



## Optimization of Cibunar Linggarjati Arabica Coffee Quality: Brix Level Analysis and Postharvest Techniques

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*Arabica coffee, post-harvest processing, dry process, full washed, selective harvesting*

### ABSTRACT

The Cibunar Linggarjati coffee plantation as one of the producers of Arabica coffee in Kuningan, West Java has considerable potential. This study compares the post-harvest results of Arabica coffee processed through two methods: dry process and full washed. The harvest process is based on red picking criteria, namely choosing ripe coffee cherries based on their color, and yellowish-red to dark red colors. The brix level research was carried out, to apply sugar content standards in coffee cherries in preventing the decline in coffee quality, which is very important for sustainable agriculture and market acceptance. This study focuses on measuring the brix level of coffee cherries to assess the sugar content and maturity. Observation of the brix content of Sigararutang cherries and Yellow Caturra of Arabica coffee that has matured optimally at a value of 12°-20° brix. Meanwhile, the brix level for coffee cherry ripeness that is not optimal ranges from 8,801° brix to 9,623° brix. The methodology involves selective harvesting of ripe cherries and manual sorting to separate fresh red cherries from raw and deformed cherries. The fermentation process is carried out in full washed, because it has a significant impact on improving the taste of coffee by reducing the bitter taste and distinctive aroma. This study was conducted for six weeks, using a sample of 14 Arabica coffee trees, consisting of Sigarutang and Yellow Caturra varieties in a ratio of 1:1. It is hoped that this research aims to contribute to the understanding of post-harvest processing techniques and their impact on the quality of Arabica coffee, which is very important to maintain the quality of Indonesian coffee production in the global coffee market.

## INTRODUCTION

Indonesia has two types of coffee that have economic value and are traded commercially, namely Arabica coffee and Robusta coffee. Arabica coffee has a superior taste compared to Robusta coffee, so the demand for Arabica coffee is higher than Robusta coffee. The world's coffee consumption is 70% Arabica coffee and 26% Robusta coffee (Ministry of Agriculture, 2017). The value of coffee exports in 2020 ranks fifth after palm oil, rubber, cocoa, and coconut with an export contribution of 2.91%. In 1984-2022, coffee plantations experienced fluctuations in increase, with an average growth of 1.37% per year. Between 2018 and 2022, Arabica coffee production centers in Indonesia were predominantly located in several provinces, particularly Aceh and North Sumatra. With percentages of 32.02% and 31.98% or average production of 66.13 thousand tons and 66.05 thousand tons. The other largest Arabica coffee producing provinces are South Sulawesi and West Sumatra with percentages of 12.27% and 5.62% or an average production of 25.34 thousand tons and 11.60 thousand tons per five years (Agricultural Data and Information Systems Center, 2022).

High coffee production needs to pay attention to the quality of coffee. One of the strategies that can support the development of coffee in Indonesia, namely in the harvest and post-harvest process as well as processing with coffee defect values, bean size test, color and odor test referring to SNI No.01-2907-2008 and standards Specialty Coffee Association of America (SCAA). Coffee processing can affect the quality of coffee because improper post-harvest handling, especially during drying, can influence the effectiveness of the processing process and ultimately determine the final quality of coffee beans (Pratama et al., 2025). The wet processing process can produce better coffee than dry processing. Farmers in Indonesia generally use dry processing because the cost is lower than wet processing so that the quality of coffee is still low (Sembiring et al., 2015).

Dry processing in coffee begins with sorting ripe coffee cherries followed by pulping and drying until the moisture content reaches around 10–12%, which is considered optimal for maintaining coffee quality (Pratama et al., 2025). Good coffee beans at grade 1 can be obtained through dry process if it is in accordance with good and correct operational standards. By improving the quality of raw materials for the taste of Arabica coffee and marketing product innovation as a producer can increase the market value of coffee so that it can be accepted as a supplier. Post-harvest processing has a great effect on the physical quality, taste, and market value of coffee beans, especially in the drying stage which plays an important role in maintaining coffee bean quality (Pratama et al., 2025). There are four commonly used processing methods, namely, dry milled wet processing (Full wash-dry hulling), wet grinding wet processing (Full Wash-Wet Hulling), semi-wet processing (Semi-wet processing or pulp natural process), and dry processing (Dry Processing). The difference in the way of processing lies in the use of water required for peeling the skin Cherry or washing. The most important part of the processing is the sorting and fermentation of coffee. Before processing, Cherry The quality of the coffee is checked. Sorting Cherry Coffee is done manually by separating Cherry fresh red coffee with other ingredients, such as Cherry green, Cherry black, leaves, and twigs. Coffee fermentation is typically carried out to degrade the mucilage layer attached to the surface of the parchment skin surrounding the coffee beans. This process also plays an important role in reducing bitterness, enhancing flavor characteristics, and producing a smoother taste profile in the final coffee product (Wahyudi et al., 2016).

The quality of Indonesian coffee is still relatively low because it contains many young and defective coffee beans. Quality improvement can be done by improving handling from

pre-harvest, harvest period, and post-harvest. Pre-harvest management is emphasized on pest and disease control, especially the *Stephanoderes hampei* pest infestation that causes the seeds to perforate. Harvest period handling is emphasized on selective picking. Post-harvest handling is emphasized on proper coffee processing such as fermentation, drying, and sorting. Arabica coffee farmers in Indonesia have not implemented the selection of coffee cherry ripeness with special standards. Farmers choose cherries by looking at colors, such as yellow-reddish or deep red. The selection depends on the type of coffee variety harvested. The application of the sugar content standard in coffee cherry is expected to avoid a decrease in the quality of Arabica coffee. Research on the successful implementation of harvest quality standards will be a consideration for Arabica coffee business actors in order to achieve sustainable agriculture and be accepted by the community and the coffee production market.

## RESEARCH METHODS

The research activity was carried out at the Cibunar Linggarjati coffee plantation, Kuningan Regency, West Java Province. The research was carried out for 6 weeks starting from June 24 to August 5, 2024. The main object of the research is the post-harvest processing of Arabica coffee varieties Sigararutang and Yellow Caturra. The number of samples used in the study amounted to 14 Arabica coffee trees, with a comparison of Sigararutang and Yellow Caturra varieties. 1:1.

Quantitative observations were made during the study by collecting data. The data was obtained through direct observation by looking at the harvest process until post-harvest coffee continuously. The harvesting process according to (Abdillah, 2021), namely:

1. Harvesting (picking): Picking is the process of harvesting coffee that has entered the perfect maturity phase, which is red. Picking is done manually using hands, the purpose is manual picking so that the cherry fruits picked are more selective and avoid unripe coffee cherries.
2. Brix levels Cherry: Observations were made on Cherry Ripe coffee is characterized by a change in the color of the outer skin. The skin of the dark green fruit is still young, the yellow is half ripe and if it is red then the coffee fruit is ripe and becomes blackish after it is overripe (About Ripe). Sugar levels were measured using a hand-held brix refractometer with a scale of 0-32°brix. The optimal ripeness of coffee cherries is on a scale of 12-20°brix, and the brix content for ripeness Cherry Coffee that is not optimal ranges from 8,801° Brix to 9,623° Brix. The value of coffee brix content can be correlated with coffee quality (Silva S et al., 2014).
3. Sorting: Sorting is the process of sorting the harvested coffee cherries. Coffee fruits are separated that are perfectly ripe, cherries are green, rotten cherries, overripe cherries and garbage. Sorting is done manually using hands when picking coffee cherry fruits. Soaking sorting is also carried out before the fermentation process in the wet post-harvest process. The coffee cherry fruit floating in the immersion will be separated from the sunken coffee cherry fruit.
4. Yield weighing: Yield is calculated by weighing the weight of the sample tree with the overall fruit weight of the harvest, packaging and transportation  
The post-harvest process is carried out in 2 different ways, namely wet processing and dry processing. The difference between wet and dry processes is compared to the results.
5. Green bean grading: Green bean grading was conducted by collecting samples from each storage container. A total of 300 g of green beans was weighed and then manually sorted to separate high-quality beans from defective ones (BSN, 2008). The defective beans were further classified based on defect value criteria to determine the

quality grade of Arabica coffee. This procedure was applied to both dry process and wet (full wash) processing methods.

## RESULTS AND DISCUSSION

### A. Harvesting

#### 1. Picking

The use of the red-picking method, in which only ripe to overripe cherries were selected, contributed to the quality of the harvested coffee beans. This method ensures that the cherries are at an optimal level of maturity, which is essential for producing high-quality coffee. As shown in Figure 1b, ripe red cherries represent the ideal condition for harvesting, as they have reached full maturity and are suitable for further processing. The selection of uniformly ripe cherries is also important in maintaining consistency in flavor and overall coffee quality.



Figure 1 Red picking Arabica coffee fruit; a) Manual coffee picking process, b) Red picked coffee fruit

#### 2. Brix cherry content of coffee fruit

Brix content is an observation made to determine the sugar content in coffee fruits. Observations are made after picking. Checking the brix content of Arabica coffee was carried out with two different varieties, namely, the Yellow Caturra and Sigararutang varieties. Brix level measurement can be done using a brix refractometer measuring device. The mucus part in the meat Cherry coffee is located between pulp and parchment. Mucus has content, water (84.2%), protein (8.9%), sugar (4.1%), pectic substances (0.91%), and ash (0.7%) (Castillo et al., 2018).

According to (Silva S et al., 2014) Optimally ripe Arabica coffee at a value of 12°-20° brix. Brix rate for ripeness Cherry Coffee that is not optimal ranges from 8,801° Brix to 9,623° Brix. Based on the interval of these values, it can be a reference that the sugar content in the Cherry Optimal ripe coffee is greater than the value of sugar content in Cherry Unripe coffee is optimal. Sugar content in fruit Cherry Optimal coffee can produce a better taste, when compared to sugar levels that are not optimally ripe.

The purpose of brix measurement is to determine the ratio of sugar in fruits of two varieties Cherry Cigararutang and Yellow Caturra coffee. Observation of brix levels was carried out for 3 days. According to (Abdillah, 2021) Ripe coffee is characterized by a change in the color of the outer skin. The skin of the dark green fruit is still young, the yellow is half ripe and if it is red then the coffee fruit is ripe and becomes blackish after it is overripe (About Ripe). Measurement of sugar levels in Cherry Coffee can correlate with the final quality of coffee such as the determination of the post-harvest process and the roasting process (Roasting). The post-harvest process of sugar content has a task as a reducer and a non-reducer. Roasting process (roasting) sugar contained in green coffee beans (green beans) of 6-10% of the total weight. The sugar content influences into the sweeter taste in the final coffee result. Sugar also contributes to the development of similarities, because during caramelization the sugar in the roasting process will produce acetic acid

Figure 2a of day 1 observation, in Figure 2b of day 2 observation, and in Figure 2c of day 3 observation. The color of *the over ripe* fruit turns slightly brown, then the orange color becomes more yellow and undergoes a ripening process. In addition to the color of the cherry, the determinant of the ripeness of the coffee cherry is optimally measured by measuring the dissolved sugar content (brix content). Brix levels of Sigararutang and Yellow Caturra harvested, the observation of brix levels as seen from the color of coffee cherry fruits when brix levels were observed for 3 days there were fluctuations in the increase in sugar levels with different *cherry* colors. The color of the cherry fruit can describe the ripeness of the coffee cherry. The selection was made in dark green, yellow, orange, and black-black red (over ripe).

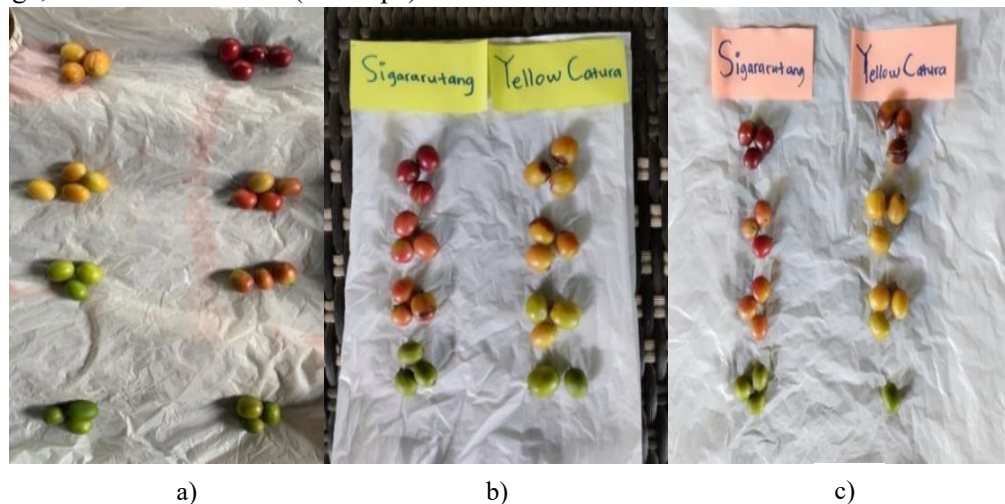


Figure 2 Brix level measurement for 3 days; a) Day 1 brix level measurement, b) Day 2 level measurement, c) Day 3 level measurement

The average brix content of the Sigararutang and Yellow Caturra varieties in Figure 3 when viewed from the varieties with higher brix levels, namely in the Yellow Caturra variety up to an average of 15, while in the Sigararutang variety, the highest brix level reached 14. The highest brix levels are found in red-and-black coffee fruits (over ripe). The average brix level is the lowest in green fruits, which is 8 in the Sigararutang variety, and 9 in the Yellow Caturra variety. On the observation of the 2nd and 3rd days, green and yellow cherries experienced an increase in sugar levels.

The increase in sugar levels is due to the fruit undergoing a ripening process, the presence of a respiration factor that is still working on the coffee cherry fruit. In yellow fruits, the average brix content of the cigar variety is superior, which is 11, and in the Yellow Caturra variety it is 10. In orange fruits, the Yellow Caturra variety has a higher

brix level of 13, while the Sigararutang variety is 13. The difference in brix levels in each color phase is influenced by different fruit ripeness.

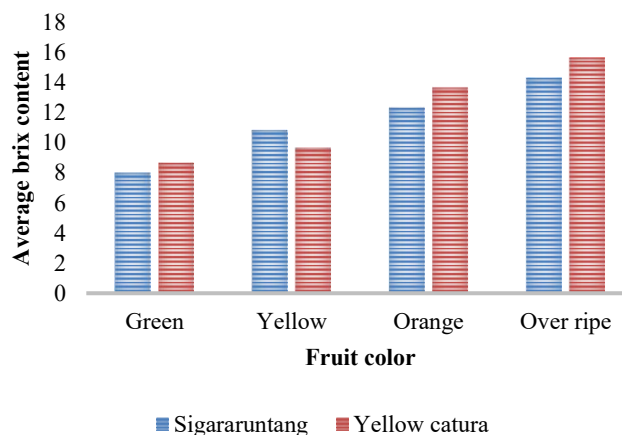


Figure 3 Harvest brix rate

Brix levels of Sigararutang and Yellow Caturra (post-harvest), post-harvest brix levels are seen in Figure 4. The Yellow Caturra variety has a higher brix content when compared to Sigararutang. In overripe fruits, the Yellow Caturra variety can reach an average brix level of 15, while the Sigararutang variety only reaches an average brix level of 13. In yellow fruits, the average brix content of the Sigararutang variety is superior to reach brix 10, while the Yellow Caturra variety has an average brix content of 9.

In green and orange fruits, it can be seen that the brix content of the Yellow Caturra variety is higher, when compared to Sigararutang. The highest brix content is obtained in the color of the cherry over ripe fruit because it has experienced optimal ripeness, while the green color is obtained the lowest brix content because the fruit is not optimally ripe

Brix levels of Sigararutang and Yellow Caturra (post-harvest), post-harvest brix levels are seen in Figure 4. The Yellow Caturra variety has a higher brix content when compared to Sigararutang. In overripe fruits, the Yellow Caturra variety can reach an average brix level of 15, while the Sigararutang variety only reaches an average brix level of 13.

In yellow fruits, the average brix content of the Sigararutang variety is superior to reach brix 10, while the Yellow Caturra variety has an average brix content of 9. In green and orange fruits, it can be seen that the brix content of the Yellow Caturra variety is higher, when compared to Sigararutang. The highest brix content is obtained in the color of cherry over ripe fruit because it has experienced optimal ripeness, while green color is obtained the lowest brix content because the fruit is not optimally ripe.

Brix levels of Sigararutang and Yellow Caturra (post-harvest), post-harvest brix levels are seen in Figure 4. The Yellow Caturra variety has a higher brix content when compared to Sigararutang. In the over ripe fruit, the Yellow Caturra variety can reach an average brix level of 16, while the Sigararutang variety only reaches an average brix level of 12. In yellow fruits, the average brix content of the Sigararutang variety is superior to reach brix 10, while the Yellow Caturra variety has an average brix content of 9. In green and orange fruits, it can be seen that the brix content of the Yellow Caturra variety is higher, when compared to Sigararutang.

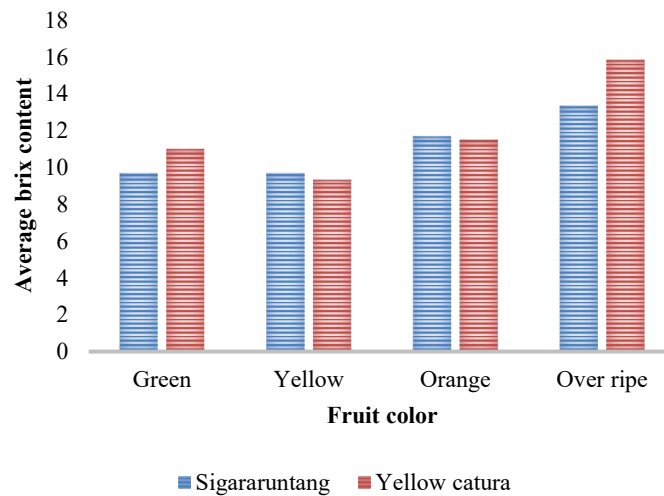


Figure 4 Post-harvest brix level

The Brix levels of Sigararutang and Yellow Caturra after harvest are shown in Figure 4. The data were analyzed descriptively to compare the Brix values between the two varieties. In general, Yellow Caturra tended to have higher Brix values than Sigararutang. This can be seen in overripe fruits, where Yellow Caturra reached an average Brix value of 16, while Sigararutang only reached 12. However, at the yellow stage, Sigararutang showed slightly higher Brix content (10) compared to Yellow Caturra (9). In green and orange fruits, Yellow Caturra also generally showed higher Brix values.

The highest Brix levels were found in overripe fruits, indicating that the fruit had reached optimal ripeness, while the lowest values were observed in green fruits because they were not yet fully mature. In general, optimally ripe Arabica coffee cherries have Brix values ranging from 12° to 20°, while unripe cherries range from about 8.8° to 9.6° Brix. These results show that the level of ripeness has a strong effect on sugar content, where the riper the fruit, the higher the Brix value. This is important because higher sugar content can contribute to better coffee flavor.

### 3. Sorting

Sorting is carried out at the time of harvest picking, fruits that have been picked and sorted at the time of red picking in Figure 5a are sorted to see the difference in the color of coffee fruits. The mining in Figure 5b of the coffee fruit is done to separate between the floating and sunken cherries. The goal is to maintain the quality of red picked coffee.



Figure 5 Sorting of red picked coffee fruits; a) Sorting coffee fruits, b) Coffee fruit mining

#### 4. Crop weighing

According to Cahyadi et al. (2021) The altitude can affect the yield, where at an altitude of 800 meters above sea level an average harvest of 1.4 kg/plant, then at an altitude of 1,000 meters above sea level an average of 2.07 kg/plant. At an altitude of 1,250 meters above sea level, an average harvest weight of 6.04 kg/plant was obtained, and at an altitude of 1,400 meters above sea level, an average harvest weight of 3.18 kg/plant was obtained. The height in planting Arabica coffee trees can affect the yield of the plant's weight.

Crop weighing was carried out to determine the yield of coffee cherries from both Sigararutang and Yellow Caturra varieties. The data were analyzed descriptively to compare the harvest weight between the two varieties. Based on the results from 14 sample trees, the total harvest weight reached 59.6 kg, with an average of 4.25 kg per tree. The highest yield recorded was 8 kg, while the lowest was 2.7 kg, as shown in Figure 6, it can be seen that the harvest weight varies among the sampled trees. In general, the Sigararutang variety tended to produce higher yields compared to Yellow Caturra. This variation suggests that differences in variety and plant conditions may affect coffee productivity. Overall, the total harvest obtained in this study reached approximately 1.5 tons of Arabica coffee from both varieties.

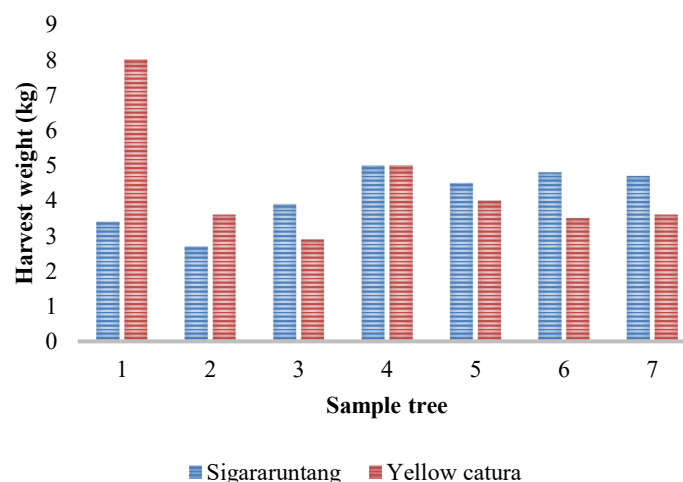


Figure 6 Weighing of the yield of coffee tree samples

B. Comparison of Arabica coffee processing

Comparisons are made to find out the differences that can distinguish the two processes. Comparisons were made in the sorting, peeling, washing, and drying processes. As for the comparison, it is in Table 1:

Table 1 Comparison of Arabica coffee processing

Yes	Processing characteristics	Dry process	Wet process (full wash)
1	Sorting	Sorting is done at the beginning manually, by separating green and red coffee cherries. The mining process on coffee that is still cherry-shaped is done to distinguish between floating and sinking	Sorting is done at the beginning before the grinding process. Sorting is done manually, namely by separating green <i>cherry</i> coffee and red <i>cherry</i> coffee
2	Peeling	Peeling is carried out at the end, when the cherries have dried. Skin stripping using <i>dry milled</i> huller machine tools	Peeling of the skin is carried out at the beginning, namely stripping with a wet milling huller machine
3	Washing	Washing is only done at the beginning before the drying process of <i>coffee cherry</i> fruits.	Washing is carried out at the beginning, and during the mining of coffee grains
4	Drying	Drying coffee is done in the open using a tarp, and drying is still done using <i>cherry peels</i> .	Drying in the form of grain is carried out using ultraviolet plastic ( <i>greenhouse</i> coffee drying)

a. Sampling

Process Grading according to (Pramono et al., 2018) process time or duration Grading may affect the results Grading coffee. Optimal results are obtained after Arabica coffee in Grading for 3 minutes. Quality greatly affects the value or selling price of coffee commodities. To meet consumer demand, coffee traders usually employ a number of people as sorters. Sorting is an effort to group seeds (Green Bean) based on the quality of the seeds that have been determined by the company according to the quality standard defect value system which refers to SNI No.1-2907-2008. Sorting aims to separate normal seeds from defective, broken, smelly, and dirty seeds. Thus, the quality of the beans is an added value to the selling price of coffee (Green Bean) for non-farmers traders (Budiarto et al., 2023).

The grading results of green coffee beans are presented in Figure 7. Based on the classification, most of the coffee beans met the established quality standards according to the defect value system. This indicates that the sorting and post-harvest handling processes were carried out properly, resulting in good-quality green beans. The quality of the coffee beans plays an important role in determining their market value. Better quality beans, with fewer defects, tend to have a higher selling

price. Therefore, the grading process is essential to ensure that the coffee meets quality standards and consumer expectations.

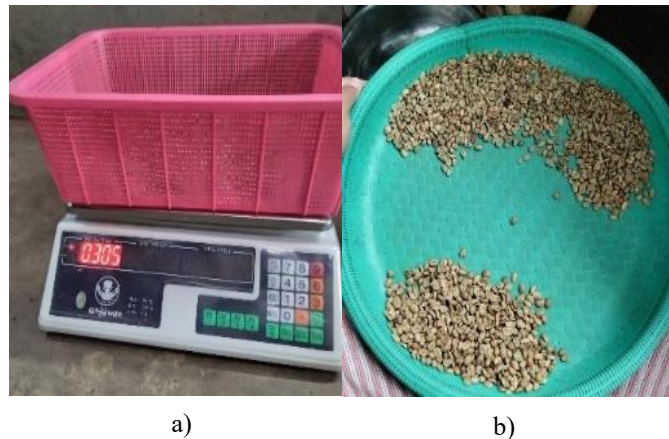


Figure 7 Coffee green grading process; a) Green bean weighing, b) Green bean sorting

b. Criteria for Arabica dry process defect (natural)

The results of green bean grading are shown in Figure 8. From the classification, it can be seen that the beans consist of both good quality and defective beans based on the defect value criteria. The presence of defective beans reflects the overall quality of the coffee produced. In general, a lower number of defects indicates better quality beans and more proper post-harvest handling. This shows that the grading process plays an important role in maintaining coffee quality and determining its market value.



Figure 8 Grading green bean coffee dry process

c. Criteria for defective Arabica wet process (full wash)

The results of green bean grading for the wet process (full wash) are presented in Figure 9. Based on the classification, both good quality and defective beans were identified according to the defect value criteria. The presence of defects reflects the overall quality of the coffee produced. In general, a lower number of defective beans indicates better quality and more effective post-harvest processing. This shows that the wet processing method also plays an important role in determining the final quality of Arabica coffee.



Figure 9 Grading of green bean coffee wet process (full wash)

The criteria for defective value are carried out, with provisions according to the criteria for coffee quality defect value according to (BSN, 2008), i.e. in Table 2:

Table 2 Criteria for coffee bean defect value

Yes	Criteria for the defective value of coffee beans	Dry process	Wet process (full wash)
1	1 Black <i>beans</i> defective value = 1	34	10
2	2 Partially <i>black beans</i> defect value = 1		50
3	2 <i>Broken black beans</i> : defective value = 1	12	
4	1 Husk <i>coffee</i> defect value = 1	6	
5	4 <i>Brown beans</i> defective value = 1	42	10
6	1 Large <i>husk fragments coffee husk</i> value = 1		
7	2 Medium <i>husk fragments coffee husk fragments</i> = 1	9	8
8	5 Small husk fragments of <i>coffee husk</i> = 1	6	
9	10 Beans in <i>silver skin</i> defective value = 1		
10	2 Beans in <i>parchments</i> , defective value = 1	28	
11	2 Large <i>parchment fragment (large parchment fragment)</i> defect value = 1		
12	5 Medium size horn skin defective value = 1		
13	10 Horn skins small size defect value = 1		
14	5 <i>Broken beans</i> defective value = 1	186	25
15	5 Young seeds ( <i>immature beans</i> ) defective value = 1		
16	10 beans with <i>one hole</i> defective value = 1		
17	5 Perforated seeds of more than one defective value = 1	18	80
18	10 Spotted <i>beans</i> defective value = 1	10	70
19	1 Twigs, soil, large size stones defect value = 5		
20	1 Twigs, soil, stones of medium size defective value = 2		
21	1 Branches, soil, stones small size defect value = 1		
Total		106	67

d. Quality classification

Quality classification is obtained by the *dry process* obtained a total score criterion of 106, while *Wet Process* obtained a total score criterion of 67. According

to the criteria for coffee quality defect value according to (BSN, 2008), with the following conditions:

- a. Quality 1: total maximum defect value of 11 pieces
- b. Quality 2: total defect score 12-25
- c. Quality 3: total defective score 26-44
- d. Quality 4a: total defect score 45-60
- e. Quality 4b: total defect score 61-80
- f. Quality 5: total flaw score 81-150
- g. Grade 6: Total Handicap Score 151-22

The quality classification of the dry process method was obtained with a quality of 5, and the wet process method obtained a quality value of 4 (4b). It can be seen from the results, the quality classification of the wet process processing method is superior in quality value, when compared to the dry process method.

## CONCLUSION

The conclusion that can be drawn from the research is that the optimal brix content of the Yellow Caturra variety is higher, when compared to Sigararutang. The highest brix level in the variety of Yellow Caturra reached 15.67 and Sigararutang 14.33 at the time of harvest, while at the time of post-harvest picking the Yellow Caturra variety reached 15.83 and Sigararutang 13.33. The lowest brix content for harvest picking the Yellow Caturra variety reached an average of 8.67 and Sigararutang 8, while at the time of post-harvest picking the Yellow Caturra variety reached 11 and Sigararutang 9.67. The post-harvest production activities of wet process Arabica coffee, when compared to the production of dry processed Arabica coffee, are better, with the quality of wet process Arabica coffee, which is obtained 4 (4b) with a defect value of 67 and Arabica *dry process*, which is a quality value of 5 with a defect value of 106.

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