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Empowerment of Cassava Leaf Silkworm Cultivation Groups Through Processing of Ceara Rubber Tree (*Manihot Glaziovii*) as Local Food Potential

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ABSTRACT

Food security has become an increasingly urgent global issue as the impact of climate change and the global food crisis intensify. Indonesia, as an agrarian country, has great potential to strengthen its food system to be self-sufficient and sustainable, one of which is through the empowerment of local farmer groups. This article discusses efforts to enhance food security through agricultural product diversification by leveraging untapped local potential, specifically the processing of rubber tree (Manihot glaziovii) tuber skins. Empowerment activities were conducted with the Sutra Alam Gunung Sewu group in Gunungkidul Regency, DIY, which had previously only utilized the plant's leaves as silkworm feed. The tubers and bark of this tree, which are nutrient-rich but contain high levels of cyanide acid, have the potential to be developed as an alternative food source if processed properly. The empowerment program was implemented to enhance the group's capacity to process the tuber bark into useful products. Evaluation was conducted using pre-test and post-test instruments to measure improvements in members' knowledge and skills. The results showed a 120% increase in general knowledge and an 84% increase in understanding of information regarding the potential of local food and the processing of risky materials into safe consumption. This initiative contributes to food diversification and the economic empowerment of local communities in supporting national food security.

Keywords: Cassava Leaf Silkworm; Ceara Rubber Tree; Manihot Glaziovii; Empowerment of Groups; Rongkop; Gunung Kidul

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INTRODUCTION

Food security has become a global issue in line with the extreme climate change that has hit the world. The United Nations (UN) summarizes the issue of food security in the 17 Sustainable Development Goals (SDGs) in the second point, namely Zero Hunger (Department of Economic and Social Affairs, 2015). In the Asta Cita program promoted by the Red and White Cabinet, food security is included in the main vision of the program to address global challenges, namely the second Asta Cita.

The national food crisis needs to be mitigated and a comprehensive strategy implemented so that it can be overcome as soon as possible (Winata et al., 2024). Food security is the foundation of community welfare and an important pillar in

maintaining social stability and national sovereignty. Indonesia, as an agrarian country with high biodiversity, has great potential to build a sovereign and sustainable food system. Strengthening the agricultural sector and farmers as the main actors in agriculture is crucial and needs more attention from the government. Not only products, but agricultural businesses also need to be diversified (Hidayat, 2023). Diversification of agricultural products serves to enrich the types of agricultural products and explore the potential of local foods that have not yet been discovered by farmers (Fathi et al., 2022). Efforts to build food security can be supported by the government, universities, or private foundations through integrated programs that are measurable in their success and sustainable (Rumawas et al., 2021).

Sutra Alam Gunung Sewu is a group of silkworm farmers located in Rongkop and Girisubo subdistricts, Gunungkidul Regency, DIY. This group has successfully adapted silkworms to feed primarily on rubber tree leaves (Manihot Glaziovii). Rubber tree leaves contain chemical compounds such as flavonoids, saponins, and tannins (Asmuruf et al., 2024). In addition to rubber tree leaves, silkworms can also be fed cassava leaves and cassava tubers, but rubber tree leaves have been proven to increase the hatching rate of silkworm eggs (Aprilia, 2019; Setiyawan & Fitasari, 2018). According to this group, rubber tree leaves also strengthen silkworms' resistance to pungent odors (Subrata et al., 2024). Given the rocky and difficult terrain of Rongkop District for planting trees, Sutra Alam Gunung Sewu cultivates rubber trees on hillsides as the primary food source for silkworms.

The rubber tree tuber is known for its high cyanide (HCN) content, so it is never processed by the community. This high HCN content also means that rubber tree tubers are rarely traded (Isvandiary, 2020). Consuming cyanide can cause various diseases and even death, making it dangerous for both humans and animals (Hasan & Taufiq, 2022). The rubber tree tuber becomes wood fiber when the tree is over two years old, but the tuber skin can still be utilized if processed properly to reduce the cyanide acid content (Yerizam et al., 2018). The rubber tree tuber contains other nutrients that can be utilized for food, including carbohydrates, protein, fat, and water (Aulia et al., 2023; Lubis et al., 2023; Purnomo, 2024; Yuniar et al., 2020; Yuniarti et al., 2024). The Sutra Alam Gunung Sewu group only utilizes the leaves of the rubber tree as silkworm feed. However, there is still potential in the bark of the rubber tree that can be utilized and has the potential to be developed into bioethanol (Praputri et al., 2018), edible film (Amrillah et al., 2019; Wahyuningsih et al., 2019), and even as a local food source.

This community empowerment program aims to increase the capacity of the Gunung Sewu Natural Silk leaf cassava silkworm cultivation group in processing rubber tree bark. The rubber trees planted by the group are more than two years old and have not been utilized at all. Through this program, it is hoped that the community can increase their food reserves and thus their income (Ula, 2021). The capacity building of group members is measured using pre-test and post-test instruments. The results of the capacity building of group members are presented in easy-to-understand graphs and followed by an in-depth analysis related to the capacity building.

MATERIALS AND METHODS

The bark of the rubber tree has not yet been utilized by the Sutra Alam Gunung Sewu group. Therefore, processing rubber tree bark can improve skills and the economy in the long term. In this community empowerment activity, the method applied is participatory action. The participatory action method involves the community as active subjects, not objects, in the process of identification, decision-making, and implementation of solutions. The participatory action method shown in Figure 1 involves problem identification, knowledge transfer, capacity building, reflection, and evaluation.

In implementing the method, the problem identification stage is carried out through group discussions or structured interviews to explore local understanding of the use of rubber tree bark. Knowledge transfer is carried out by delivering material through focus group discussions (FGD) and interactive counseling. Capacity building is carried out by sharpening the understanding of group

members regarding the material that has been provided. Reflection is carried out by reviewing the results of sharpening understanding with an in-depth analysis of the capacity gains obtained by group members. Subsequently, an evaluation is conducted to determine the sustainability of the program to be provided.

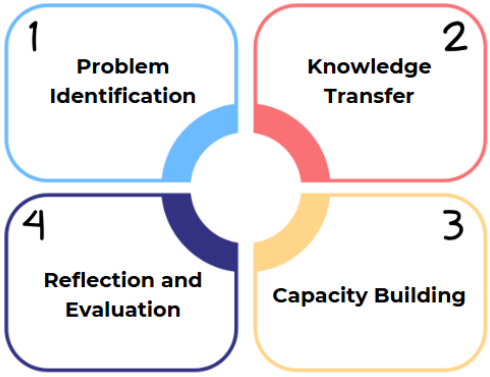

Figure 1. Participatory action methods applied in community empowerment activities

Procedure

In implementing community empowerment programs, the implementation procedures are carried out by involving various parties. The parties involved in collaborating on the community empowerment program in the Sutra Alam Gunung Sewu group include the Muhammadiyah Yogyakarta Regional Leadership Council for Community Empowerment (MPM PWM DIY), the Muhammadiyah Gunungkidul Regional Leadership Council for Community Empowerment (MPM PWM Gunungkidul), and the Pringombo Village Administration.

1. *Problem Identification*

The problems were identified through direct interviews with the Sutra Alam Gunung Sewu group. The results of the identification of the problems faced by the Sutra Alam Gunung Sewu group focused on the lack of utilization of rubber tree tubers. This was due to the group's lack of knowledge about how to handle the HCN content in rubber tree tubers to be used as processed products. At this stage, after the problem identification results were obtained, a formulation was carried out to find a suitable solution so that the problem could be resolved. Figure 2 shows the discussion process carried out with the Sutra Alam Gunung Sewu group and the program implementation partners.

Figure 2. Discussion on problem identification in the Gunung Sewu Natural Silk group

The Ceara rubber tree has an ash content of 0.4734%, crude fat content of 0.5842%, crude fiber content of 0.0067%, crude protein content of 0.475%, and carbohydrate content of 98.4674%. However, the tubers of the Ceara rubber tree contain carbohydrates and hydrocyanic acid (HCN). This makes the cassava tuber unsuitable for use as a food ingredient. However, given its potential, cassava could be processed into a food ingredient through further processing. The testing and processing of cassava were conducted at the Food Technology Laboratory of UAD.

2. Knowledge Transfer

Samples of rubber tree tuber skin were taken to the UAD Food Technology Laboratory for testing and processing to reduce HCN content. After obtaining the test results, the next step was to conduct an interactive FGD to present the test results. In this stage, FGD participants who are members of the Gunung Sewu Natural Silk Group were given pre-tests and post-tests to measure their level of understanding of rubber tree tuber skin processing. The questions given to group members were related to general knowledge of rubber tree tuber skin processing and utilization, as shown in Table 1.

Table 1. Common questions asked during knowledge transfer activities

Question	Score
General knowledge of ceara rubber tree bark processing	1-5
Cera rubber tree bark processing activities	1-5
Example of ceara rubber tree bark processing	1-5
Urgency of ceara rubber tree bark processing training	1-5
Level of group interest in ceara rubber tree bark processing training	1-5

3. Capacity Building

After completing the knowledge transfer stage, the capacity improvement of the Sutra Alam Gunung Sewu group members was measured. This stage involved all group members answering questions about the information provided during the knowledge transfer. This measurement served to determine how deeply the group members understood the information provided by the empowerment team. The questions asked were pre-test and post-test questions, which are summarized in Table 2.

Table 2. Questions to determine the level of understanding

Question	Score
Utilization of available ceara rubber tree bark	1-5
Dangers of ceara rubber tree bark	1-5
Content of ceara rubber tree bark	1-5
Constraints of ceara rubber tree bark processing	1-5
Benefits of ceara rubber tree bark processing for groups	1-5

4. Reflection and Evaluation

Reflection was carried out by analyzing the results of capacity building among group members, both in terms of general knowledge and information reception skills. The results of knowledge transfer and capacity building measurements were presented in the form of data tables and graphs, which were then analyzed. Evaluation is conducted by discussing the results of the reflection with MPM PWM DIY, MPM PDM Gunungkidul, Pringombo Village, and the Sutra Alam Gunung Sewu group. The evaluation results are designed to further empower the Sutra Alam Gunung Sewu group.

RESULTS AND DISCUSSION

After identifying the problems, deciding on solutions to overcome them, and formulating methods for implementing the program, the Sutra Alam Gunung Sewu group empowerment program was executed. The steps taken were to conduct an analysis of rubber tree tuber samples at the UAD Food Technology Laboratory. Several parameters identified were HCN content, starch content, ash content, and moisture content. The steps in identifying HCN that were carried out are described as follows.

Raw Materials Preparation

Cassava peel is prepared, followed by sorting of raw materials with young and undamaged cassava peel. Cassava peel is washed with running water to clean any dust or dirt that sticks to it. The sample used for each treatment is 20 grams. The flow chart for raw material preparation can be seen in Figure 3.

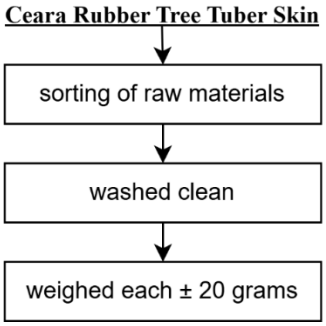

Figure 3. Flow diagram of raw material preparation

Sample Immersion

Soaking was carried out with several treatments with 3 replicates, namely without zeolite, activated zeolite, and non-activated zeolite, each with 20 g of sample, then added with 100 mL of distilled water and placed in an Erlenmeyer flask, then soaked with several variations of treatment time for 4 hours, 6 hours, 8 hours, and 10 hours. The samples were then thoroughly washed, coarsely blended, extracted, and distilled. The drying flow diagram can be seen in Figure 4.

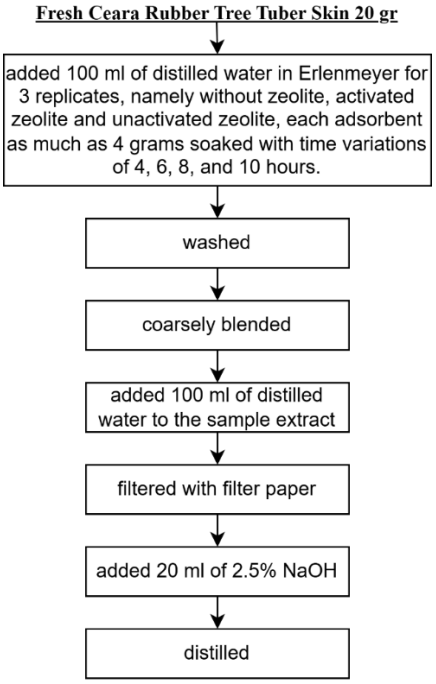

Figure 4. Flow chart of rubber tree tuber skin immersion

HCN Level Measurement

The analysis to determine the HCN content was carried out using argentometric titration, preceded by a distillation process. A sample of 20 g was added to 100 mL of distilled water and placed in an Erlenmeyer flask, then soaked with several treatments for 4, 6, 8, and 10 hours. After that, another 100 mL of distilled water was added. The extracted cassava peel sample was filtered using filter paper, then added to an Erlenmeyer flask containing 20 mL of 2.5% NaOH, and then distilled. Once the distillate reached 75 mL, 8 mL of NH_4OH, 5 mL of 5% KI, and 0.02 N $AgNO_3$ were added. The titration was performed in three replicates, each containing 25 mL of distillate. The flow diagram can be seen in Figure 5.

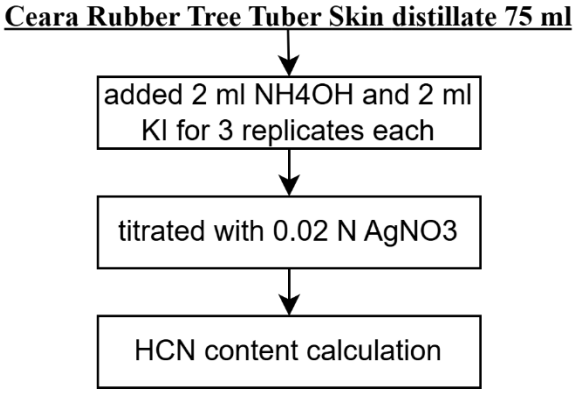

Figure 5. Titration flow diagram

Based on the results of the study, an 8-hour immersion using activated zeolite was the most efficient method, reducing levels to 5.7 ppm, while the minimum HCN consumption limit in foodstuffs is 10 ppm. Documentation of the identification activity of rubber cassava peel is shown in Figure 6.

Figure 6. Documentation of the identification of rubber tree bark

Socialization to Groups

After the identification of rubber tree tubers was completed, the empowerment team conducted a socialization program for the Sutra Alam Gunung Sewu group. The purpose of this socialization was to present the results of the identification of rubber tree tubers. Through this socialization, it is hoped that the Sutra Alam Gunung Sewu group will gain an understanding of the contents and potential of rubber tree tubers.

The indicators of success for this outreach activity are knowledge enhancement through knowledge transfer and increased understanding through capacity building. The measurement instruments used are pre-test and post-test sheets. The assessment is carried out by comparing the results of the pre-test (test before the outreach activity) and the post-test (test after the outreach

activity). In terms of knowledge transfer, group members obtained an average pre-test score of 1.69%. After the socialization, the results of the identification of rubber tree bark were given to the group, and the average post-test score obtained was 3.71%. The knowledge enhancement achieved by the Sutra Alam Gunung Sewu group, which was 120%, indicates that the knowledge transfer by the empowerment team was successfully implemented. The visualization of the knowledge enhancement of the Sutra Alam Gunung Sewu group is shown in Figure 7.

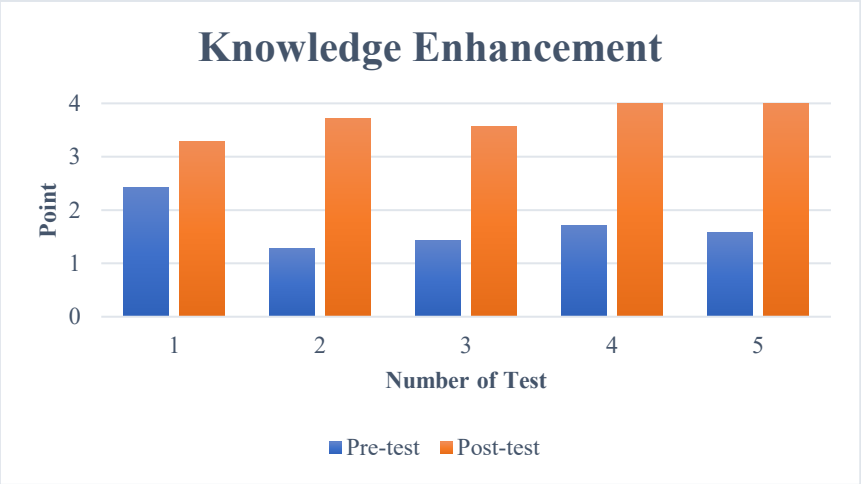

Figure 7. Knowledge enhancement of the Sutra Alam Gunung Sewu group after dissemination of the results of the identification of rubber tree bark.

Measurements of capacity improvement were also conducted by measuring increased understanding. The indicator of increased understanding used a similar instrument, namely pre-test and post-test sheets. The measurement results showed that group members obtained an average pre-test score of 2.00%. After the results of the identification of rubber tree bark were shared with the group, the average post-test score obtained was 3.69%. The increased understanding achieved by the Sutra Alam Gunung Sewu group was 84%. This indicates that the empowerment team successfully provided increased understanding to the Sutra Alam Gunung Sewu group. The visualization of the increased understanding of the Sutra Alam Gunung Sewu group is shown in Figure 8.

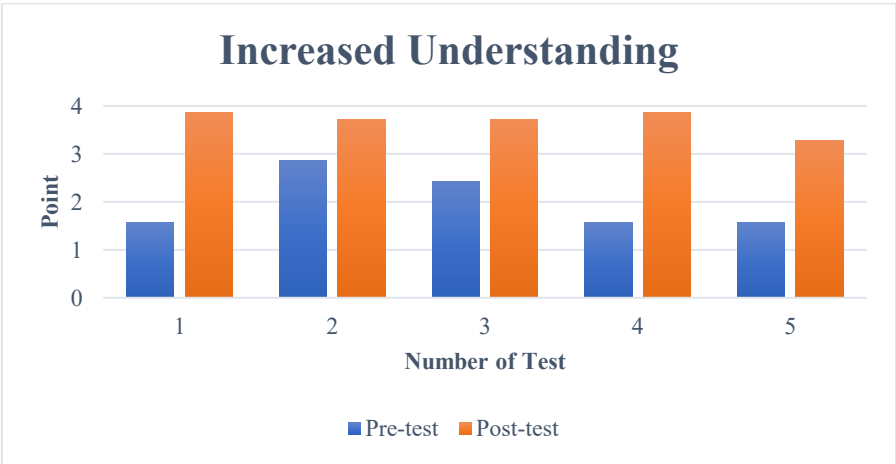

Figure 8. Increased understanding of the Sutra Alam Gunung Sewu group after dissemination of the results of the identification of rubber tree bark.

Program Continuity Strategy

After the dissemination, the next step is to develop a strategy for the sustainability of the program. The sustainability of this program aims to ensure that the results of the dissemination of the rubber tree tuber skin content are followed up by the group. In this case, the follow-up on the utilization of rubber tree tuber skin by the group is assisted by MPM PWM DIY and MPM PDM Gunungkidul.

CONCLUSIONS AND RECOMMENDATIONS

Community empowerment activities in the Sutra Alam Gunung Sewu cassava leaf silkworm cultivation group have been carried out. The rubber tree tuber skin, which has not been utilized until now, has been identified by the community service team. The results of the identification of the rubber tree tuber's composition have also been presented to the Sutra Alam Gunung Sewu group along with their collaborative partners, namely MPM PWM DIY and MPM PDM Gunungkidul. There are two main parameters in measuring the success of empowerment: knowledge enhancement and increased understanding. The measurements conducted using pre-test and post-test instruments yielded satisfactory results, with knowledge enhancement at 120% and increased understanding at 84%. This indicates that the community empowerment activities in the Sutra Alam Gunung Sewu group have successfully enhanced the group's capacity.

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Conflict of Interests

The authors declared that no potential conflicts of interest with respect to the authorship and publication of this article.

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