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Quality of Kintamani Arabica and Pupuan Robusta Green Bean Coffee Based on Defects of Fermentation Process with Full Washed Method

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Abstract

The flavors of Balinese coffee that have been worldwide are Kintamani Arabica coffee and Pupuan Robusta coffee. Both of these coffees have obtained a certificate of Intellectual Property Rights with Geographical Indications from the Ministry of Law and Human Rights. After harvesting coffee, it will go through post-harvest handling. Common postharvest handling is washed, semiwashed, natural, honey and their derivatives undergo a process called fermentation. The factors that affect the fermentation are the right starter culture, appropriate and controlled fermentation in order to get a good coffee flavor, better taste quality. In this study, the fermentation process used starter culture of kefir, baker's yeast, tape yeast and natural with the aim of knowing the yield of dry HS coffee beans, rice coffee (green beans), bean weight, color and quality characteristics based on SNI 01-2907-2008 of Arabica coffee from Kintamani and Pupuan Robusta coffee. The highest yield of dry HS beans for Kintamani Arabica coffee was 21.57% and green beans 18.31% from the fermentation process with kefir starter culture. The highest yield of dry HS beans for Pupuan Robusta coffee was 25% and green bean coffee 21.00% from the fermentation process with kefir starter culture. The weight of Kintamani green bean Arabica coffee is 0.22 grams from the fermentation process with kefir starter culture. The weight of Pupuan green bean Robusta coffee beans is 0.28 grams from the fermentation process with kefir starter culture. The performance of bright green and uniform color, brownish green coffee, green beans Arabica Kintamani and Robusta Pupuan are from a fermentation process with a kefir starter culture. The quality of green bean coffee based on the defect value of Kintamani Arabica and Pupuan Robusta coffee is included in quality category 2 from the fermentation process with kefir starter culture.

Keywords: quality defect value, green bean coffee, kintamani Arabica, pupuan Robusta
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1. Introduction

The flavors of Balinese coffee that have been worldwide are Kintamani Arabica coffee and Pupuan Robusta coffee. Both coffees have obtained a certificate of Intellectual Property Rights with Geographical Indications from the Ministry of Law and Human Rights (Alfons. M, 2010). Coffee flavor experts say that Pupuan Robusta coffee has a taste that is not too bitter, typical of chocolate, because of the intercropping method with cocoa plants while Kintamani Arabica coffee has a taste and aroma that tends to be citrusy, does not have a spice or spice aroma. Spices typical of other types of coffee in Indonesia. This is thanks to its unique cultivation process. As for the body, it tends to be medium and not too bitter with a sour taste like oranges. This is what makes Kintamani Arabica coffee preferred. In addition, Kintamani Arabica coffee is an export commodity that has not too high caffeine content. Arabica and Robusta coffee forms are different. Arabica beans are oval in shape with a wavy cleavage in the middle. But in Robusta, the shape of the beans is more rounded and the cleavage that is owned also tends to be straighter.

After harvesting coffee, it will go through post-harvest handling. Common postharvest handling is washed, semiwashed, natural honey and their derivatives undergo a process called fermentation. The factors that affect the fermentation are the right starter culture, appropriate and controlled fermentation in an effort to get a good coffee flavor, better taste quality. Fermentation in coffee will change the sugar compounds that are in the layer between the fruit skin and seed coat into alcohol. This is because the sugar compounds contained in the mucus have the property of absorbing water from the environment (hygroscopic). The surface of the coffee beans tends to be moist, which hinders the drying process. In addition, sugar compounds was a good media for bacteria growing

that can damage the quality of coffee beans. The purpose of this process is to remove the remaining mucus layer on the surface of the skin of the coffee bean, thereby facilitating the process of washing the mucus that is still attached to the beans and reducing the bitter taste and encouraging the formation of a "mild" impression on the brewed taste (Fahran. M, 2019). Fermentation in coffee cherries can also increase flavor in the presence of metabolites produced by microbes (Pereira et al., 2015). During fermentation, there will be a breakdown of complex compounds into simpler compounds such as reducing sugars, and metabolites such as organic acids will be produced (Suprihatin, 2010). These simple compounds and their metabolites will function as precursors of volatile compounds during roasting. Fermentation of coffee cherries generally uses fruit pulp as a source of carbon and nitrogen for microbial growth. During microbial growth, ethanol, acetic acid and lactic acid are produced and other metabolite products that will lower pH (Pereira et al., 2015).

Factors that affect fermentation must pay attention to the right starter culture, appropriate and controlled fermentation to obtain a good coffee flavor (Lee et al., 2015). In this study, the fermentation process used a starter culture of kefir, baker's yeast, tape yeast and natural. The purpose of this study was to determine the yield of dry HS coffee beans, green bean coffee, bean weight, color and quality characteristics based on SNI 01-2907-2008 Kintamani Arabica coffee and Pupuan Robusta coffee.

2. Research Methods

2.1 Place and time of research.

The research site is in the probiotic product house of the Bali kefir house, Jalan Gemitir N0. 40 Denpasar, Food Technology Laboratory, Faculty of Agricultural Technology, Udayana University. Research time is from April to September 2022.

2.2.Objects and Samples.

The object of this research is the starter of kefir inoculum of tape yeast and baker's yeast. The samples of this research are Arabica and Robusta coffee. Arabica coffee is obtained from the Bali Kintamani Coffee Plantation located in Kintamani District, near Mount Batur, Bangli Regency. The type of Balinese coffee is Arabica and is grown on land with an altitude of about 1000 meters above sea level. Robusta coffee was obtained from Pupuan sub-district, Tabanan regency, Bali.

2.2 Tools and materials.

The tools used in this research are analytical scales. plastic jars, nanpan, para-para. While the materials used in this study were kefir starter, tape yeast, Arabica coffee baker's yeast, rubusta coffee. *Research Implementation.* The coffee cherries used are Kintamani Arabica and Pupuan Robusta. The coffee cherries are harvested by picking red (red cherries). Figure 1.

Figure 1. Coffee cherries are harvested with red picks

The coffee beans that have been picked were then undergo separation process (sorting). At this stage, the coffee beans were submerged in the water and if the beans float, this indicates that the beans are defective. These defective coffee beans were then separated from other coffee beans. Figure 2 showed the defective and good coffee beans..

Figure 2. The process of separating (sorting) coffee beans

As is known, coffee plants do not bear fruit simultaneously, therefore harvesting fully ripe coffee cherries must be done selectively. Harvesting of coffee cherries is done manually by picking ripe fruit. The next step is to peel the skin and flesh of the coffee beans using a pulper or peeler (Figure 3).

Figure 3. Peeling the skin and flesh of coffee beans with a pulper

The peeled coffee beans (no later than 2 hours after skin removal were treated with anaerobic fermentation with probiotic microbes. Probiotic microbes from kefir starter culture, tape yeast culture and baker's yeast. (Figure 4).

Figure 4. Anaerobic Fermentation Treatment

Fermentation for 36 hours, after completion of fermentation, the next stage is washed and dried in the sun. (Figure 5) .

Figure 5. Drying Process

The drying process was carried out to reduce the moisture content of the coffee beans by 10-12%. After drying, the coffee beans are stored first to rest or rest, where at this stage the coffee beans are inserted into the huller to release the parchment skin (also called pergamino) so that dry coffee beans are produced without horn skin (rice coffee/green beans), then roasted and powdered

2.4 Research design

The study used a randomized block design with 5 (five) replications. The treatment is as follows:

AK : Kintamani Arabica coffee

RP : Pupuan Robusta coffee

Aerobic fermentation treatment

I : Natural fermentation

II : Fermentation with kefir starter

III : Fermentation with baker's yeast

IV : Fermentation with tape yeast

2.5 Observation Parameters and Testing Procedure.

Parameters observed were: yield of dry HS coffee beans, green beans, weight of beans, color and quality characteristics based on SNI 01-2907-2008.

2.5.1 Yield.

Determination of the yield value in this study was to compare the weight of the green beans produced with the initial weight of the coffee cherries. The yield value is calculated by the following formula:

$$\text{Yield} = \frac{\text{Green Bean/HS dry weight}}{\text{Wet Coffee Fruit Weight}} \text{ X } 100\%$$

Seed Weight

$$\text{Seed Weight} = \frac{\text{100 grams of seeds}}{\text{Total Coffee per 100 grams}}$$

2.5.2 Color performance

The color performance assessment of Kintamani and Pupuan Robusta coffee, green bean Arabica, was carried out visually by 5 panelists. To ensure that the coffee color in each treatment was compared with the color on the green color chart (Figure 6).

Figure 6. Green Color Chart

2.5.3 Coffee Quality Characteristics

Quality test was carried out on coffee beans by weighing 300 grams of Kintamani Arabica and Pupuan Robusta coffee beans separated manually according to the criteria for quality defects in SNI. The results of the separation are grouped according to quality groups 1 to 6. Quality 1 is the highest quality and 6 is the lowest quality. Classification of quality (grade) based on the value system defects every 300 grams of coffee. Quality 1 total defect value maximum 11 Quality 2 total defect value 12 to 25 Quality 3 total defect value 26 to 44 Quality 4a total defect value 45 to 60 Quality 4b total defect value 61 to 80 Quality 5 total defect value 81 to with 150 Quality 6 the total number of defects from 151 to 225.

2.6 Data analysis

The data obtained was then analyzed statistically Analysis of Variance (ANOVA) using SPSS version 21 software, if it showed significant results then continued with the Least Significant Difference (BNT) test with 95% confidence level. The explanation of the results of the analysis was carried out descriptively and graphically.

Research Flowchart

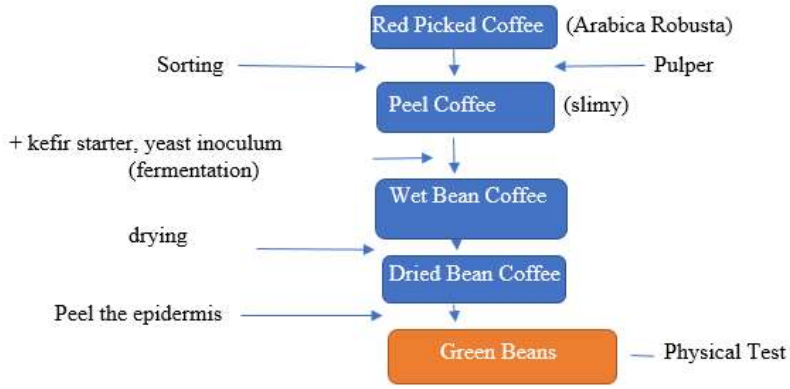

Figure 7. Research Flowchart

3. Results and Discussion

3.1 Yield

The results of the analysis of the yield of dry HS coffee beans (Hard Skin = horn skin), Kintamani Arabica green beans and Pupuan Robusta coffee produced by anaerobic fermentation with fully washed processing methods, were shown in Figure 8 as follows.

Yield is the ratio of coffee beans after and before the process. The yield of aerobic fermentation using a fully washed processing method, in Figure 9 the yield of each treatment of dry HS Arabica Kintamani coffee with natural fermentation is 20.92%, fermentation with kefir starter culture 20.86% and fermentation with baker's yeast culture 20, 86% and fermentation with tape yeast culture 20.21%. Kintamani Arabica green beans fermented naturally 17.82%, fermented with kefir starter culture 18.31%, fermented with bread yeast culture 18.15% and fermented with tape yeast culture 17.50%. The yield of each treatment was natural fermented HS Robusta Pupuan coffee 24,37 %, fermented with 25.00 % kefir starter culture and 25, 00 % yeast yeast culture and 24,68 % fermented tape yeast culture. Pupuan green bean Robusta coffee is naturally fermented 20.00%, fermented with 21.00% kefir starter culture, fermented with bread yeast culture 21.00% and fermented with tape yeast culture 20.15%.

Based on analysis of variance was significant in all treatments ($p < 0.05$). The average yield of dry HS Arabica Kintamani coffee: 20.89 ± 0.49%, . Kintamani green bean Arabica coffee average : 17.95 ± 0.21 %. Yield of dry Pupuan Robusta HS coffee: 24.76 ± 0.28%, Pupuan green bean Robusta coffee average: 20.53 ± 0.49%. The minimum yield is 20.20%, maximum 21.59% dry HS Kintamani Arabica coffee, Kintamani green bean Arabica coffee minimum 17.50%, maximum 18.34 %. the minimum yield of Pupuan Robusta HS coffee is 24.35 %, maximum 25.20%, Pupuan green bean Robusta coffee is minimum 19.80 %, maximum 21.20%.

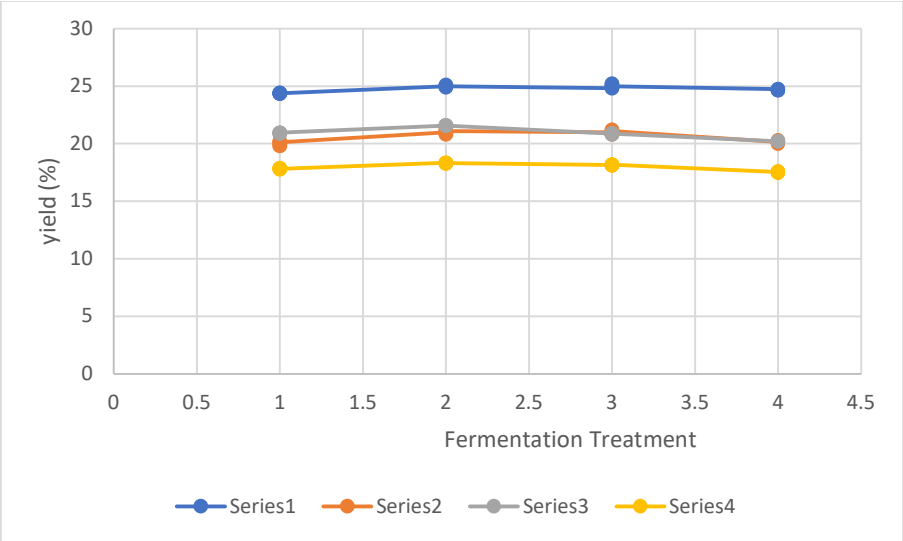

Figure 8. Graph of green bean Arabica Kintamani and Pupuan Robusta coffee yields

Series 1: Pupuan HS Robusta coffee. Series 2: Pupuan green bean Robusta coffee
Series 3: Kintamani HS Arabica Coffee. Series 4: Kintamani green bean Arabica coffee

Based on the average yield of green bean coffee and dry HS coffee, Pupuan Robusta is higher than Kintamani Arabica. The higher yield was followed by the weight of Pupuan Robusta coffee beans which was higher than Kintamani Arabica coffee. This yield is not much different from the yield of Arabica coffee in general, namely 16-18% and Robusta coffee 22-24%. The high and low yield is influenced by the quality of the green coffee from the picking process, sorting process, processing method. In this study, only the red ones were picked, the sorting process was done by soaking the floating coffee and coffee, there were still yellow or green ones, coffee that was defective due to the influence of pests and diseases was separated (mined). Sorting was also carried out at the time of washing (full washed method). The coffee fermentation process in fully washed processing causes the loss of many coffee components (Megah, 2009), thus causing lower yields. However, fermented coffee has a stronger aroma (Poerwanty, 2018)). Lin (2010) stated that proper handling with wet processing will affect the quality of the taste of the coffee produced. The taste of coffee beans produced from wet processing is better than that produced from dry processing (Murthy and Naidu, 2011)

3.2 Seed Weight

The results of the analysis of green bean coffee, Kintamani Arabica coffee and Pupuan Robusta coffee from anaerobic fermentation using a fully washed processing method, are shown in Figure 9 as follows.

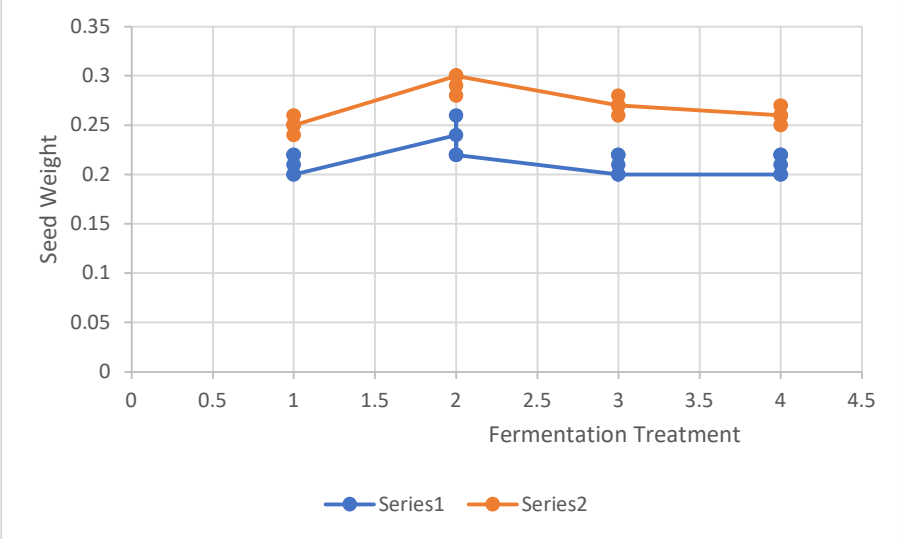

Figure 9. Weight graph of Kintamani Arabica and Pupuan Robusta coffee beans
Series 1: Kintamani Arabica coffee. Series 2: Pupuan Robusta coffee

Figure 9 showed the weight of Kintamani green bean Arabica coffee is naturally fermented 0.21 gram, fermented with 0.22 gram kefir starter culture, 0.21 gram of bread yeast culture and 0.21 gram of tape yeast culture. Weight of Pupuan green bean Robusta coffee beans with natural fermentation 0.25 grams, fermentation with kefir starter culture 0.28 grams, fermentation with bread yeast culture 0.27 grams and fermentation with tape yeast culture 0.26 grams. From these data, it can be seen that there is a decrease in the weight of Kintamani Arabica and Pupuan Robusta coffee. Shrinkage occurs during the post-harvest process, namely in the fermentation process, peeling fruit skin, washing (full washed). Based on analysis of variance, all treatments had a significant effect ($p < 0.05$). The average weight of Kintamani green bean Arabica coffee was about 0.21 ± 0.01%, Pupuan Robusta: 0.27 ± 0.02%. Heavy shrinkage occurs in rice coffee (green bean) in addition to the fermentation process as well as when peeling fruit skins, drying, stripping horn skins, and grading green bean coffee.

3.3 Coffee Color Performance

The results of the color performance assessment obtained for each treatment on green bean coffee are presented in Figure 10 as follows.

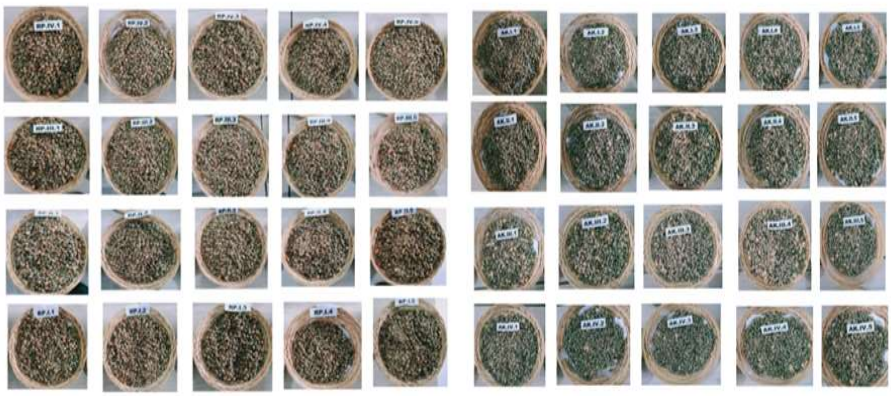

Figure 10. Color performance of Kintamani and Arabica coffee green bean coffee of Robusta Pupuan

From the results of the panelists' visual assessment by comparing with the green chart (Figure 6) the color performance of Kintamani Arabica coffee is uniformly bright green and Pupuan's light brownish green Robusta coffee is less uniform. In the fermentation process it will dissolve the mucus layer that still protects the HS coffee,

the mucus layer disappears, and then the condition of the green coffee beans will turn bright green. The occurrence of a light brownish green color in Pupuan Robusta coffee is due to the washing process. Uneven washing will affect the color performance of dry HS coffee. The difference in color performance can be seen in the color of dry HS coffee, Kintamani Arabica coffee and Pupuan Robusta coffee as shown in Figure 11.

Pupuan Robusta dry HS coffee

Kintamani Arabica dry HS coffee

Figure 11. Color performance of dry HS coffee

3.4 Quality of Green Bean Arabica Kintamani and Pupuan Robusta Coffee based on Total Defect Value

The results of the green bean coffee quality assessment based on the total defect value of all treatments on Kintamani Arabica and Pupuan Robusta coffee from anaerobic fermentation using the full washed processing method are presented in Table 1 as follows.

Table 1. Quality of Green Bean Arabica Kintamani and Pupuan Robusta coffee

No	Type of Defect	Total Defect Value							
		Kintamani Arabica Coffee				Pupuan Robusta Coffee			
		AK I	AK II	AK III	AK IV	RP I	RP II	RP III	RP IV
1	1 (one) black seed	2	1	1	2	2	2	2	2
2	2 (two) black seeds part	2	1	1	2	2	2	2	2
3	2 (two) black seeds broken	2	1	2	2	2	2	2	2
4	1 (one) coffee spindle								
5	4 (four) seeds chocolate	6	2	8	7	9	3	7	8
6	4 (four) huskies big size	3	2	2	2	2	3	3	2
7	2 (two) huskies medium size	3	2	2	2	3	1	2	2
8	5 (five) huskies	3	1	1	2	3	1	1	1

	small size								
9	10 (ten) seeds fair-skinned	2	1	1	1	3	1	1	1
10	2 (two) seeds horn-skinned	4	6	8	8	9	3	8	7
11	2 (two) seeds big horn skin	2	2	2	2	3	2	3	3
12	5 (five) seeds horn-skinned medium size	3	1	1	2	3	1	1	2
13	10 (ten) seeds horn-skinned small size	2	1	1	1	2	1	1	1
14	5 (five) broken seeds	7	2	6	6	9	2	5	8
15	10 (ten) seeds one hole								
16	5 (five) seeds more holes from one								
17	10 (ten seeds spotted	2	2	3	2	2	2	3	2
18	1 (one) branch, soil or rock big size								
19	1 (one) branch, soil or rock medium size								
20	1 (one) branch, soil or rock small size								

Total value	43	25	39	41	54	26	41	43
Quality Category	3	2	3	3	4a	2	3	3

Information
AK = Kintamani Arabica
RP = Robusta Pupuan
I : Natural fermentation
II : Fermentation with kefir starter
III : Fermentation with baker's yeast
IV : Fermentation with tape yeast

Table 1 shows that Kintamani green bean Arabica coffee is of grade 2 (two) produced from fermentation with a kefir starter, from natural fermentation, with baker's yeast and tape yeast including category 3, Pupuan Robusta coffee beans entered quality 2 are produced from fermentation with a kefir starter. , natural fermentation belongs to category 4a with baker's yeast and tape yeast is included in category 3. There is a difference in quality in the treatment of natural fermentation, baker's yeast and tape yeast with fermentation with kefir as a starter, seen from cocoa beans, horn-crusted seeds and cracked seeds. The brownish green bean color change in Pupuan Robusta coffee is caused by a maillard oxidation reaction that causes browning of the coffee beans involving compounds with carbonyl groups. Category 2 (two) in Kintamani Arabica and Pupuan Robusta coffee according to the yield analysis, the weight of the beans in the fermentation process with kefir starter culture.

In this study, kefir starter culture and yeast culture were used. Kefir starter containing species of microorganisms including Lactococcus acidophilus, L. kefir, L. kefirgranum, and L. parakefir which functions in the formation of lactic acid from lactose. While the yeast culture for bread uses the fungus Saccharomyces cerevisiae, while for tape yeast there are additional fungi such as using the fungus Aspergillus oryzae. Yeast can convert glucose into alcohol and CO2. In tape yeast there are microorganisms that under anaerobic conditions will produce amylase and amyloglucosidase enzymes. These two enzymes are responsible for the decomposition of carbohydrates into glucose and maltose. This fermentation process can affect the color of green bean coffee because during cultivation the plants are not treated optimally so that they are attacked by pests, diseases and this affects the quality of the coffee beans, even though they have been picked red and green. good sorting process. The number of horn-skinned seeds can be caused by the process of stripping the horn skin by the huller machine that is not optimal and the number of broken seeds can be caused by the pulper and huller process.

4. Conclusion

Based on the results, discussion and objectives, it can be concluded as follows.

1) The highest yield of dry HS beans for Kintamani Arabica coffee is 21.57% and green beans 18.31% from the fermentation process with kefir starter culture. The highest yield of dry HS beans for Pupuan Robusta coffee was 25% and green bean coffee 21.00% from the fermentation process with kefir starter culture.
2) The weight of Kintamani green bean Arabica coffee is 0.22 grams from the fermentation process with kefir starter culture. The weight of Pupuan green bean Robusta coffee beans is 0.28 grams from the fermentation process with kefir starter culture.
3) The performance of bright green and uniform color, brownish green coffee, green beans Arabica Kintamani and Robusta Pupuan are from the fermentation process with a kefir starter culture.
4) Based on the value of quality defects, Kintamani and Pupuan Arabica green bean coffee and Pupuan Robusta are included in quality category 2 from the fermentation process with kefir starter culture.

5. Suggestion

Based on observations of dry HS coffee bean yield, green bean coffee yield, bean weight, color performance, and defect values in Kintamani Arabica coffee and Pupuan Robusta coffee processed with the full washed method, it is recommended that the fermentation process using a kefir starter culture be suggested.

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