

Efectifity Of Plant Rejuvenation Technology (Side Grafting Method) On Quality Characteristics Of Cocoa Beans

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ABSTRACT

Cocoa beans is one of a commodity that was still profitable and exported to several countries in the World, Cocoa beans are currently used frequently now if seen from quality is still low, this is caused by several things, one of the factor is genetic character of cocoa plant, and a lot of farmers was cultivated the old cocoa plant, that are not optimal to productive anymore. The solution was applied for this problem is applicate plant rejuvenation technology program such as side grafting techniques which are expected to be able to improve the quality and quantity of cocoa beans, so this study aims to see how much the effectifity of Plant Rejuvenation Technology (Side Cleft Grafting Method) Program by using four types of clone treatments. Among them is Local, S-1, S-2 and MCC clone on the cocoa beans quality was produced, including, Fat Content, Total Acid and Moisture Content of cocoa beans, the research method used was the analysis of Randomized Block Design and each treatment was repeated for three times, after that Anova analysis also doing, to get information about relationship between two variable on this research, and the last used Duncan method is Multiple Range Test continued using the SPSS application Ver. 21, to obtain data on the relationship between each treatment given. The results obtained that, the application of plant rejuvenation technology on cocoa plants in is given an effect on the quality of the cocoa beans produced, in this study using four types of clones, based on the Duncan test, it was obtained data, show the types of clones that gave the best quality characteristics, that is water content, fat content and total acid, is it S-2 and MCC clones, from In this study it can be concluded that side grafting technique is effective in rejuvenating cocoa plants, because it can be improve the quality characteristics of the cocoa beans produced, and each type of clone used also affects the quality of the cocoa beans produced.

Keywords:

Cocoa, Plant
Rejuvenation,
Side Cleft
Grafting Method,
Quality

INTRODUCTION

Cocoa is one of the plantation commodity whose growth so suitable in the tropic area, and according to some society, think that cocoa bean is commodity which have high selling value in terms of productivity and society needs [1]. However that, the quality of the cocoa beans produced is still low, make it difficult to compete with another cocoa in the world market. Several efforts have been made by the government in order to overcome this problem, such as rejuvenating old cacao plants, expanding the area, rehabilitating, intensifying and In plant diversification, this effort is expected to be able to support increased the cocoa production.

The current low productivity of cocoa is caused by several factors, one of the factors is age of the plant which to old, so that it is not optimal again to produce large quantities of cocoa beans, based on previous research that the productivity of cocoa plants aged among 15-20 years begins to decline, where the ability to produce is only a half of its potential productivity, so it is need some action, is application of rehabilitation for old plants [2].

The problem that is usually experienced by farmers in cocoa commodity development is, production still very low, which only less than 500 kg produced in a year, because the seeds was used, came from unclear origin, so even though it has been planted for years, nonetheles cocoa beans was produced still low quantity. There are few cocoa pods produced, besides that the cultivated cacao plants are no longer productive, namely over 25 years. With the Gernas program

issued by the Government, the implementation of plant rehabilitation using superior seeds derived from different clones, has resistance to CPB pests. Where this activity is carried out by side cleft grafting technique, which is quite easy to apply and does not need to dismantle the plant, according to [3]. Side grafting method is an economical and profitable program, because with the application of this technique it does not need to wait long to harvest back.

Side grafting method can be applied to cocoa plants for restore production from old plants. Cocoa is an annual commodity that is considered to have high economic value in domestic or overseas market. The cocoa cultivation process is also quite short because within 4 years the cocoa pods can be harvested. If cultivated with good properly, it can be produce up to 25 years. According to [4]. In 2018 to 2019 there was a significant decrease in production of Indonesian Cocoa beans, where in 2018 the income of cocoa production was 366.000 tons, then in 2019 the production was 285.000 tons, this decline was 81.000 tons. , this is cause by productivity problems and reduced planting area. The decrease in cocoa productivity in Indonesia caused by the large number of old plants [5]. Unproductive Plants which is old can be rehabilitated by providing side cleft grafting method, which connects the scion (entres) from superior seeds to local cocoa rootstocks [6] and [7].

West Sulawesi is one of province being a cocoa producer with a contribution of 10% to the national cocoa production, from this data it shows

that cocoa is one of the pillars of increasing farmer income in West Sulawesi, but ironically this production continues to decline, based on data from the Data Center and Agricultural Information [8] the decline occurred by approximately 10 tons from 2012 to 2015, the factors that influenced this decline were the area of the garden, old plants, damaged, unproductive, affected by pests. So that farmers began to apply plant rejuvenation technology, that is side grafting method on cocoa plants, however, currently data related to the success of this technology is still lacking, especially in West Sulawesi, so that observations regarding the effectiveness of the application of plant rejuvenation technology (Side grafting method) using the different clones needs to be done to see, how far this technology can increase the productivity and quality characteristic of cocoa beans.

METHOD

This research was conducted in the Cocoa Plantation, Pussui Village, sub-district Luyo District. Polewali Mandar and at the Laboratory of Nutrition, Faculty of Animal Husbandry, Hasanuddin University to test the quality characteristic of cocoa beans. This research was conducted by maintaining cocoa plants that had been grafted using four types of clones, is it S-1, S-2 and MCC clones, while for control or comparison samples also observed untreated local cocoa clones, each sample was carried out three replications. Data analysis using ANOVA method, then further test with Duncan Multiple Range Test at 90% level, using SPSS application

version 21 to assess the influence of various treatment on the results was obtained.

1. Testing Parameters

a) Water Content

The water content of cocoa bean was observed by calculating the difference between the weight of the cocoa bean dried in an oven at 103 ° C for 16 hours which was calculated using the equation (SNI 2323: 2008) :

Water Content (%)

$$= \frac{(M_1 - M_2)}{(M_1 - M_0)} \times 100 \dots \dots \dots (1)$$

- Information :
- M₀** : Weight of Cup and Cover (g)
 - M₁** : Weight of Cup, Cover and sample before before drying (g)
 - M₂** : Weight of Cup, Cover, and Sample after drying (g)

b) Fat Content

Testing of Fat Content of Cocoa Bean is according to reference (SNI 2323: 2008), where the principle is to extract bean fat using a non-polar organic solvent (petroleum benzene 40 °C - 60 °C, after hydrolyzing with HCL solution.

The equation used is as follows:

$$\text{Fat Content (\%)} = \frac{100(M_2 - M_1)}{M_0} \times \frac{100}{(100 - KA)} \dots (2)$$

Information :

M_0 = Weight of Sample (g)

M_1 = Weight of boiling flask and boiling stone (g)

M_2 = Weight of boling flask, boiling stone and fat (g)

KA = Water content of sample (g)

c) Total Acid

The total acid test was done by dissolving the sample with aquadest and then titrating it with NaOH solution. Where the percentage of total acid is calculated by the equation:

$$\text{Total Acid (\%)} = \frac{ml NaOH \times N. NaOH \times Grek \times FP}{Weight of sample \times 1000} \times 100 \dots (3)$$

Information :

F_p = Dilution Factor

$Grek$ = Gram Equivalent

RESULT AND DISCUSSION

1.1. Water content

Observations was done on cacao plants with side cleft grafting method using S-1, S-2, and MCC clones and local cocoa as control samples. Based on the analysis of variance carried out on the treatment of side grafting method with different types of clones on water content of cocoa beans, it is presented in table 1.

Table 1. Water Content of cocoa bean

Treatment	Repetition			mean
	1	2	3	
Local	5,75	5,87	5,65	6±0,11 ^a
S-1	6,97	6,78	6,5	7±0,23 ^b
S-2	6,02	6,7	6,9	6,54±0,46 ^b
MCC	6,33	6,7	6,75	6,59±0,22 ^b

Different letters in Superscript Mean numbers Is very significant difference (P<0.005)

Side cleft grafting method treatment on cocoa plants had a significant effect (P <0.05) on the resulting of water content, it is shown in Table 1 that the local clone as a comparison sample was different from other clones with superscript a, but for each clone type treatment had no real effect, the water content produced by types S-1, S-2 and MCC were in the same superscript, indicating that the three clones had the same water content.

Water content data of cocoa beans have been tested, that shown at Graph 1 below.

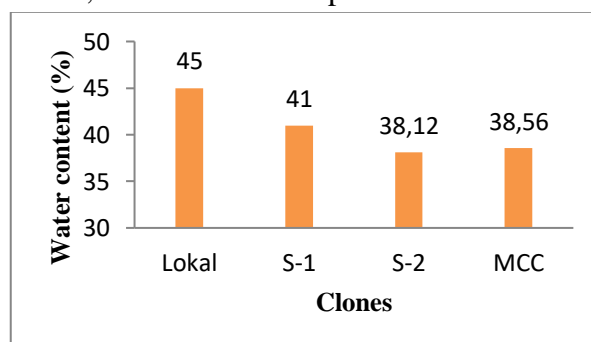


Figure 1. Water Content Of Cocoa Bean After Side Cleft Grafting Method

Based on physical tests in the laboratory about water content of cocoa beans that have been applied side cleft grafting method with various types of clones (graph 1), it shows if water content of cocoa beans produced ranges from 6 - 7%, where the value obtained is in accordance with the SNI 2323-2008, with a maximum water content is 7.5%. Water content is completely

affected by drying way was done. The cocoa beans physical characteristic being great concern by the buyers is water content, especially companies, because it affect the shelf life of cocoa beans, if water content is high, it is very easy to damage growth of fungi which makes the taste and quality characteristic of cocoa beans decrease, this is accordance with the opinion [9], states that the water content of export quality is with a value of 6-7% if the water content value exceeds that then it is not safe to be stored for a long time, whereas if the water content is also too low below 6% then the seeds are not entered into company standards because it can cause fragility during storage and distribution. According to [10], a high water content with a value of 8% and above causes the seeds to be easily attacked by fungi and insects, thereby increasing the risk of seed damage, whereas if the water content is below 5% it causes the seeds are easily to damage.

1.2. Fat Content

Fat content testing carried out is presented in table 2 below:

Table 2. Fat Content

Treatment	Repetition			Mean
	1	2	3	
Lokal	44,87	45,32	44,89	45±0,25 ^a
S-1	40,01	40,45	41,65	41±0,84 ^b
S-2	38,14	37,9	38,32	38,12±0,21 ^c
MCC	38,6	37,99	39,1	38,56±0,55 ^c

Different letters in Superscript Mean numbers Is very significant difference (P<0.005)

Side grafted cocoa beans showed a significant difference fat content in the beans. Where the data shows the highest cocoa bean fat is in the local

cocoa type without side grafting treatment, while the lowest fat content is in the types of clones S-2 and MCC which have almost the same values, is 38, 12 and 38.56. From the analysis of variance it can be explained that the treatment of S-2 clones was not significantly different from MCC clones but significantly different from S-1 and local clones. This suggests that the side grafting method has an effect on the fat content contained by the seeds, depending on the type of clone used. According to [11] the fat contained in the seeds is determined by the fat constituent components, where this component is not influenced by the processing of the seeds after harvest, but is influenced by the maturity of the fruit on harvest, the type of clone, the place to grow and the harvest season, if Cocoa beans are harvested during the rainy season, so usually the resulting fat content is relatively higher.

1.3. Total Acid

The total acid test was conducted to determine the total acid in cocoa beans from each type of clone used. The total acid data is shown in Graph 2 below:

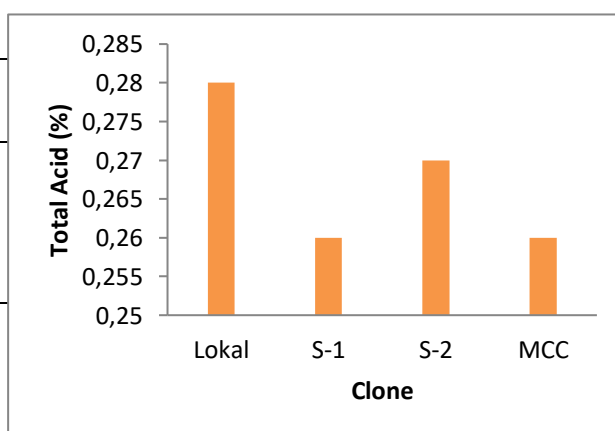


Figure 2. Fat Content Of Cocoa Bean After Side Grafting Method

Based on the test, the data showed that the highest total acid was in cocoa beans without side grafting treatment, and the lowest total acid was in cocoa beans is S-1 and MCC clones, this indicates that the acidity of local clones without applied side grafting method was low, because the total acid obtained was more higher than the other clones, whereas for S-1 and MCC clones containing high acidity, the acidity or pH of the seeds is influenced by Total Acid, where if the total acid is high, the acidity is low and vice versa, according to the opinion of [12] parameter for determining processed products with acids, where if the total acid content in food material increases, this is in line with the decrease the pH value of the food ingredient.

The effect of clone treatment applied to the side cleft grafting method is presented in table 3 below.

Table 3. Total acid of Cocoa Beans

Treatment	Repetition			Mean
	1	2	3	
Local	0,23	0,29	0,31	0,28±0,04 ^a
S-1	0,22	0,32	0,23	0,26±0,05 ^b
S-2	0,29	0,23	0,3	0,27±0,03 ^b
MCC	0,26	0,3	0,22	0,26±0,04 ^c

Different letters in Superscript Mean numbers Is very significant difference (P<0.005)

Analysis of variance result conducted showed that there was a significant effect of the side cleft grafting method applied to the total acid produced, and further tests using the Duncan method showed that the treatment of local clones, and S-1, S-2 and MCC were significantly different to the total acid produced, meanwhile, the S-1 and S-2 clones were not significantly different. According to [13] side grafting

treatment on cocoa plants has a significant effect on the total acid produced.

CONCLUSION

Plant rejuvenation technology (side grafting method) is a program to improve productivity in terms of quality and quantity of cocoa pods and beans, with this method, old cacao plants that are no longer optimal in productivity can return to productivity, research that has been done shows the application of plant rejuvenation technology take effect on the quality characteristics of the cocoa beans produced, and the use of different types of clones also had a significant effect on the quality of cocoa beans, for types of clones that were good in terms of quality were, use of MCC and S-2 clones.

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