



Cocoa Cultivation Technology and Cocoa Post-harvest Technology in The Kusuma Sari Women Farmers Group

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Abstract

The primary product made in Candikusuma Village, Melaya District, Jembrana Regency, Bali, is cocoa. In order to boost community empowerment based on cocoa plantations, including cocoa cultivation and cocoa post-harvest technology, the PM-UPUD initiative seeks to support the growth of farmer groups and micro, small, and medium-sized enterprises. The operational techniques that are employed include direct practice, monitoring, assessment, surveys, and consultations. The Kusuma Sari Women's Farming Group, a farmer group affiliated with PM-UPUD (Community Service for Regional Superior Product Businesses), is situated in Candikusuma Village, Melaya District, Jembrana Regency, Bali. Partners encounter issues with the caliber of the cocoa beans they produce as well as insufficient knowledge about planting and caring for cocoa trees following harvest. The Kusuma Sari Women's Farmers Group now has the ability to grow cocoa and manage it post-harvest in an integrated and thorough way thanks to PM-UPUD initiatives. The application of cocoa bean fermentation technology and cocoa planting technology are among the talents that the PM-UPUD program partner group will use in 2024. Farming communities now have the ability to create fermented cocoa beans, which are more valuable to consumers. PM-UPUD initiatives have the potential to boost community welfare and revenue, particularly for those in the cocoa producer group.

Keywords: Bali cocoa, GAP, GHP, GMP, post-harvest technology

1. Introduction

Chocolate is a processed product that is very popular worldwide, both in the form of chocolate bars, powder, and various other derivative products. Indonesia, one of the world's largest cocoa-producing countries, has great potential in the chocolate processing industry. The cocoa industry has enormous potential to improve the economy and spread income to the government and farmers (Schaad, 2018) Global and domestic demand for chocolate products continues to increase, opening up great opportunities for local producers to enter a wider market. However, this potential has not been fully exploited optimally, especially by farmers and small and medium enterprises (UKM).

Therefore, chocolate processing training is an urgent need to increase production capabilities and the competitiveness of local business actors. Through this training, it is hoped that participants will be able to understand the cocoa processing process, from post-harvest to the final product that is ready to be marketed. Apart from that, this training is also expected to equip participants with knowledge about quality standards, sanitation, and food safety following applicable regulations. To increase the added value of local cocoa products and support the local economy, training in processing chocolate into chocolate powder and chocolate bars is very important. This training not only improves technical skills but also provides insight into business management and marketing of processed chocolate products. It is also hoped that this training will have a positive impact on the local economy, improve the welfare of cocoa farmers, and reduce dependence on exports of raw cocoa beans.

Efforts to increase cocoa plant productivity can be made through optimizing cocoa care and proper post-harvest handling. Maintenance is the activity of maintaining all aspects of the growth of cocoa plants from the immature stage

to mature plants. In addition, maintenance is an effort to ensure that an asset continues to be produced economically (Tardzenyuy, 2020).

The application of HACCP (Hazard Analysis and Critical Control Point) in the food industry aims to prevent danger from occurring so that it can be used as an effort to ensure food quality to meet consumer needs. The stages of the harvesting, fermentation, drying, sorting, packaging, and storage processes are CCP (Critical Control Point) identified in the post-harvest handling of cocoa. Inadequate handling can result in mycotoxin contamination in cocoa beans increasing. Control measures can be taken to minimize contamination cases during cocoa handling by implementing GMP (Good Manufacturing Practices), including proper sanitation and hygiene. Meanwhile, post-harvest control of cocoa is by implementing GAP (Good Agricultural Practices). Recommendations for improving the quality of smallholder cocoa in the form of HACCP can be used and implemented at the farmer level, concerning the implementation of GAP and GHP for cocoa handling to improve the quality of smallholder cocoa (Panisello, 2001).



Figure 1: Cocoa Tree

Candikusuma Village is a village consisting of a beach area and plantations, located on the South coast of West Bali. Candikusuma Village is one of the cocoa-producing villages in Bali. There is a Kusuma Sari Women's Farmers Group in this village which has 18 members with the group leader named Ni Sayu Ketut Suartini. This group still really needs support to be able to manage cocoa plantations and post-harvest, so they need assistance so that the group has supporting activities that can help increase income.

2. Literature Review

Cocoa tree beans (*Theobroma cacao*) are fruit seeds that have undergone fermentation and drying before being processed and used as a basic ingredient for making chocolate. However, these seeds can also be processed into other products (Defitri, 2024). Cocoa is one of the most important plantation commodities for the Indonesian economy and contributes to increasing the country's foreign exchange (Subroto, 2023).

In the last 15 years, the demand for cocoa beans and their by-products, such as cocoa-based chocolate and butter, has increased globally. This increase in demand encourages the expansion of production and added value from harvests, which are popular innovation products that are beneficial for the local economy and regional intensification in Indonesia. Cocoa beans, cocoa oil, chocolate paste, chocolate cake, and chocolate powder are processed cocoa ingredients. The components of the cocoa fruit consist of cocoa pod skin, pulp, and cocoa beans, and can produce various food products, the most common of which is chocolate. The cocoa bean processing process includes harvesting, breaking, or peeling the cocoa beans, fermentation, soaking, washing, and drying. After drying, the cocoa beans go through a roasting process. After that, it is processed into chocolate powder, chocolate bars, and other chocolate preparations (Schwan, 2004).

GAP (Good Agricultural Practices) are good cultivation practices that comply with guidelines. GAP must be implemented following the Good and Correct Cocoa Cultivation Guidelines because it will increase the productivity of cocoa plants and benefit the community (Ayenor, 2007). Implementing coffee harvesting and post-harvest techniques by paying attention to GMP (Good Manufacturing Practices) is an important step in ensuring high-quality coffee production. Coffee farmers who implement this practice not only support increasing their income and welfare

but also play a role in providing coffee products that can meet the needs of consumers who hope to get the best products (Al Azis et al., 2024).

3. Materials and Methods

The Kusuma Sari Farmer Group consists of 18 people and is located in Candikusuma Village, Melaya District, Jembrana Regency, Bali. The PM-UPUD activities of the Cocoa Farmers Group in Candikusuma Village, Jembrana Regency, are planned to be carried out face to face. Partners will be given training, counseling, and direct practice to learn about cultivation management, post-harvest, and processing of cocoa plants.

The implementation of this program consists of several activities that focus on increasing production and post-harvest management of cocoa by:

- (a) Training and counseling on cocoa plantation cultivation
- (b) Training, counseling, and practice on good cocoa planting methods (GAP/Good Agriculture Practice)
- (c) Providing equipment assistance for post-harvest management of cocoa
- (d) Increased knowledge of good post-harvest management (GHP/Good Handling Practice), good product handling (GMP/Good Manufacturing Practice), and utilization of fermentation systems in post-harvest chocolate.

4. Results and Discussion

It was found from the pre-operation survey that small farmers had not utilized technology well. In the technology transfer process, there are communication barriers. Technology transfer does not last long due to a lack of understanding and support from farmers. In the end, it will develop and ultimately fail because the use of technology does not take into account the effectiveness of the technology, which cannot guarantee an increase in farmers' income.

Appropriate Technology in the management of cultivation, post-harvest, and cocoa processing is a solution to the problems faced by partners according to their problems. Partners also gain knowledge about how to cultivate (GAP), product handling (GHP), and good handling (GMP) of cocoa, and they also get assistance with the equipment needed for the cultivation, post-harvest, and processing of cocoa. Post-harvest technology can increase agricultural production and production

Partners receive direct instruction and practice in cultivating cocoa plants and post-harvest handling. The following is a description of the activities carried out.

- (a) Training, counseling, and practice on good cocoa planting methods (GAP/Good Agriculture Practice)

Cocoa bean production is influenced by many factors, such as seeds, fertilization, maintenance (such as pruning and weeding), and pest and disease control. With good seeds and care (GAP), including fertilization and pest control, high-quality cocoa beans can be produced (Leksono, 2021). The application of good agricultural practices (GAP) for cocoa encourages farmers to apply them in cocoa cultivation activities so it is hoped that this can be a potential development step for local and surrounding communities.

The implementation of good agricultural practices (GAP) by partners is as follows.

- [1]. Land preparation: pay attention to the physical properties of the soil such as drainage, structure, effective depth, water level, and soil consistency (Rubiyo & Siswanto, 2012)
- [2]. Seedling: seeds that are of good quality (fertile) and grow faster if planted in the garden with good nursery supervision (Ghosh, 2015)
- [3]. Pest and disease control: controlling pests and diseases of cocoa plants includes keeping the cocoa plant environment clean, using pesticides to spray, and picking disease-infected cocoa pods (Manuhutu, 2023)
- [4]. Soil fertilization: fertilization is the most important determining factor, especially the balance between the amount and type of fertilizer used at the seedling stage. To achieve high quality and productivity of cocoa seeds, plants must be given fertilizer as needed (Unnikrishnan, 2022)
- [5]. Maintenance: the purpose of maintenance is to create a good framework for plant growth, ensure sunlight enters the canopy evenly, plants are better able to produce more fruit, and plants are more resistant to pest and disease attacks (Repullo, 2012)

(b) Increased knowledge of good post-harvest management (GHP/Good Handling Practice)

One way to improve the quality of agricultural products is post-harvest, where various actions or treatments are carried out on agricultural commodities after harvest until the commodities reach the hands of consumers. Post-harvest handling aims to ensure that agricultural commodities remain in good and suitable condition when consumed or used as raw materials for processing (Buclatin, 2020)

Post-harvest handling of cocoa beans greatly determines the quality of the results. It is an important component in the production of cocoa and its products. The stages of post-harvest handling of cocoa beans are as follows (Subrot, 2023)

- [1]. Fruit splitting and seed sorting: removing the cocoa beans from the skin and placenta of the fruit is called fruit splitting. We can carry out the process of breaking this fruit mechanically or manually. Once the skin and cocoa beans are separated, place the cocoa beans in a cleaned container before discarding the pith.
- [2]. Cocoa fermentation: fermentation is carried out to obtain high-quality dry cocoa beans that have a distinctive cocoa taste and aroma. Apart from improving quality, fermented bean waste increases the selling price.
- [3]. Soaking and washing: after the fermentation process, washing is carried out to reduce the pulp attached to the seeds.
- [4]. Drying and tempering: to prevent damage during domestic and international shipping, drying reduces the moisture content of beans from 60% to around 6-7%. The process of drying cocoa beans usually takes five to seven days.
- [5]. Warehousing: this is the final step to maintain the quality of the cocoa beans before they reach consumers. Avoid storing cocoa beans with other food ingredients.



Figure 2: Fermentation Box

Producing good quality cocoa beans not only requires the use of seeds and plants that meet certified standards but also requires appropriate post-harvest procedures. One of the post-harvest stages is the fermentation of cocoa beans. The purpose of the fermentation process is to turn off the body of the bean so that the bean does not expand so that changes can easily occur in the cocoa bean such as the color of the bean, increasing the aroma and taste, improving the consistency of the bean, and removing the pulp (Niikoi Kotey, 2022). With fermentation, cocoa farmers can maintain quality and obtain better economic value (Manalu Gockowski, 2013). Cocoa beans are fermented for 5 to 7 days. The content of components or compounds in cocoa beans increases or decreases day by day during the fermentation process. In addition, physical changes occur slowly in cocoa beans during fermentation.

Quality levels are determined as quality control monitoring measures. All cocoa beans to be exported must meet quality standard requirements supervised by an appointed regulatory body. The quality standards for Indonesian cocoa beans are regulated by the National Standard for Indonesian Cocoa Beans (SNI 01-2323-2008). This standard includes definitions, classifications, quality requirements, sampling methods, test methods, labeling requirements, packaging methods, and recommendations for fermented, cleaned, and dried products (Muksin, 2023).



Figure 3: Kusuma Sari Women Farmers Group

Based on the results of activities, it can be seen that the technical knowledge, skills, and abilities of partners in implementing the program have reached 85%. The system applied is a fermentation technique which reaches 95%. The results of monitoring and mentoring show that the fostered partner group has made the system sustainable by carrying out assigned program activities, including the cocoa bean fermentation process to produce fermented cocoa beans. In this project, our partners have received direct benefits, namely in the form of increased sales of cocoa beans when farmers have produced quality fermented cocoa beans that meet standards, with dry prices reaching IDR. 55,000 per kilogram, while unfermented cocoa beans only cost IDR 25,000 - IDR. 28,000 per kg. Therefore, our partners experience an increase in revenue of up to 50%.

5. Conclusion

The Kusuma Sari Farmers Group has the capacity and skills to plant and manage cocoa trees comprehensively. The skills applied by the PM-UPUD project partner group in 2024 include the application of cocoa planting technology and the application of cocoa bean fermentation technology. PM-UPUD activities can increase income and improve the welfare of the community, especially members of the cocoa producer group. Additional support is needed to give priority to partners to process cocoa beans independently and produce processed cocoa products such as chocolate powder and chocolate bars.

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