

MODERNIZING COMMUNITY-BASED AGROINDUSTRY: IMPLEMENTATION OF AUTOMATED SEIVING MACHINES TO ENHANCE PALM SUGAR QUALITY AND QUANTITY FOR THE NIRA SARI MURNI GROUP

Nur Wijayanti^{1*}, Laksmi Putri Ayuningtyas¹, Nofiyati², Achmad Wildan¹

¹Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto, 53122, Central Java, Indonesia

² Faculty of Engineering, Universitas Jenderal Soedirman, Purwokerto, 53122, Central Java, Indonesia

*Email: nur.wijayanti@unsoed.ac.id

Abstract. The Nira Sari Murni Farmers Group, located in Batuanten Village, Cilongok, Banyumas, specializes in the production of crystal and molded coconut sugar, involving approximately 200 coconut sap tappers and 26 local workers. Despite its significant production potential, the group faces several critical challenges, including unstable product quality caused by seasonal variations, limited access to modern equipment, simple packaging, a lack of product certification, and restricted market reach. This community service program aimed to enhance both the quality and quantity of production through the diffusion of science and technology, while simultaneously strengthening product innovation and market competitiveness. Key interventions included the introduction of "*Tangkis*," a natural palm sap preservative designed to improve product stability and colour, alongside comprehensive training in product diversification, packaging innovation, labelling techniques, business legality, and digital marketing. Additionally, an automatic sieving machine was provided to optimize operations. The results indicate a significant improvement in the participants' knowledge and marketing skills, as reflected in increased training evaluation scores. Furthermore, production efficiency was notably enhanced, with the automatic sieving machine reducing both labour intensity and processing time. Ultimately, product diversification and improved packaging have bolstered the group's credibility in online and offline markets, contributing to the long-term sustainability of the rural agroindustry and local economic welfare.

Keywords: crystal sugar, Batuanten, sieving machine, training, quantity and quality

1. Introduction

Banyumas Regency in Central Java is widely recognized as a primary hub for coconut sugar production in Indonesia. As of 2023, the region supports over 27,000 local farmers, with Cilongok District emerging as the most significant industrial centre(1). Within this productive landscape, the Nira Sari Murni Farmer Group in Batuanten Village plays a pivotal role, managing approximately 200 organic farmers and maintaining a robust production capacity of 1.5 tons of crystal sugar per day

Despite this high productivity, the group faces technical challenges that hinder their competitiveness. A major issue is the unstable quality of the sugar due to the use of traditional, rudimentary sap preservatives. Research indicates that the type and concentration of natural preservatives are critical in determining the final quality and shelf life of coconut sugar (2–4). Furthermore, the group relies on manual labour and simple tools, such as basic sieves, which make it difficult to achieve uniform grain size efficiently when facing large-scale market demands.

Business legality and certification also pose significant barriers to growth (5,6). Currently, the group only holds a Basic Business Identification Number (NIB) and lacks essential certifications like the PIRT (Home Industry Food Product) permit and Halal certification. These credentials are vital in the modern food industry to build consumer trust and secure placement in formal retail and international markets. Without them, the group's high-quality organic sugar is often limited to bulk sales through intermediaries rather than direct retail.

The group's branding and marketing efforts are in urgent need of modernization. Currently, their use of unbranded, clear plastic packaging fails to convey product value or provide essential nutritional data—missing a key opportunity to attract customers through effective design (7). Furthermore, relying on a single exporter and lacking a digital presence severely limits their market access and prevents them from maximizing profitability in today's digital economy..

To mitigate these identified challenges, this community empowerment initiative seeks to bolster the technical proficiency, product quality, and manufacturing volume of the Nira Sari Murni Farmer Group. The intervention encompasses the implementation of automated sieving technology to optimize operational efficiency and the application of "*Tangkis*" natural preservatives to ensure consistent quality standards. Furthermore, the project facilitates legal compliance through mentorship for PIRT and Halal certifications, alongside the formulation of a comprehensive digital marketing strategy. These integrated efforts are intended to transition the traditional collective into a competitive market entity, thereby strengthening the economic resilience of the local community.

2. Methods

Partner Participation and Target Audience The project was conducted through a collaborative partnership with the Nira Sari Murni Farmer Group, located in Batuanten Village, Cilongok District, Banyumas. This group, which coordinates approximately 200 organic coconut sugar farmers, served as the primary beneficiary. The methodology emphasized active participation, where the partners were involved not just as trainees but as active collaborators in implementing new technologies and marketing strategies. **Implementation Strategy** The program was executed through a structured five-stage approach designed to ensure the sustainability of the intervention:

1. Socialization and preservative innovation

The first stage focused on introducing "*Tangkis*," a natural preservative designed to stabilize the quality of coconut sap. Farmers participated in sessions to understand the benefits and application of this natural alternative over traditional, less effective methods.

2. Product diversification training

To increase the economic value of their raw materials, the team provided hands-on training for creating derivative products. This included the development of ginger-infused syrups and spiced beverages utilizing by-products (coarse granules) from the sieving process.

3. Diffusion of science and technology in branding

This stage addressed the group's branding limitations. The team provided training on modern packaging techniques and labeling requirements, including the calculation and inclusion of nutritional facts to meet commercial standards.

4. Mentorship on business legality

To overcome market barriers, the program provided intensive assistance in securing essential legal permits. This included facilitating the application processes for PIRT

(Home Industry Food Product) permits and Halal certification, guiding the partners through document preparation and registration.

5. Technology implementation and digital marketing

The final phase involved the handover of automatic sieving machines to modernize production and increase efficiency. Simultaneously, the partners received coaching on digital marketing strategies, learning to manage Facebook Ads, Google Ads, and social commerce platforms to reach a direct-to-consumer market.

The success of the interventions was measured through a quantitative evaluation process. Participants underwent pre-tests and post-tests during each training session to track knowledge gain. The effectiveness of the program was categorized based on these results, where a score exceeding 70% was established as the benchmark for a highly successful training outcome. Furthermore, ongoing monitoring was conducted to ensure that the granted machinery was integrated into daily operations and that the digital marketing accounts remained active.

3. Results And Discussion

3.1 Product innovation through the application of natural sap preservative (“Tangkis”)

One of the main interventions implemented in the partner group was product innovation training focusing on the application of an instant natural palm sap preservative known as “Tangkis.” The preservative was applied directly to fresh coconut sap prior to heating and processing into molded sugar, and also during the reprocessing of molded sugar (repro) into crystal coconut sugar.



Figure 1. Natural sap preservatives “Tangkis”

The application of “*Tangkis*” (Fig. 1) showed a noticeable improvement in product quality. The resulting crystal sugar appeared cleaner, with a more consistent and brighter brown color. The preservative helped stabilize sap quality during processing, particularly under fluctuating seasonal conditions that often affect fermentation rate and final sugar characteristics. From a practical perspective, this simple technological intervention provided producers with better control over raw material quality without altering their traditional processing identity. This demonstrates that small-scale innovation at the raw material stage can significantly influence final product performance.

3.2. Diversification of coconut sugar byproducts

Another important outcome was the diversification of products through the utilization of coarse crystal sugar flakes (brondol) obtained from the sieving process.

Previously, these coarse fractions were considered low-value byproducts and were often difficult to reprocess into uniform crystal sugar. Through training and mentoring, the coarse sugar flakes were developed into raw materials for coconut sugar-based ginger and spice syrup beverages (Fig. 2). This innovation transformed a byproduct into a marketable product with added economic value. The diversification strategy not only reduced production waste but also created a new income stream for the group. In addition, the development of spice-based beverages aligns well with consumer trends toward natural and functional drinks. The diversification approach illustrates how simple product development strategies can enhance resource efficiency and strengthen the economic resilience of rural agroindustry's.



Figure 2. Coconut sugar-based ginger syrup

3.3. Application of automatic sieving machine technology

The diffusion of science and technology was further strengthened through the introduction of two units of automatic crystal sugar sieving machines, each consisting of three sieve layers. The implementation of automatic sieving technology significantly improved operational efficiency. Compared to manual sieving, the machine reduced processing time and labour intensity, making the sieving stage more effective and consistent. The multi-layer sieving system allowed better particle size separation, resulting in more uniform crystal sugar. Consequently, production capacity increased due to the reduction of bottlenecks in the finishing stage. Beyond technical improvements, the introduction of the machine also enhanced the group's confidence in adopting modern yet appropriate technology. The strong enthusiasm shown by members during training and practical sessions indicates a high level of acceptance and readiness for technological transformation.

3.4 Improvement of packaging design and product labelling

Another significant outcome of the program was the improvement of packaging techniques, packaging design, and product photography. The training covered essential components that must be included on food labels, including product identity, ingredient lists, net weight, producer information, and nutrition facts. The inclusion of nutrition information is particularly important, as it provides consumers with transparent data about the nutritional content of coconut sugar products.

Prior to the intervention, the Nira Sari Murni Group used large transparent plastic packaging (bulk packaging) without attractive design elements and with limited labelling information. This type of packaging reduced the product's market appeal and competitiveness. Through the program, partners were introduced to more attractive and

consumer-oriented packaging formats (Fig. 3). Crystal coconut sugar is now packed in smaller windowed plastic pouches with full sticker designs and zipper seals. The new packaging design includes complete labelling components and a more professional visual identity.



Figure 3. Packaging in before and after program implementation

To evaluate participants' understanding, pre-tests and post-tests were conducted. The average pre-test score was 60, indicating limited knowledge of packaging standards and labelling requirements. After the training, the post-test score increased to 90, demonstrating substantial improvement in understanding. In addition to training, the group received packaging grants to support immediate implementation.

3.5. Strengthening business legality and product certification awareness

At the time of the program, the group only possessed a Business Identification Number (NIB) and had not yet obtained distribution permits or product certifications. Participants were provided with practical guidance regarding the importance of food distribution permits (PIRT) and halal certification, including documentation requirements and application procedures. Following the training, the group registered with the local Health Office to participate in food safety counselling as a prerequisite for applying for PIRT certification. Regarding halal certification, participants were informed that due to their production scale, registration must follow the regular paid scheme rather than the self-declare scheme. Although the process is more complex, members recognized that halal certification is essential, not only because of regulatory requirements but also as a guarantee of product assurance for consumers.

3.6. Digital marketing and market expansion

To complement improvements in product quality and packaging, digital marketing training was conducted to expand market reach and increase partner income. The training covered online marketing strategies, including Instagram, Facebook Ads, YouTube promotion, and social media commerce. Participants were guided on how to create engaging product content, develop effective taglines, and manage customer interactions. A key recommendation was the appointment of a dedicated administrator to manage digital accounts consistently and actively encourage customer reviews. As part of the program, social media accounts for Facebook Ads and Instagram were created for the group.

Beyond online promotion, the group was encouraged to participate in offline marketing events such as expos organized by benih.baik.com and VISA. These events were attended by representatives from the Ministry of Trade, regional government leaders,

financial institutions, and the general public. Participation in such expos enhanced product visibility and increased credibility among broader market stakeholders.

4. Conclusion

The Nira Sari Murni Farmers Group project demonstrates that combining technical upgrades with business training significantly boosts rural industry performance. By implementing "Tangkis" preservatives and automatic sieving machines, the group improved product quality, increased production capacity, and reduced labour intensity. Furthermore, diversifying products into spice-based beverages and professionalizing packaging and digital marketing expanded their market reach. This integrated approach provides a sustainable model for improving the productivity, competitiveness, and economic welfare of community-based enterprises..

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