that double stemmed ones in trait.

Number of Shoots

Durian seedlings double stem Petruk Otong combination tends to produce a higher number of shoots than single stems seed or single stem seedling of Otong Petruk, except durian Otong-sapuan have a fewer number of shoots than the control. Numberя of buds on each treatment are presented in Figure 3.

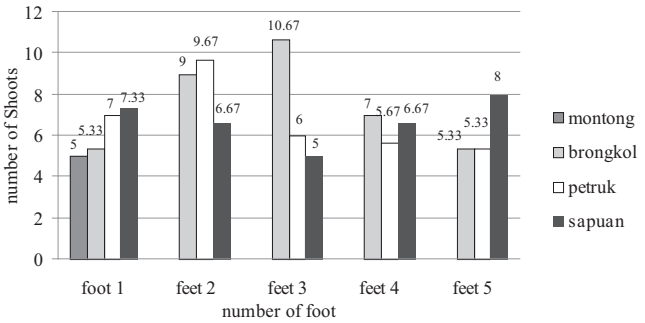

Fig. 3. Number of Shoots After Grafting

Results of analysis of variance in the number of post-grafting shoots conducted for 3 months showed that each treatment and combination of the number of legs and different varieties do not have a significant impact on a variable number of post-grafting buds. This shows that the number of buds have just as good even though the growth rate had been treated number of legs attached and different varieties, but the use of a double rootstock provides the number of shoots more than a single root durian.

This difference occurs because the bud formation is closely related to compatibility and food reserves in the second rod. According to Mathius et al. (2007) will not be the formation of proteins in the stem are not compatible because there are barriers to translocation of water and nutrients from the roots to the leaves and translocation of assimilates from leaves to all parts of the plant. The ability of plants form buds are also affected by the amount of accumulated reserves in the stump eating (Irawan and Gruber, 2004). Stump or larger trees produce buds are more than trees are small even though both are the same age (Adinugraha and Moko, 2006).

Addition of Stem Diameter

Durian seedlings double stem Otong sapuan has the greatest stem diameter, followed by a double stem of Brongkol seedlings. Three kinds of stem diameter of double stem seedlings has larger diameter than the diameter single-rooted seedlings of durian. Added high seedlings in each treatment are presented in Figure 4.

Results of analysis of variance accretion rootstock diameter conducted for 3 months showed that the combination of the number of legs and varieties do not give a significantly different effect, but more influential is the treatment of va-

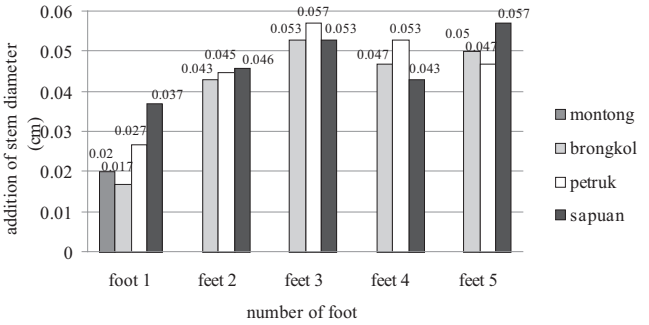

Fig. 4. Histogram Addition of Stem Diameter

rieties in stem diameter increment variable montong post continued. Most reports on grafting suggest that changes in scion are controlled by the rootstock through controlled uptake, snthesis, and translocation of water, minerals, and plant hormones (Davis et al., 2008). Big stem have better growth, so that can provide and transferring nutrients and minerals for growth (Sudidjo, 2009).

Diameter of Shoot

Diameter of shoots from otong has about the same value. This is because the shoots montong as scions formed is still too small based on the age and size relatively similar. Diameter shoots on each treatment are presented in Figure 5.

Based on the results of analysis of variance of the parameters of the shoot diameter showed that the addition of the foot does not have a significant impact on the growth of the shoot diameter. The treatment effect was not significant to diameter shoots at 3 months of age due to the growth of young plants have not been able to make starch or carbohydrates are good enough to be able to grow normally. The availability of food depends on the size of stem diameter is proportional to the amount of available food reserves. This is consistent with the statement Suwasono (1989) that the large diameter rod availability of food more than those with

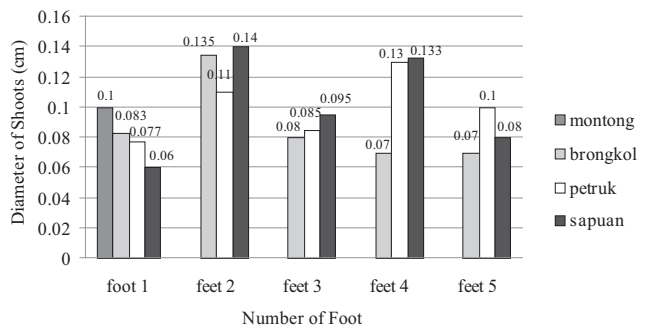

Fig. 5. Histogram of Shoot Diameter

a smaller diameter. Other literature that support is Hartman et al (2001) diameter rod is getting away from the shoots are generally larger and the diameter differences directly affect the ability of the plant to form buds for the average difference between the type and variability of carbohydrates and other stored materials.

The Number of Leaves

The number of leaves formed during the three months indicates that a double stem durian seedlings sapuan has leaves that are more than double stem durian seedlings Petruk, when compared with the number of leaves on a single stem durian seedlings which have leaves of 10-15, it appears that the seeds of double stemdurian generally have leaves more than 4 feet of Otong-Petruk who number fewer leaves than the control. The numbers of leaves on each treatment are presented in Figure 6.

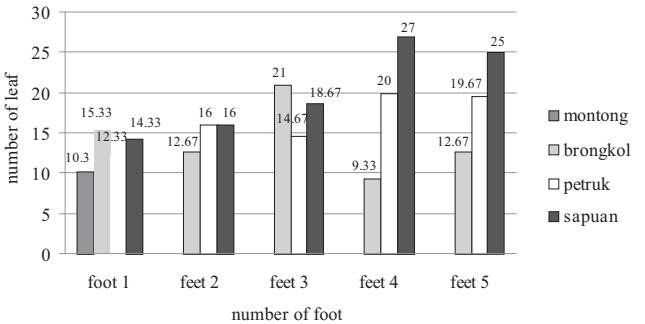

Fig. 6. Histogram of Leaves Number

Based on the results of analysis of variance the number of leaves showed that the combination treatment did not show any real effect, but more influential to treatment varieties. Durian seedlings which are grafted with sapuan 5 stems has leaves that are actually more than multiple stems of durian seedling otong-Petruk while the seeds of multiple stem treatment otong-Brongkol has leaves that amount did not differ significantly. When compared with the number of leaves on the addition of stem treatment showed no effect on the number of leaves, but there is a trend that the multiple stem of durian seedlings generally have leaves that are more than single-stem seedlings of durian (Figure 7).

Grafted plants on the rootstocks were more vigorous with significant higher yields in comparison with the non-grafted plants (Paroussi et al., 2007). Increasing the number of leaves on the multiple stem agreed with Ghoffar and Ashari research (2015), the addition of rootstock increase the number of leaves and buds are formed. Qin et al (2014) suggest that the use of a double rootstock increase the growth of plants, one of which the number of leaves due to transport

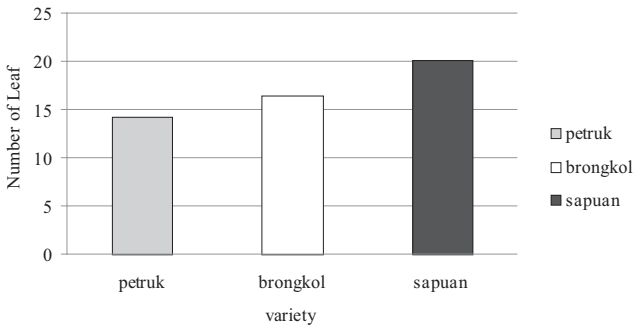

Fig. 7. Histogram effects of variety on durian seedling to the number of leaf

The figure followed by the same letter shows that there is no significant different in DMRT 5%

minerals and nutrients better formed than single rootstock. Wang et al (2010) stated that the use of double rootstock can also improve water uptake.

Leaf Area

Leaf area can be shown how much chlorophyll content. The chlorophyll fluorescence parameters can be used to assess photosynthetic performance in vivo (Baker 2008). Leaf area Otong as scions has almost the same value despite the addition of the treated leg. This is caused by age tend to be young, if you want to see the difference in leaf area formed needed a little time so that the effect of adding the rootstock can be seen. Histogram leaf area for each treatment are presented in Figure 8.

Based on the results of the analysis of a wide variety of leaves showed that the combination treatment time does not give a significantly different effect on the variable leaf area.

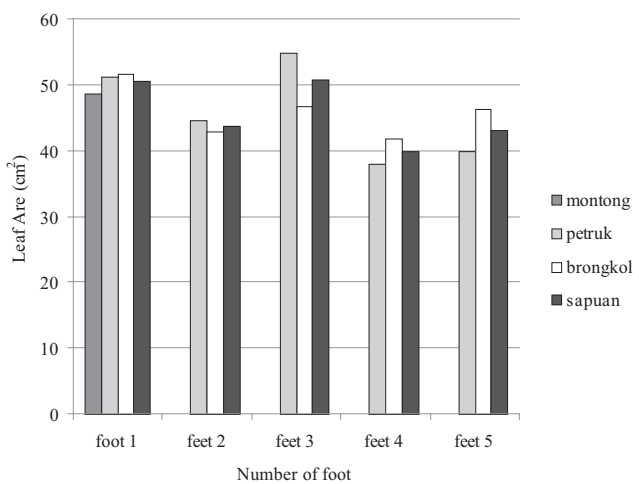

Fig. 8. Histogram of Leaf Area

Roselina et al. (2007) states that the extension of plant height and leaf area largely caused by the activity of the hormone gibberellin nature accelerates cell division activity. Thus the condition stems montong who have received treatment increase the number of feet with some varieties have the same fitohormon. Addition of exogenous hormone during grafting can be given to give more significant results.

Conclusions

Based on the research results that have been obtained, it can be concluded as follows:

Seedling which are grafted by the number 3 stem tend to have a better crop performance than single stem seedlings of durian.

The grafting with the addition of a multiple stem of combination Montong-Sapuan has good compatibility which it affects the number of leaves formed.

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