

## Increasing Farmer Productivity with Clove Shelling Tools Dulamayo Puncak Farmers Group

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### Abstract

**Purpose:** The project aimed to improve clove farming in Dulamayo Selatan village, Telaga Subdistrict, Gorontalo District, which is one of the clove-producing villages in Gorontalo Province. The team designed clove shelling technology to help farmers shell (separate the stalk and flower) their clove harvests.

**Method:** The initial activity of the project was to conduct a Focus Group Discussion (FGD) or discussion with the farmer group partners. Training on making organic fertilizer (compost) was carried out, utilizing materials around which can then be applied to clove plants. The design of the clove shelling tool was carried out by the team along with the students involved.

**Practical Applications:** The clove shelling tool has been handed over to the farmer group, a total of 5 tools. Through the introduction of clove shelling technology and training in making organic fertilizers, farmers' knowledge related to technology adoption and understanding in clove farming efforts through counseling and simulation has increased.

**Conclusion:** The project successfully introduced a new technology for clove shelling and provided training for making organic fertilizer. This has not only eased the process of clove farming but also increased the knowledge of farmers about technology adoption and understanding in clove farming efforts



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### Introduction

Dulamayo Selatan Village, located in Telaga Subdistrict, Gorontalo District, is approximately 23.5 Km from the center of Gorontalo City, with a travel time of about 48 minutes and an area of 1.750 Km<sup>2</sup>. Most of the residents are farmers with various commodities such as cloves, nutmeg, cinnamon, coffee, and fruits. The most developed agricultural commodity in Dulamayo Selatan Village is cloves, not only because it is quite profitable for farmers, but also because the hilly demographics of the area, with an altitude of 500 – 1000 meters above sea level, support the development of clove commodities or other perennial plants. The management of agricultural commodities in Dulamayo Selatan Village, especially cloves, is still manual, with clove flowers being picked and then shelled (separation of stalks and seeds) manually after the harvest is collected. The Dulamayo Puncak farmer group, led by Arfan Ishak and consisting of 20 farmers in Dulamayo Selatan Village, was chosen for several considerations. The farmer group is a social group born in the community through mutual agreement to achieve the goal of improving welfare through agricultural management. In addition, there is no supporting technology for clove farming in the partner village. The level of human resources of partners based on education in Dulamayo Selatan Village, Gorontalo District, according to the demographic data of Dulamayo Selatan Village, the population of Dulamayo Selatan Village is 2,050 people, where the number of male residents is 1,062 and the number of female residents is 988, with the number of Household Heads (KK) reaching 620. The educational level of the population varies, where the level of education of people who did not receive education through Elementary School (SD) is 39 people while those who reached the level of SD education is 941 people. People with Junior High School (SLTP) education level are 168, for residents who have a High School (SMA) education reach 125 people, D3 23 people, Bachelor's degree (S1) 19 people.

Referring to the condition of human resources and agricultural partners, based on field observations, it is depicted that the human resources of partners are still generally low, both in terms of formal education and knowledge about technology in the field of agriculture, so that farmer productivity is not optimal. Dulamayo Selatan Village is one of the clove production centers in Gorontalo District, the majority of commodities developed by farmers in Dulamayo Selatan Village are cloves. The hilly topography of the village is one of the supporting factors for the development of clove commodities or other perennial plants. In general, there is no technology that farmers use in clove farming, which impacts the length of harvest time and production which indirectly affects farmer productivity. The management of clove harvests in Dulamayo Selatan Village is still conventional or manual, there are several things that influence the adoption of technology in Dulamayo Selatan Village including difficult road access and the distance from the city which is quite far and also the level of farmer education, in line with the opinion of Burhansyah (Burhansyah, 2019) the acceleration of technology adoption is significantly influenced by the distance of the farming location and the distance of the settlement to the source of technology, the level of education and accessibility to the highway. In addition to the lack of technology adoption, farmers also depend on the use of chemical fertilizers, this certainly affects soil fertility and the sustainability of agriculture, in accordance with the opinion of Tumewu et al (Tumewu et al., 2018) the use of inorganic fertilizers has several weaknesses, besides the relatively expensive price, continuous use or continuously with high doses, can cause environmental pollution and until the productivity of the land decreases. Clove plants require maximum care, in addition to harvesting only once a year, the decrease in soil fertility due to the use of chemicals also affects the production of clove plants. Therefore, appropriate technology is needed that is able to maximize the productivity of clove farmers and increase farmers' understanding of the benefits of using organic fertilizers in agriculture.

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There are three issues with the partners that are the objectives of this activity. First, the aspect of Agricultural Technology Adoption (the absence of appropriate technology to assist farmers in clove cultivation due to the lack of farmer technology adoption and the presence of many organic materials that are not utilized by partners such as clove leaves, weeds on agricultural land, clove plant stalks, animal manure, and household waste). Second, the aspect of Human Resources (limited knowledge of technology innovation). Third, farmer cultivation techniques (lack of farmer understanding of the utilization of surrounding organic materials that can be processed into fertilizers). Farmer Productivity The higher the level of farmer productivity, the higher the income from the farmers. One of the drivers of increased farmer productivity is the use of time, with the help of technology, farmers can shorten working hours so they can complete several activities in a short time. Human resources (HR) are the most important capital and wealth of every human activity. Humans as the most important element must be analyzed and developed in such a way. Time, energy, and their abilities can be fully utilized optimally for the benefit of the organization, as well as for individual interests. As the first and main factor in the development process, HR is always the subject and object of development. The level of labor productivity plays a very important role in national economic growth, where national and regional income is largely obtained by improving the quality of HR (Oktavia et al., 2017).

Clove Agriculture Clove farming is one of the agricultural businesses that has been a flagship for farmers. Cloves have been an export commodity by the government, and provide a large economic opportunity for farmers. The surge in clove prices occurred when the industrial need for cloves increased. The efforts of some farmers who still survive with clove farming indicate that there is something that becomes a reason for the farmer, a reason not owned by other farmers. The reason referred to is the existence of a relationship owned by farmers with outsiders, parties that are able to provide information to farmers to survive, or even parties that are able to guarantee to be able to accommodate the production results of farmers (Malik, 2015). Cloves are an agricultural commodity in the plantation sector that provides a large contribution to the economy, ranging from the smallest industry to large industries. Because cloves are still widely used as cooking spices, the main ingredient for making cigarettes and used as a medicine for health (Sardianti et al., 2023). Technology in Clove Agriculture There are several technologies in clove agriculture that have been introduced, such as those made by Susanto (Susanto et al., 2021), namely a clove dryer with a capacity of 15 Kg, this tool can dry agricultural products that are not affected by the weather and can also save land and drying time, to replace the drying process, namely drying cloves using a drying machine using an electric motor drive system. Here the electric motor is the main driver to drive the tube containing cloves. With the same function but different components and working methods, it was also designed by Nugroho (Nugroho & Hariri, 2021) Designing a Clove Dryer with a Capacity of 30 kg Based on Arduino, The design of this clove dryer uses the Pahl & Beitz design method to get a design concept that suits the needs. To carry out the drying process with specifications, namely, the heating device (Heater) uses a Tubular Heater, uses an arduino uno microcontroller system and a humidity temperature sensor using DHT22, uses a centrifugal type Blower, uses a 2 × 16 LCD, uses a profile of an iron elbow frame measuring 40 × 40 [mm], the dimensions of the tool are 1000 × 800 × 1200 [mm]. So that the desired drying result will be obtained, namely with a water content that remains between 12 – 14% according to the safe drying level for storage.

#### **Method**

Three issues with the partners are the objectives of this activity. The first is the aspect of Agricultural Technology Adoption, where there is no appropriate technology to assist farmers in clove cultivation due to the lack of farmer technology adoption. There are also many organic materials that are not utilized by partners such as clove leaves, weeds on agricultural land, clove plant stalks, animal manure, and household waste. The second issue is the aspect

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of Human Resources, where there is limited knowledge of technological innovation. The third issue is farm cultivation techniques, where there is a lack of farmer understanding of the utilization of surrounding organic materials that can be processed into fertilizers.

Table 1. Program Implementation Methods

Problem Prioritization	Solution	Implementation Method
Partner technology adoption rates are still low	Socialization of technology on clove commodities	FGD with partners related to clove sheller technology that can be utilized and obstacles in clove farming
Farmers pick clove crops manually	Design appropriate technology	Clove sheller design with partners
Concentration of chemical fertilizer use on partner commodities	Training and counseling on the benefits of organic fertilizers for plants	Making organic fertilizer with surrounding materials that are easily obtained by partners
Partner clove cultivation still relies on experience	Increased understanding of farmers about the right clove cultivation procedures	Counseling on clove cultivation and pest control on plants
Organic materials such as livestock manure, household waste and agricultural waste have not been utilized	Utilization of organic materials for agricultural commodities	<ol style="list-style-type: none"> <li>1. Making organic fertilizer that is ready to be applied to plants and has been fermented</li> <li>2. Application of organic fertilizers on clove plants</li> </ol>

Farmer productivity is crucial. The higher the level of farmer productivity, the higher the income from the farmers. One of the drivers of increased farmer productivity is the use of time. With the help of technology, farmers can shorten working hours so they can complete several activities in a short time. Human resources (HR) are the most important capital and wealth of every human activity. Humans as the most important element must be analyzed and developed in such a way. Time, energy, and their abilities can be fully utilized optimally for the benefit of the organization, as well as for individual interests. As the first and main factor in the development process, HR is always the subject and object of development. The level of labor productivity plays a very important role in national economic growth, where national and regional income is largely obtained by improving the quality of HR (Oktavia et al., 2017).

Figure 1. Clove Sheller Tool Design



Source: Private Documentation, 2023.

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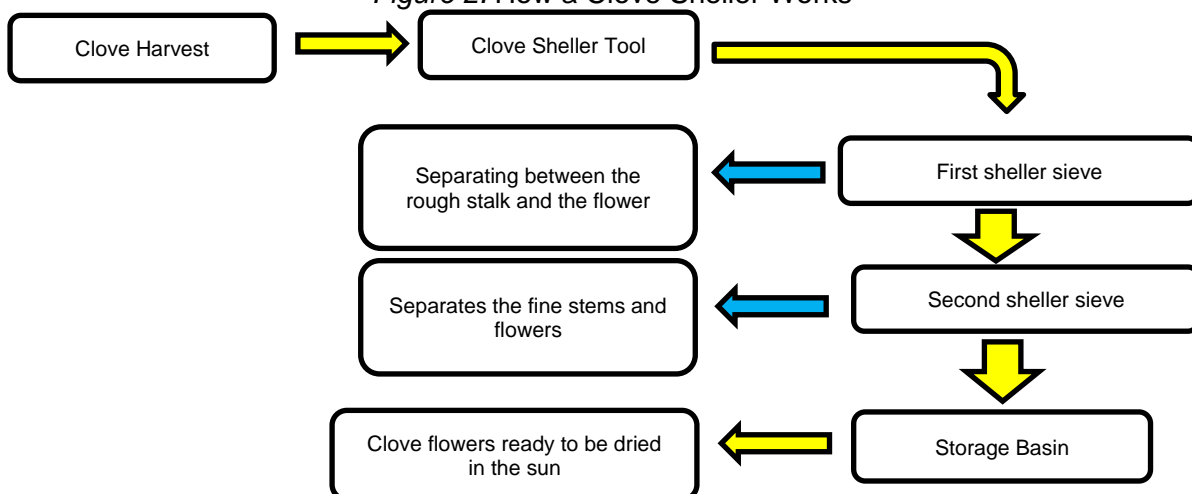
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Clove farming is one of the agricultural businesses that has been a flagship for farmers. Cloves have been an export commodity by the government and provide a large economic opportunity for farmers. The surge in clove prices occurred when the industrial need for cloves increased. The efforts of some farmers who still survive with clove farming indicate that there is something that becomes a reason for the farmer, a reason not owned by other farmers. The reason referred to is the existence of a relationship owned by farmers with outsiders, parties that can provide information to farmers to survive, or even parties that are able to guarantee to be able to accommodate the production results of farmers (Malik, 2015). Cloves are an agricultural commodity in the plantation sector that provides a large contribution to the economy, ranging from the smallest industry to large industries. Because cloves are still widely used as cooking spices, the main ingredient for making cigarettes and used as a medicine for health (Sardianti et al., 2023). There are several technologies in clove agriculture that have been introduced, such as those made by Susanto (Susanto et al., 2021), namely a clove dryer with a capacity of 15 Kg, this tool can dry agricultural products that are not affected by the weather and can also save land and drying time, to replace the drying process, namely drying cloves using a drying machine using an electric motor drive system. Here the electric motor is the main driver to drive the tube containing cloves. With the same function but different components and working methods, it was also designed by Nugroho (Nugroho & Hariri, 2021) Designing a Clove Dryer with a Capacity of 30 kg Based on Arduino, the design of this clove dryer uses the Pahl & Beitz design method to get a design concept that suits the needs. To carry out the drying process with specifications, namely, the heating device (Heater) uses a Tubular Heater, uses an arduino uno microcontroller system and a humidity temperature sensor using DHT22, uses a centrifugal type of Blower, uses a 2 x 16 LCD, uses a profile of an iron elbow frame measuring 40 x 40 [mm], the dimensions of the tool are 1000 x 800 x 1200 [mm]. So that the desired drying result will be obtained, namely with a water content that remains between 12 – 14% according to the safe drying level for storage

### Result

The clove shelling tool works by separating the stalk and clove flower after they are harvested or picked. The harvested cloves are poured onto the top of the shelling tool, and then the flowers will be filtered to the second filter. The second filter is made from a 5/8 inch paralon pipe and is installed at a 30° angle, driven by a spring. The clove flower seeds left in the second filter go directly to the container (basin). The direct impact of this technology is to accelerate the clove shelling process by up to 70%.

Figure 2. How a Clove Sheller Works



Source: Private Documentation, 2023.

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The first activity, which was carried out on August 19, 2023, was the making of organic fertilizer with the speaker Mr. Fardiyansjah Hasan S.P., M.Si. Organic fertilizer is made from materials that are easily obtained by farmers. This activity begins with counseling and then continues with direct training. The fermentation of organic fertilizer is carried out for 1 month before it is ready to be applied. The tools used in this fermentation are: a mixing tub/bucket, crowbar, hoe, wooden board, wooden stake, scoop, and tarpaulin. The materials used in this activity are: M4, brown sugar, goat manure, corn litter, tree branches, dry grass, green grass, leaves, sawdust, and water.

*Figure 3. Extension on Making Organic Fertilizer*



Source: Private Documentation, 2023.

*Figure 4. Fertilizer Manufacturing and Fermentation Process*



Source: Private Documentation, 2023.

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The first step is to dig a hole 30 cm deep with an area according to the amount of material that will be made into fertilizer. Then, the dug hole is fitted with a wooden board and stake as a wall. The second step is to place each material in the available hole in layers according to the type of organic material that will be fermented. Each layer is watered with water that has been mixed with brown sugar and M4. After all the materials are placed in the fermentation hole, the third step is to cover it with a tarpaulin and control is carried out every week. I Made Sudiarta, a member of the team, told the farmers that the fermented material will shrink, so more organic material can be added for fermentation.

*Figure 5. Process of Mixing Fertilizer Ingredients in a Fermentation Container*



Source: Private Documentation, 2023.

*Figure 6. Installing Tarpaulin for the Fermentation Process*



Source: Private Documentation, 2023.

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The next activity is to design a clove shelling tool, a total of 5 units. The clove shelling tool is designed using materials that are easily obtained by farmers, so after the manufacturing training and simulation are held, the farmer group partners and skilled members can design or make it independently. The design of the tool begins with making the main beam and pole frame as a support for the main filter, with the main pole height being 85 cm and the width being 82 cm. Next, the main filter board is made with the size of the wooden board used being 50 cm wide and 80 cm long with a thickness of 2 cm. On the main filter, holes are made every 2 cm using a 12 mm drill bit. The main filter board is installed with a partition wall on all sides, which also serves as a container for shelling.

*Figure 7.*



Source: Private Documentation, 2023.

*Figure 8.*



Source: Private Documentation, 2023.



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The next step is to make a second filter made from a 5/8 inch paralon pipe, with a filter length of 90 cm. The paralon pipe is nailed on top of the wooden frame with a diameter adjusting the width of each shelling pole. The paralon pipe is installed with a 2 mm gap.

*Figure 9.*



Source: Private Documentation, 2023.

*Figure 10.*



Source: Private Documentation, 2023.

### **Discussion**

The activities carried out in this project have demonstrated significant potential in improving agricultural practices and productivity. The introduction of the clove shelling tool and the organic fertilizer production process are two key innovations that have been implemented. The clove shelling tool is a remarkable innovation that has the potential to revolutionize the clove industry. By accelerating the clove shelling process by up to 70%, it not only saves time but also reduces the manual labor required in the process. The design of the tool, which

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separates the stalk and clove flower after they are harvested, is ingenious. The use of a second filter made from a 5/8 inch paralon pipe installed at a 30° angle, driven by a spring, ensures that the clove flower seeds go directly to the container. This tool is designed using materials that are easily obtained by farmers, promoting self-sufficiency and independence among the farmer groups. The organic fertilizer production process is another significant activity that was carried out. The process begins with counseling and then continues with direct training. The fermentation of organic fertilizer is carried out for 1 month before it is ready to be applied. The tools and materials used in this fermentation are easily accessible to farmers, which makes this process highly sustainable and cost-effective. The step-by-step process of digging a hole, placing each material in layers, watering each layer with water mixed with brown sugar and M4, and covering it with a tarpaulin is well thought out. The fact that the fermented material will shrink, allowing for more organic material to be added for fermentation, is an important observation that can help optimize the process. These activities have shown that with the right tools and knowledge, farmers can significantly improve their productivity and sustainability. The success of these activities also underscores the importance of community service programs in disseminating knowledge and skills among farmers. Future work should focus on refining these processes and tools, and exploring other innovative solutions that can further enhance agricultural practices. It would also be beneficial to conduct a comprehensive evaluation of the impact of these innovations on the farmers' productivity and income. Overall, the results of this project are promising and demonstrate the potential of simple, locally sourced innovations in transforming agricultural practices and improving livelihoods. The project serves as a model for similar initiatives in other agricultural communities.

### Conclusion

Clove farmers in Dulamayo Selatan Village, Telaga Subdistrict, Gorontalo District have not yet known technology for clove farming. Therefore, the program brought by the PKM team from Ichsan Gorontalo University was well received by the farmers in Dulamayo Selatan Village. The farmers were very enthusiastic to watch the simulation of how the clove shelling tool works. In addition, through organic fertilizer making training, farmers were equipped with new knowledge and skills about utilizing surrounding resources that have not been used so far, such as agricultural waste - corn, cloves, grass, kohe, sawdust, etc. After conducting organic fertilizer making training, farmers were also given knowledge related to how to evaluate organic fertilizer during the fermentation period, so that the volume of fertilizer made can be added independently. Of the 5 tools given to farmers, they are used by clove farmers to shell their harvest, which has been manual so far. With this tool, the use of clove shelling time can be faster up to 70%.

### Acknowledgements

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