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Application of Coffee Pulper and Huller Machines Technology in Salak District in Improving Coffee Post-Harvest Efficiency and Effectiveness

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ABSTRACT
Robusta coffee is one of the superior agricultural varieties in Salak District, Pakpak Bharat Regency because it has a strong aroma and a more bitter taste. Partner of one of the robusta coffee farmers in Salak District still use traditional tools to peel the coffee cherries they cultivate. This is an obstacle in the post-harvest processing of coffee. This coffee fruit peeling tool requires a lot of manpower, a long time, and a large percentage of unpeeled coffee cherries. Therefore, the community service team helped overcome the partner's problem with the aim of implementing post-harvest technology in coffee bean production. The method used was the provision of pulper and huller machines and practical training in using these machines in the application of post-harvest coffee processing. The results obtained were that almost 100% of the coffee fruit skin and coffee horn skin were peeled using the pulper and huller machines. The percentage of coffee beans produced by the pulper machine is 64-74% of wet coffee cherries and the percentage of dry coffee beans without horn skin produced by the huller machine is 38,18-42,19% of peeled coffee beans with pulper machine.

Keyword: Coffee Huller, Coffee Pulper, Post-Harvest Technology, Robusta Coffee

1. Introduction

Community service partner is coffee farmer who cultivate coffee and business owner who process coffee cherries into dry coffee beans. The coffee variety used is Robusta which has been planted. Robusta coffee is one of the superior commodities and is widely cultivated in Indonesia. The characteristics of robusta coffee are higher caffeine content than Arabica coffee, slightly acidic, and a more bitter taste [1]. The land for planting robusta coffee is located in Salak 1 Village, Salak District, Pakpak Bharat Regency, which has an area of 1.5 hectares.

The community service team conducted a survey to the community service partner's location and discussed the problems faced by the partner. From the survey results, it was found that the obstacles faced by the partner were the tools used in the coffee fruit peeling process still using traditional tools. The tool is driven by human power so it requires a lot of energy and a long time, thus reducing the productivity of the partner's business.

Community service partner carries out the harvesting process on coffee berries that have characteristic orange to bright red colors. Coffee harvesting is based on the level of fruit ripeness and is carried out when the fruit is red (the fruit is 10 to 11 months old) [2]. The size of the roundness (sphericity) of coffee berries with red

ripeness robusta coffee varieties is 0.868 mm where the increasing ripeness of the coffee berries also increases the sphericity value [3].

The process of peeling ripe coffee beans into wet coffee beans is done simply using traditional tools (Figure 1). This tool is made of wood with a grinding plate attached to a bent nail that aims to grind the coffee fruit so that it breaks and the skin of the fruit is removed from the coffee beans. However, this tool is manually operated by human power so that it requires great energy and a long time.

Figure 1. Traditional coffee peeling tools used by partner

This traditional peeling tool also produces a relatively high percentage of broken beans, the skin is still mixed with peeled coffee beans, and the percentage of unpeeled fruit is quite large so that partner has to separate them manually and peel them again. Therefore, partner is constrained to increase their production volume because it takes a long time and a lot of energy. The time needed to peel the coffee fruit skin into wet coffee beans is around 125 kg per hour. In addition, partner is also constrained in terms of price and access to buy the coffee peeling machine and the lack of education received by partner in the skills of using the coffee peeling machine. Based on this, this is an obstacle or problem for partner in developing their business so that partner needs a coffee fruit skin peeling machine so that the dry coffee bean production process is more effective and efficient. Therefore, partner hopes that the community service team can help in providing the coffee fruit skin peeling machine and the training on how to use it.

2. Method

The method of implementing activities to overcome problems from partner is:

1. The team holds direct discussions with partner regarding the post-harvest technology needed so that the coffee peeling process is more efficient and does not take a long time so that it can improve the quality and quantity of coffee bean production produced by partner.
2. The community service team provides coffee fruit skin peeling machine and coffee horn skin peeling machine to partner so that partner is assisted in the process of peeling coffee fruit skin in the production of dry coffee beans and can increase their productivity and business management.
3. The community service team provides training in using the coffee fruit skin peeling machine and the coffee horn skin peeling machine to partner by practicing directly so that partner can understand and be skilled in using it.

3. Result and Discussion

The process of peeling coffee fruit from the skin of the fruit and the skin of the coffee horn is one of the post-harvest stages in producing dry coffee beans. However, the coffee fruit peeling tool owned by the partner is a traditional tool and its use is still manual. This traditional coffee fruit peeling tool uses quite a lot of human

power, requires a long peeling time, and the peeling results obtained are less than optimal because there are still many coffee fruits that are not peeled so that the partner must peel them again using the tool.

In overcoming these problems, the community service team provided a solution in the form of providing two post-harvest coffee machines, namely a coffee fruit skin peeling machine called a coffee pulper machine and a coffee horn skin peeling machine called a coffee huller machine (Figure 2). This pulper machine functions to separate coffee beans from the outermost coffee fruit skin and coffee fruit flesh (mesocarp) quickly, easily, and efficiently, while the huller machine functions to separate coffee beans from the peeling results with a pulper machine that have been dried from the horn skin and skin. The specifications of the pulper and huller machines can be seen in Table 1.

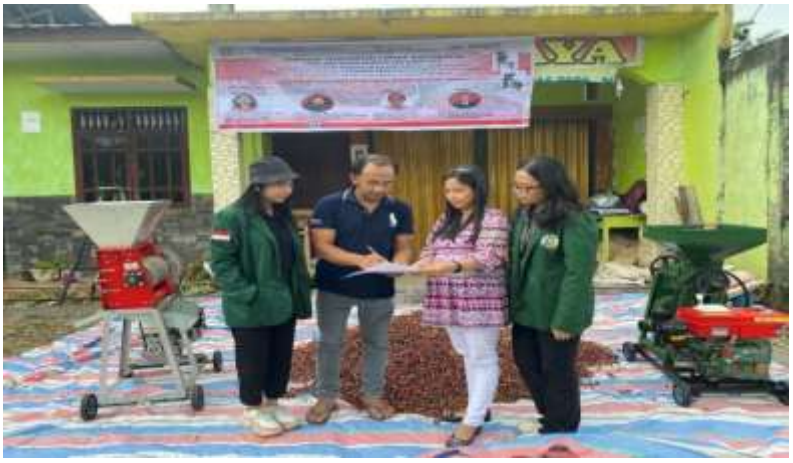
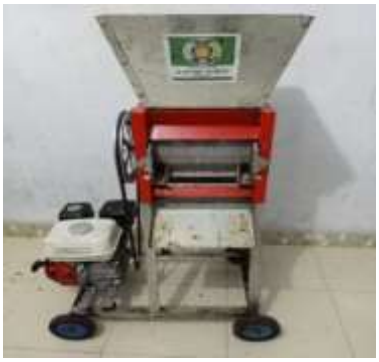


Figure 2. The community service team handed over the pulper and huller machines to the community service partner at the community service location

Table 1. The specifications of the pulper and huller machines

Machine name	Specification
Pulper 	Engine Power: 6.5 HP Engine Rpm: 3600 Rpm Oil Type: SAE 10W30 Production Capacity: 160-200 kg/hour Dimensions: 62 cm x 40 cm x120 cm Frame: Angle Iron Fuel: Gasoline/Pertalite
Huller 	Combustion system: Front chamber Diameter x stroke length: 75 x 80 Stroke volume (ltr): 0.353 Continuous power (hp/rpm): 7.0/2600 Cooling system: hopper Production capacity: 100-250 kg/hour Dimensions: 100x10x110 cm Fuel: Diesel

The community service team conducted training on the use of pulper and huller machines at the service location (Figure 3). This training activity began with the service team practicing the use of the machines to the service partner. After that, the service partner practiced the use of the pulper and huller machines until they were skilled.

(a) **(b)**

Figure 3. Practical training activities on the use of a pulper machine (a) and a huller machine (b) at the community service location

The purpose of the pulper or wet coffee bean peeler machine is to separate the endosperm skin from the epidermis or wet skin [4]. The stages of using the pulper machine (Figure 4) are as follows:

1. Turn on the machine by turning on the ON button and pulling the lever to move the wheel/coil (make sure the gasoline fuel is filled),
2. Insert the picked wet coffee fruits (cherries) into the collection funnel (you can add enough water),
3. The peeled coffee beans come out of the output hole, and
4. The coffee skin also comes out in a separate place, namely a different output hole.

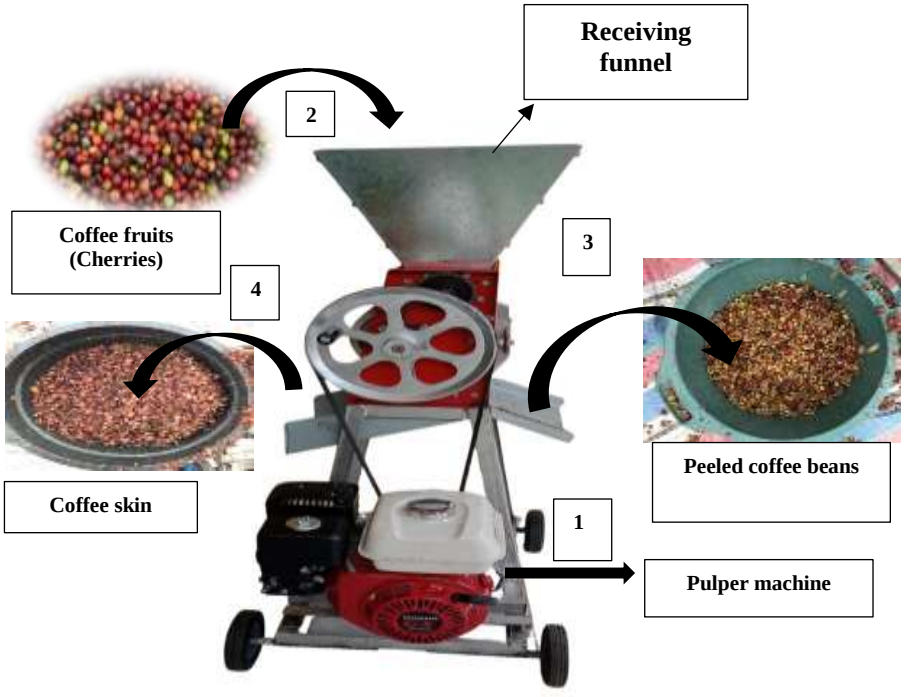


Figure 4. Stages of using a pulper machine

The huller machine aims to separate coffee beans from the skin where the coffee beans that will be peeled are in a dry state. The water content affects this process, namely the lower the water content (dry), the better the results (the number of broken/defective beans is small) and the process can be repeated twice until clean green beans are produced [5]. The stages of using the huller machine (Figure 5) are as follows:

1. Turn on the machine by turning on the ON button and pulling the lever to move the wheel/coil (make sure the diesel fuel is filled),
2. Insert the dry coffee beans from the peeling process with the pulper machine and which have been dried in the sun into the collection funnel.
3. The coffee beans that have been peeled from the skin come out of the output hole, and
4. The coffee skin also comes out in a separate place, namely a different output hole.

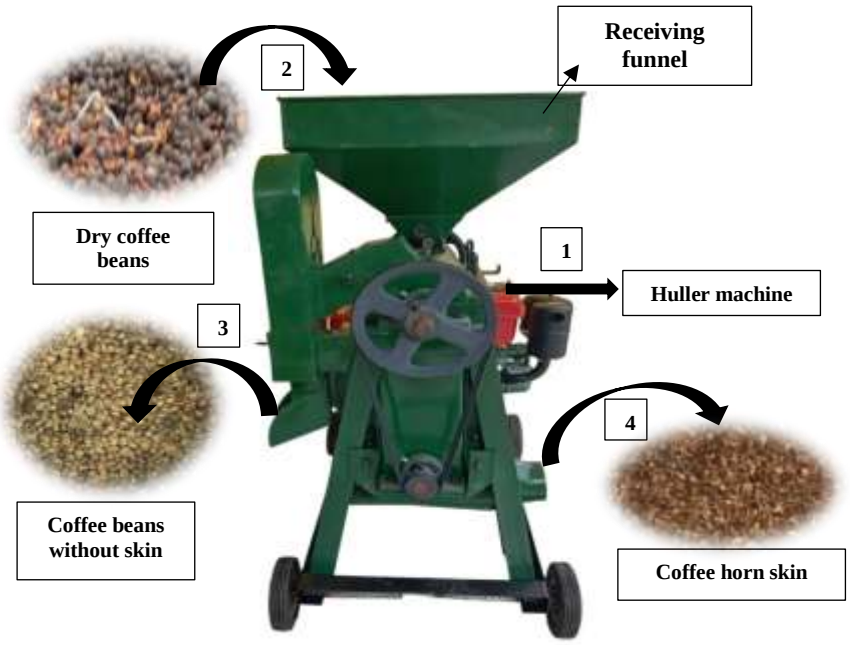


Figure 5. Stages of using a huller machine

The result of peeling coffee beans with a coffee pulper machine is coffee beans that have been peeled from the coffee fruit skin (Figure 6a) and coffee fruit skin dregs. After that, the peeled coffee beans are dried in the sun and the skin is peeled using a coffee huller machine and produces coffee beans without skin and coffee skin dregs (Figure 6b).

(a) **(b)**

Figure 6. Coffee beans that have had their skin and flesh peeled using a pulper machine (a) and dry coffee beans that have had their horns peeled using a huller machine (b)

The results of the coffee fruit peeling process using pulper and huller machines can be seen in Table 2 and Table 3 below. The data was conducted in 5 repetitions. The percentages of coffee beans that had been peeled with a pulper machine from fresh coffee fruits (cherries) were around 73,07% in the first repetition, 64% in the second repetition, 73% in the third repetition, 71,82% in the fourth repetition and 74% in the fifth repetition.

After that, the coffee beans that have been peeled with a pulper machine are dried in the sun and produce dry coffee beans. The dry coffee beans are peeled with a huller machine. The percentages of dry coffee beans peeled from the horn skin with a huller machine from peeled coffee beans with a pulper machine were 40% in the first repetition, 42,19% in the second repetition, 38,18% in the third repetition, 39,24% in the fourth repetition and 39,19% in the fifth repetition.

Table 2. Data on the use of pulper machine

Repetition	Fresh coffee fruits (cherries)	Peeled coffee beans with a pulper machine	Percentage of peeled coffee beans
1	13 Kg	9,5 Kg	73,07%
2	50 Kg	32 Kg	64%
3	75 Kg	55 Kg	73%
4	110 Kg	79 Kg	71,82%
5	150 Kg	111 Kg	74%

Table 3. Data on the use of huller machine

Repetition	Peeled coffee beans with a pulper machine	Dry coffee beans without horn skin using huller machine	Percentage of dry coffee beans without horn skin
1	9,5 Kg	3,8 Kg	40%
2	32 Kg	13,5 Kg	42,19%
3	55 Kg	21 Kg	38,18%
4	79 Kg	31 Kg	39,24%
5	111 Kg	43,5 Kg	39,19%

When compared to using a traditional and manual coffee peeling tool, 37 kg of fresh coffee is ground into 35 kg because there are still many coffee fruit skins still attached to the coffee fruit (not peeled) and less peeled coffee skin, then the coffee is dried into 8.5 kg. The manual or traditional coffee peeling tool works at 50-70 kg/hour on freshly picked wet coffee fruit and 20-35 kg/hour on dry fruit, while the pulper machine works at 160-200 kg/hour and the huller machine works at 100-250 kg/hour. Therefore, pulper and huller machines can help coffee farmers in the process of peeling coffee fruit skin efficiently and effectively in terms of time, production quantity, and quality of coffee beans produced.

4. Conclusion

The science and technology provided by the community service team is the assistance of a coffee fruit skin peeling machine or coffee pulper machine and a coffee horn skin peeling machine or coffee huller machine. Community service partner experienced an improvement in values in the field of education because partner became skilled in practical training activities on the use of pulper and huller machines provided by the community service team in community service activities in Salak District, Pakpak Bharat Regency. Partner felt an increase in quality and quantity in the process of peeling coffee berries into dry coffee beans without horn skin because the peeling process became more efficient in terms of time and more effective in terms of the quality of the coffee beans produced because the pulper machine works at 160-200 kg/hour and the huller machine works at 100-250 kg/hour, when compared to the manual and traditional coffee peeling tools that partner previously had. Partner felt very helped by the assistance of the machines and training provided which were useful in the process of peeling coffee beans from the coffee fruit harvest in the partner's fields.

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