Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.9.No.3. 2022 (24) 196- 200 DOI: 10.32734/jpt.v9i3, Dec.10215

Improving the Quality of Cacao Beans (Theobroma cacao L.) With the Use of Yeast Types and Soaking Time in the Fermentation Process

Perbaikan Mutu Biji Kakao (*Theobroma cacao L.*) *Dengan Penggunaan Jenis Ragi dan Lama Perendaman Pada Proses Fermentasi*

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ABSTRACT

The quality of cocoa beans at the farmer level is very low. One of the main factors that makes the quality of cocoa low is fermentation. Fermentation improvements will improve the quality of the cocoa beans produced. This study aims to examine the effect of using the type of yeast and soaking time on the quality of cocoa beans. This research was carried out in the laboratory of the Faculty of Agriculture UISU Medan using a factorial Completely Randomized Design (CRD), which consisted of two factors, namely: Factor I type of yeast (R) consisting of 4 levels: R0 = Control; R1 = Baker's Yeast; R2 = Yeast Tempe and R3 = Yeast Tape. Factor II Immersion time (P) consists of 4 levels: P1 = 1 hour; P2 = 2 hours; P3 = 3 hours and P4 = 4 hours with 2 repetitions. Parameters observed were yield, pH, moisture content, fat content and taste and aroma organoleptic tests. The data were analyzed by means of variance and if it had a significant effect, then it was continued with the Duncan's Multiple Range Test (DMRT). The results of the study showed that the type of yeast had a significantly different effect on pH, moisture content, fat content and taste and aroma organoleptic test values. Soaking time had significantly different effect on pH, fat content and taste and aroma organoleptic test values. The interaction of the treatment with the effect of yeast type and soaking time had no significant effect on all parameters observed. Fermentation using baker's yeast during soaking resulted in an increase in the organoleptic value of taste (3.70), aroma (3.29). Soaking time causes a decrease in the level of acidity, moisture content, fat content, taste and aroma organoleptic test values. Thus the fermentation of cocoa beans with the use of baker's yeast can improve the quality of cocoa beans.

Keywords: cocoa, fermentation,quality, yeast.

ABSTRAK

Kualitas biji kakao di tingkat petani sangat rendah. Faktor *utama yang menjadikan mutu kakao tersebut rendah salah satunya fermentasi. Perbaikan fermentasi akan meningkatkan mutu biji kakao yang dihasilkan. Penelitian ini bertujuan untuk mengkaji pengaruh penggunaan jenis ragi dan lama perendaman terhadap mutu biji kakao. Penelitian ini telah dilaksanakan di laboratorium Fakultas Pertanian UISU Medan menggunakan Rancangan Acak Lengkap (RAL) faktorial, yang terdiri dari dua faktor yaitu : Faktor I jenis ragi (R) terdiri dari 4 taraf : R_0 = Kontrol; R_1 = Ragi Roti; R_2 = Ragi Tempe dan R_3 = Ragi Tape. Faktor II Lama perendaman (P) terdiri dari 4 taraf : P_1 = 1 jam; P_2 = 2 jam; P_3 = 3 jam dan P_4 = 4 jam dengan jumlah ulangan 2 kali. Parameter yang diamati adalah rendemen, pH, kadar air, kadar lemak dan uji organoleptik rasa dan aroma. Data dianalisis dengan sidik ragam dan apabila berpengaruh nyata, maka dilanjutkan dengan uji Duncan's Multiple Range Test (DMRT). Hasil pengkajian menunjukkan bahwa jenis ragi berpengaruh berbeda nyata terhadap pH, kadar air, kadar lemak dan nilai uji organoleptik rasa serta aroma. Lama perendaman berpengaruh berbeda nyata terhadap pH, kadar lemak dan nilai uji organoleptik rasa serta aroma. Interaksi perlakuan pengaruh jenis ragi dan lama perendaman berpengaruh berbeda*

tidak nyata terhadap semua parameter yang diamati. Fermentasi dengan menggunakan ragi roti selama perendaman menghasilkan peningkatan nilai organoleptik rasa (3,70), aroma (3,29). Lama perendaman menyebabkan terjadi penurunan tingkat keasaman, kadar air, kadar lemak, nilai uji organoleptik rasa dan aroma. Dengan demikian fermentasi biji kakao dengan penggunaan ragi roti dapat meningkatkan kualitas biji kakao.

Kata kunci : kakao, feremtasi, kualitas, ragi.

INTRODUCTION

The process of processing cocoa beans greatly determines the final quality of the cocoa beans. The processing of cocoa beans will determine the distinctive taste of cocoa and reduce or eliminate bad flavors. For example, bitter and astringent taste, is caused by the content of purine compounds, namely theobromine and caffeine for bitter taste. While the amount of theobromine in the cotyledons is about 1.5% and caffeine is about 0.15%. If the quality of our cocoa is not improved, in the end, the planters, especially the cocoa farmers, are the ones who are the biggest losers. And if this continues, there will be a sluggishness in our cocoa business sector, which will result in a sluggishness of our cocoa in the eyes of the world (Dirjenbun 2021).

The fermentation process is a determinant of the processing of cocoa beans. One of the benchmarks for imperfect fermentation is the production of slaty beans, namely beans that have a cheese-like texture, in cocoa the purple color is still dominant and does not produce the distinctive taste of cocoa. In addition, supervision and monitoring of each stage of the process must be carried out regularly so that there are no quality deviations because this is very much considered by consumers because cocoa beans are a raw material for food or beverages (Apriyanto et al. 2017).

The quality of cocoa beans is determined by the content of flavonoids, taste and aroma. The number of these components reaches 58% of the entire phenolic content, 37% catechins, and 4% anthocyanins (Marwati, et al, 2019). Cocoa fermentation is a decisive step in the production of quality chocolate and is highly dependent on the growth of microbiota, especially yeast, lactic acid bacteria and acetic acid bacteria (De Vuyst and Weckx, 2016).

Cocoa with a cocoa bean content of more than 70% also has health benefits, because cocoa is rich in antioxidants, namely phenols and flavonoids. With the presence of antioxidants, will be able to capture free radicals in the body. The amount of this antioxidant content is even 3 times more than green tea, a drink that has been often considered a source of antioxidants. The presence of antioxidants makes cocoa a healthy drink. Phenol, as an antioxidant, can reduce cholesterol in the blood so that it can reduce the risk of having a heart attack is also useful for preventing cancer in the body, preventing stroke, and high blood pressure. In addition, the fat content in high-quality cocoa is proven to be free of cholesterol and does not clog blood vessels. Cocoa also contains several vitamins that are useful for the body such as vitamin A, vitamin B1, vitamin C, vitamin D, and vitamin E. In addition, cocoa also contains substances and nutrients that are important for the body such as iron, potassium, and calcium. Another benefit of cocoa is for beauty-because the antioxidants and catechins present in it can prevent premature aging, so it's no wonder that cocoa scrubs are currently developing which are very good for skin beauty (http://sultra. litbang.deptan.go.id .2011).

Cocoa beans contain 55% fat content consisting of mixed triglycerides which are esters of glycerol and long-chain fatty acids. Cocoa butter can be made as a basic ingredient of confectionery, mixing powdered milk, lubricants, and raw materials for medicines and cosmetics. Cocoa fat is solid, and a high-fat content can make it difficult to process cocoa flour. So before processing this fat must be reduced to 23%. Protein in cocoa beans in combination with tannins that cannot be separated. Well-fermented seeds contain protein consisting of 13.5% albumin, 3.1% globulin, 8.3% prolamin, 13.5% glutamine, and also 43.6% residue, while unfermented seeds contain 25% acid. free amino acid (Marwati et al. 2019). But it is very unfortunate that a large number of dry cocoa beans in Indonesia are cocoa beans obtained not from fermentation (Ajmaja *et al*. 2016). Based on

Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
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the information above, this study aims to determine whether fermenting cocoa beans using yeast and soaking time produces more optimal fermented cocoa beans in terms of time and quality.

MATERIALS AND METHOD

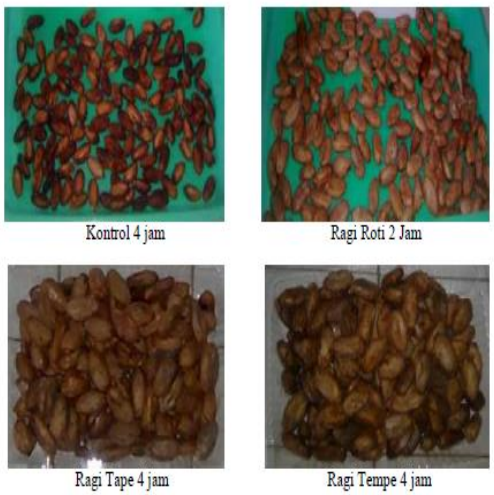
This research has been carried out at the Agricultural Product Technology Laboratory, Faculty of Agriculture, UISU Medan. The ingredients used are cocoa pods from farmers around Deli Serdang Regency and yeast (tempe yeast, bread yeast, and tape yeast). Wooden box 16 x 16 x 40 cm3, basin, burlap sack, becker glass, stainless steel knife, porcelain cup, scale.
The design model used in this study was a factorial completely randomized design (CRD), which consisted of two main factors, namely factor I: type of yeast (R) which consisted of four levels (R0 = control, R1 = baker's yeast. R2 = tempeh yeast, and R3 = yeast tape). Factor II: soaking time (P1 = 1 hour, P2 = 2 hours, J3 = 3 hours, and P4 = 4 hours). The number of treatment combinations is as many as 16 with many repetitions 2 times.

The research was carried out by sorting and selecting cocoa pods from the field, and peeling the cacao pods using a sickle or knife without touching the cocoa pulp. After that, the seeds were withdrawn from the placenta so that the cocoa pulp was clean from the skin, and placenta. Furthermore, each 500 gram sample was taken for each treatment. Before fermentation, 10 grams of yeast is dissolved in 1 liter of water, then mixed into the cocoa mass (without yeast, baker's yeast, tempeh yeast, and tape yeast). Cocoa was soaked according to treatment (1 hour, 2 hours, 3 hours, 4 hours), fermented in a box for 4 days then dried in an oven at 630C for 3 days. The parameters observed were physical form (organoleptic. test).

RESULTS AND DISCUSSION

Changes in Conditions After Fermentation

The measurement results can be seen in Figure 1. In general, it can be seen that there is decay or shedding of the pulp of cocoa beans during fermentation with the addition of yeast. This is an indication that the micro activity during fermentation derived from yeast works actively to break down the pulp into simpler compounds (glucose and acetic acid) and helps the appearance of changes in color, taste, and aroma of fermented cocoa beans (Moens *et al* 2014).



Gambar 1. Biji kakao hasil fermentasi

Fermentation of cocoa beans with the addition of baker's yeast for 2 hours produced dry cocoa beans that had a more uniform color and shape than the control, tape yeast, and tempeh yeast. The results of this test are in accordance with the research of Hermani and Winda (2013) which describes that the provision of microbes during fermentation will bring out the distinctive color of cocoa beans, namely brown. It can be explained that the main microbe of baker's yeast is the type of yeast *Saccharomyces cerevesiae*. These yeast cells have stable physiological properties, are very active in breaking down sugar, namely converting starch and sugar into carbon dioxide and alcohol, are dispersed in water, have a long shelf life, and grow very quickly (Apriyanto *et al* 2016).

Physical and Chemical Parameters

The results of the analysis of diversity (ANOVA) showed that the yeast-type treatment had a significant effect on the seed pH, fat content, and organoleptic value of taste and aroma. The average results of observations of the influence of yeast types on parameters can be seen in Table 1.

From Table 1 it can be seen that the type of yeast added to the cocoa bean soaking process resulted in the highest yield, pH, water content, and fat content at R0, the highest taste, and aroma organoleptic test values at R1. However, the type of yeast showed no

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v9i3, Dec.10215

significant difference in yield. The highest pH of cocoa beans was obtained at treatment R0 (control) and the lowest was R3 (yeast tape). The addition of yeast in the cocoa bean fermentation process is to break down glucose compounds into organic acids that lower the pH. The results of the fermentation showed that lactic acid bacteria became active which caused the seeds to die and there was a breakdown of glucose and ethanol into lactic acid and organic acids as precursors of taste, aroma, and brown color (Kadow et al. 2015; Pramana and Handoko 2022).

From Table 1 it can be seen that the highest moisture content of cocoa beans was obtained in the treatment R¬0 (control) and the lowest was R3 (yeast tempe). This is because the microbes in tempe yeast can synthesize the enzyme alpha-amylase (breakdown of starch) and break down the starch into simple sugars found in the cocoa bean pulp, making it easier to dry. Thus more water is removed from the cocoa beans (Silvia *et al* 2017).

Tabel 1. Effect of Yeast Type on the Parameters

Treatment	Parameter					
	Yield (%)	pH	Moisture Content (%)	Fat Level (%)	Organoleptic Value	
					Taste	Flavour
Yeast Types						
R_0 = Control	35.689	5.921^a	7.900^a	54.700^a	3.300^c	2.450^d
R_1 = Baker's Yeast	35.166	5.683^b	6.875^c	53.800^c	3.700^a	3.288^a
R_2 = Tempe Yeast	35.117	5.391^c	6.100^d	53.038^d	3.425^b	2.775^c
R_3 = TapeYeast	35.519	5.218^c	7.050^b	54.000^b	3.475^c	3.050^b
Soaking time						
P_1 = 1hour	35.093	5.638^a	7.200	54.375^a	3.575^a	2.763^c
P_2 = 2 hours	35.218	5.566^b	7.150	54.025^b	3.513^b	2.825^c
P_3 = 3 hours	35.536	5.518^c	7.050	53.725^c	3.463^c	2.938^b
P_4 = 4 hours	35.644	5.491^c	6.525	53.413^d	3.350^d	3.038^a

Note: Different letters in the same column of notation show significantly different effects at the 5% level.

The highest cocoa bean fat content was obtained at treatment R0 (control) and the lowest was R2 (yeast tempe). This is because the microbes in active yeast help the speed of fermentation so that organic acids are formed which can break down or hydrolyze fat resulting in lower cocoa bean fat content. The fat content produced is fat content of cocoa beans is classified in the range of 48% - 52% (Munarso et al 2016; Widayat 2015).

In an organoleptic test carried out on the taste of cocoa beans, the highest was obtained in the treatment of R2 (bread yeast) and the lowest was R3 (tempe yeast). The highest organoleptic test value of cocoa bean aroma was obtained in the treatment R2 (bread yeast) and the lowest was R0 (control). But from the time of treatment, the taste decreased and the aroma increased. This is because the microbes found in baker's yeast are more active in enzymatic processes that increase the aroma of cocoa beans. The description of the taste of cocoa beans favored by the panelists is by following with the report of Misnawi et al (2012) that during the fermentation process chemical reactions and biochemical changes occur which produce taste precursors of cocoa beans. The aroma favored by the panelists was the result of the breakdown of peptide and carbohydrate compounds during the fermentation process (Pramana and Handoko 2022; Marpaung and Putri 2019).

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CONCLUSION

Fermentation using baker's yeast during soaking resulted in an increase in the organoleptic values of taste (3.70), aroma (3.29).

Soaking time causes a decrease in the level of acidity, moisture content, fat content, taste and aroma organoleptic test values.

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