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STUDY ON ROOT STIMULATION OF CLONAL DURIAN ROOTSTOCK PROPAGATION-PRELIMINARY RESULTS

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ABSTRACT

Root stimulation technique on clonal durian rootstock propagation was evaluated in an experiment conducted from January 2006 to April 2007 at Indonesian Tropical Fruit Research Institute (ITFRI), Solok, West Sumatra. The experiment was arranged in factorial randomized block design with 4 replications and 35 plants per treatment unit. Two treatments applied were steam wound techniques: partly steam-sliced, bark-ringed, rounded skin-removed; and root growth regulator. After treatment, the stem was then mounted using media from container surface to 3 cm above the treatment point. Parameters of plant growth and rooting characteristic were collected at 4 month after treatment. Based on the results of observation, it was found that stem wounding technique has significantly effect to percentage of plant life, plant height, leaf number, and stem diameter. Application of root growth regulator was found to have significantly effect to leaf number, have not significantly effect to plant height and stem diameter, and have negatively effect to plant life. All treatments were found to have not significantly effect to all rooting parameters, whilst root oppositely grows below the treatment area. It is, therefore, suggested to narrowing the stimulation area as that in air layering technique to lead hormone accumulation on the treatment area.

Keywords: fruit, durian, root stimulation, clonal, rootstock propagation.

INTRODUCTION

Durian (*Durio zibhetinus* Murr.) is one of the most popular fruits for South East Asian people with no exception for Indonesian and so called 'King of Fruits'. This crop is the member of family *Bombaceae* and Kalimantan (Borneo) island of Indonesia believed as its center of origin (Nanthacai, 1994: Brown, 1997). Its cultivation area and productivity have posted at fourth among the fruit products, with the PDB value in 2006 reached 10% of the fruit sector (Agricultural Statistics, 2007).

One of the most important obstacles faced in durian development is the presence of rot disease caused by *Phytophthora palmivora*. This pathogen causes plant death, leaf blight, root rot, stem cancer, pre and post harvest fruit rot. Yield lost estimation caused by this pathogen in Indonesia is reported around 20-25% (Drent dan Sendall, 2004).

A suggestion to solve this problem is by using rootstock that tolerance to *P. palmivora* (Shamsudin *et al*., 2000). This rootstock could be produced from the tolerant plant through vegetative propagation (clonal) to secure genetic uniformity in seedling (Kotze and Darvas, 1983; Ernst, 2003), with regard to *P. palmivora* tolerance.

For durian, so far, no clonal rootstock propagation activity was reported. In avocado, however, clonal rootstock propagation technique has been successfully developed and commercially implemented in several countries of America and Africa (Salazar-Garcia and Borys, 1983; Ernst and Holtzhausen, 1987; Oliveira *et al*., 1999). The goal of this technique application is to propagate selected potential rootstock that tolerant to drought, flooding, saline soils, and calcareous soils, as well as for their resistance to *Phytophthora* (Salazar-Garcia and Borys, 1983). The techniques used were air layering, bark ringing, steam strangling, and IBA application (Oliveira *et al*., 1999).

Basically, this technique is the method to stimulate the formation of root to establish autonomous plant. Therefore, the successful of clonal propagation is depending on the successfully of root formation on the stem. This clonally method in Mexico is called *franqueamiento* (Salazar-Garcia and Borys, 1983), and in complete model with scion grafted is called *multiple cloning techniques* (Ernst, 2003).

The purpose of this study was to obtain root stimulation technique for clonal durian rootstock propagation.

MATERIALS AND METHODS

The experiment was conducted at Aripan Experimental Farm, Indonesian Tropical Fruit Research Institute, Solok, West Sumatra from January 2006 to April 2007. The trial was arranged in Factorial Randomized Complete Block Design, with 4 replications and 35 plants for each treatment unit.

First treatment was stem wounding technique, consisted of three treatments namely: 1) partly stem-sliced, where the bark was sliced about 1/3 part with lenght of 4-5 mm, 2) bark-ringed, where the bark was ringed using 1 mm copper-wire about 2 mm above the grafted point, and 3) rounded skin-removed, where the skin was fully removed rounded the bark with of 4-5 cm above the grafted point. The second was root growth regulator (RGR) application (Rapid root™ with active ingredient of IBA 0.20%). RGR was applied by smearing the pasta-form onto the treatment area.

Plant materials used in the experiment were grafted seedlings of local durian variety which simulatedly conducted representing the tolerant variety. After application, the seedlings were then mounted with media (mix of soil and cow manure 1:1) till 3 cm above the treatment point. Durian rootstock propagation is illustrated

in Figure-1. The seedlings are then maintained based on the nursery standard.

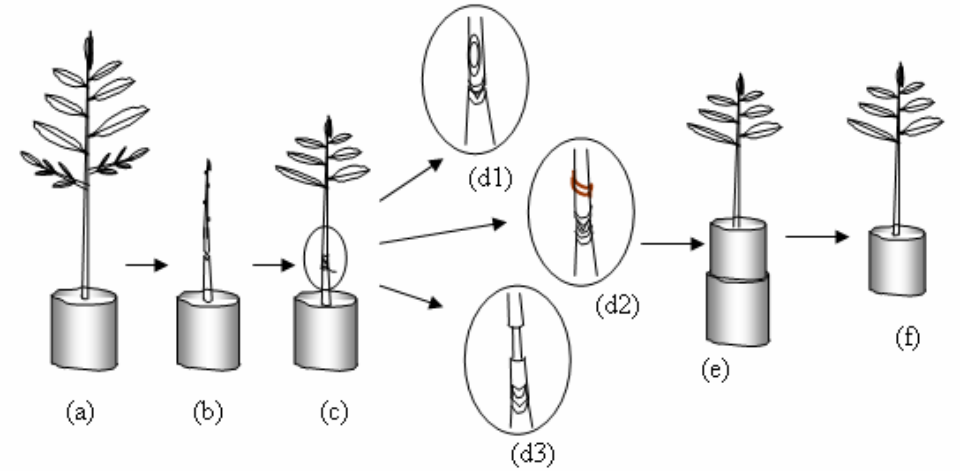

Figure-1. Illustration of durian rootstock propagation); (a) rootstock, (b) grafting of intersteam, (c) seedling ready for clonned, (d1) partly wood sliced, (d2) bark ringed, (d3) rounded skin removed, (e) mounted with media, (f) expected clonal rootstock.

Observation was conducted at 4 month after treatment on the plant growth and rooting parameters, namely: plant life percentage, plant height, leaf number, stem diameter, rooted stem, callus formation, root number, and root length. Collected data were then analyzed using Analysis of Variance (Anova) followed by 5% HSD test.

RESULTS AND DISCUSSIONS

Plant growth characteristics

Values of plant life, plant height, leaf number, and stem diameter based on statistic analyses for the treatments of stem wounding technique and RGR application are presented in Table-1.

Table-1. Effect of wounding technique and RGR application on values of plant life, plant height, leaf number, and stem diameter.

Treatment	**Plant life** (%)	**Plant height** (cm)	**Leaf number**	**Stem diameter** (cm)
Wounding Technique				
Partly wood-sliced	67.8a	29.1a	10.5a	0.36a
Bark-ringed	72.9a	27.4a	9.6a	0.34a
Rounded skin-removed	24.7b	17.6b	5.5b	0.24b
RGR Application				
Without RGR	71.1a	25.6a	10.0a	0.34a
With RGR	39.2b	23.7a	7.0b	0.29a

* Means in the same column followed by the same letter are not significantly different at 5 % HSD test

The data show that stem wounding treatment was found to have significantly effect on plant life percentage, plant height, leaf number, and stem diameter. Among three stem wound treatments, partly wood-sliced and bark-ringed are found to have higher value than rounded skin-removed treatment. Value of plant life percentage on plant with partly wood-sliced and bark-ringed treatments are 72.9% and 67.8% respectively, whilst on the plant with rounded skin-removed was 24.7%. These are presumed that stem wounding with partly wood-sliced and bark-ringed techniques are not discontinued bark function for photosintate translocation from leaf to other organs to keep plant grow normally. Plant treated with rounded skin-removed, on the contrary, discontinues the photosintate translocation which is resulting in annoyed plant growth.

RGR application was found to have not significantly effect on plant height and stem diameter, but have significantly effect on percentage of plant life and leaf number. Plant life percentage was 71.1% on seedling without RGR application, higher than seedling with RGR application where the plant life percentage was 39.2%. Similar condition was found also on the leaf number, which the highest number of leaf was on the seedling without RGR application with the number of 10.0 leaves compared to

7.0 on the seedling with RGR application on 4 month after treatment. This finding indicates that the application of RGR in fact inhibit plant growth. Its might be due to high concentration, such generally know that the RGR is useful only in low concentration, inversely inhibit plant growth in high (Salisbury and Cleon, 1995).

Mean values of plant life, plant height, leaf number, and stem diameter in different root stimulation techniques are presented in Table-2.

Table-2. Mean values of plant life, plant height, leaf number, and stem diameter for different root stimulation techniques.

Stimulation technique	**Plant life** (%)	**Plant height** (cm)	**Leaf number**	**Stem diameter** (cm)
Partly wood-sliced	81.95	26.49	9.88	0.35
Partly wood-sliced + RGR	53.68	31.64	9.28	0.35
Bark-ringed	88.28	28.91	11.68	0.36
Bark-ringed + RGR	57.55	25.85	9.36	0.33
Rounded skin-removed	43.06	21.48	8.49	0.31
Rounded skin-removed + RGR	6.42	13.75	2.44	0.18

* Data was not statistically analyzed

Among the six techniques, it was found that bark-ringed without RGR is the best technique which having highest values of plant life (88.28%), leaf number (11.68), and stem diameter (0.36cm), followed by partly wood-sliced without RGR which found to have value of plant life 81.95%. Whilst, rounded skin-removed with RGR was found to have the worst technique. Although partly wood-sliced with RGR was found to have highest value of plant height (31.64 cm), however, the value of plant life is too low which only 53.68%.

Rooting characteristics

Values of rooted stem, callus formation, root number and root length based on statistical analysis for the traits of stem wounding techniques and RGR application are presented on Table-3. In general, combinations of stem wounding technique and RGR application were found to have not significantly effect to rooted stem percentage, callus formation, root number, and root length. Partly wood sliced technique, however, was found to have highest value for all four parameters observed.

Table 3. Effect of wounding technique and RGR application on values of rooted stem, callus formation, root number, and root length.

Treatment	**Rooted stem** (%)	**Callus formation** (%)	**Root number** (piece)	**Root length** (cm)
Wounding Technique				
Partly wood sliced	2.8a	50.00a	2.9a	3.9a
Ringed	2.0a	42.50a	1.3a	2.8a
Rounded skin removed	1.4a	33.75a	1.0a	1.2a
RGR Application				
Without RGR	2.3a	44.17a	1.9a	2.9a
With RGR	1.9a	40.00a	1.7a	2.4a

* Data was transformed using Square Root Transformation
** Means in the same column followed by the same letter are not significantly different at 5 % HSD test

Mean values of rooted stem, callus formation, root number, and root length in different root initiation techniques are presented on Table-4.

Table 4. Mean values of rooted stem, callus formation, root number, and root length for different root stimulation techniques.

Initiation Technique	**Rooted stem** (%)	**Callus formation** (%)	**Root number** (piece)	**Root length** (cm)
Partly wood-sliced	7.5	42.5	2.89	2.5
Partly wood-sliced + RGR	17.5	57.5	3.06	5.78
Bark-ringed	5	45	1	3.38
Bark-ringed + RGR	10	40	1.56	2.17
Rounded skin-removed	5	45	1.75	1.75
Rounded skin-removed + RGR	2.5	22.5	0.25	0.5

* Data was not statistically analyzed

Generally, it was found that rooted stem percentage for all treatments are very low, however, the stem tend to high in callus formation. The development of callus in fact indicates that there is an opportunity of efficacy in root initiation for clonal durian rootstock. Because the callus is undifferentiated form of parenchyma cell in lignifications phase (Ernst and Holtzhausen, 1987), and adventives root of several species are known differentiated from callus which established on the tip of cutting (Hartmann *et al.*, 1990).

The average value of rooted stem, root number, and root length is relatively low. It is presumed due to the short time of observation at only 4 months after treatment. Supriyanto *et al.* (2000) stated that transplantation or grafting is a hurt process and need lots of energy for plant to recovery; consequently, the root forming requires relatively longer time. According to Sudaryono and Soleh (1994), root formation of plant wounded ideally requires six to eight months.

In this rooting characteristic observation, it was also found that roots did not grow on the wounding point, but on the stem below the grafting area (Figure-2). This is presumed due to conglomeration of media which covered entire part of stem from container surface to above the treatment. It is in according to the nature of root hormone which avoiding light and make a move by polar (Salisbury and Cleon, 1995), so that root hormone is not accumulated on the treatment area, but flatten along the stem edge covered by media, then root grows on that area.

Figure-2. Plants show root forming below the grafting area for all three treatments.

CONCLUSIONS

Stem wounding technique was found to have significantly effect to percentage of plant life, plant height, leaf number, and stem diameter. Application of root growth regulator was found to have significantly effect to leaf number, have not significantly effect to plant height and stem diameter, and have negatively effect to plant life.

All treatments were found to have not significantly effect to all rooting parameters, whilst root oppositely grows below the treatment area. It is, therefore, suggested to narrowed stimulation are as in air layering method to lead hormone accumulation on the treatment point.

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