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Dissemination of Appropriate Technology for Integrated Areca Nut Peeling Machines to Support the Economic Improvement of Farmer Partners in Kayee Lee Village, Ingin Jaya District, Aceh Besar

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Abstract

Purpose: The purpose of this community service activity is to disseminate appropriate technology for areca nut peeling machines in Aceh Besar Regency.

Method: In this product-based community service activity, the community service team offered several methods to meet the quality standard for areca nut (betel nut). The methods used in this community service activity include (i) a design method for manufacturing a betel nut peeling machine and (ii) a dissemination method to introduce the betel nut peeling machine to partners.

Practical Applications: With this disseminated technology, dried areca nuts can be peeled in a shorter time and at a relatively higher capacity (50 kg per hour). Furthermore, the areca nuts peeled by this machine are relatively uniform in shape, improving the quality of the areca nuts ready for sale. Some other benefits that partners will experience with this disseminated technology include: (1) efficient time and labor required for the areca nut peeling process, (2) reduced risk of workplace accidents.

Conclusion: This product-based community service has generated some benefits to the community and partners, in which the areca nut peeling machine can help boost the economy. By introducing this machine, the risk of workplace accidents can be avoided, and the production of betel nut can be improved.

Introduction

The areca nut (Areca catechu L.) has been used for a long time, especially in South and East Asia and even the Pacific Islands. This plant has spread throughout Indonesia. However, compared to other plantation commodities that can generate foreign exchange, areca nut still lags (Muin, 2015). This is unfortunate because betel nut is a commodity with high commercial value. According to BPTP (2012), betel nut is a commercial smallholder plantation crop of the palm species.

Initially, the people of Aceh did not develop much of their areca nut plantations, using them only as fences around their gardens. As the price of areca nut doubled, farmers began cultivating it on their plantations and in their own homes. The number of farmer groups involved in processing areca nuts into marketable areca nuts in Aceh Besar Regency is still very limited, particularly in Kayee Lee Village.

Kayee Lee Village has several community organizations, both social and economic empowerment-based. For example, Kayee Lee Village has a farmer group, a community health post cadre group, and a social and community-based youth group. Observations by the community service team at several farming businesses focused on areca nut processing revealed that they operate traditionally. This includes peeling fresh areca nuts with knives or machetes, drying them directly in the sun, and peeling them manually.

This limits the beca nut production capacity of each farming business. Farming businesses focused on areca nut products in Kayee Lee Village, Aceh Besar Regency, generally originate from individual farming groups. Furthermore, the Kayee Lee community, in addition to areca nut farmers, also breeds cattle, whose peeled areca nut husks can be processed into compost using cow dung. Unmarketable betel nut waste (not meeting sales standards) can be processed into candied betel nut candy.

Observations of several farmer groups focused on areca nut in Aceh Besar Regency revealed that the application of technology is still far from optimal production. One of the processes, peeling the areca nuts, is carried out using simple traditional tools, and drying them by simply spreading them out in yards or other empty spaces. Once the areca nuts are dry, the farmers peel them using machetes, knives, and a screwdriver. The manual peeling process naturally requires a lot of labor, resulting in high processing costs. Furthermore, this method significantly impacts the quality of the betel nut. Especially during the rainy season, submerged betel nuts increase their water content. This high water content contributes to their low selling price.

Post-harvest handling is more efficient using agricultural post-harvest machinery. Agricultural post-harvest machinery is an appropriate technology that simplifies agricultural activities in the post-harvest sector, which previously used traditional tools that were less efficient in terms of quality and quantity of processed agricultural products (Anggraini et.al., 2023). In this case, the design of the machine to be implemented requires searching for the physical and mechanical properties of the agricultural raw materials to be processed to obtain characteristics in designing the post-harvest machine (Bulan et al., 2020). The previous devotee has also designed post-harvest handling machines with crushing and chopping (Bulan et al., 2023), areca nut threshing machines (Bulan et al., 2021), palm bunch chopping machines (Bulan et al., 2019), and post-harvest handling machines with splitting (Bulan et.al., 2022).

Until now, people have been peeling betel nuts using traditional methods, such as hammers, machetes, and knives. Using these tools can increase the risk of work-related accidents and fatigue for farmers. Furthermore, the cost of peeling betel nuts manually reaches IDR 30,000 per hour per worker. This is not commensurate with the low price of betel nuts, which is IDR 5,000 per kilogram. However, the availability of this betel nut peeling machine is expected to help farmers by saving time and effort, reducing the risk of work-related accidents, increasing betel nut farmers' income due to increased betel nut production capacity, and improving the quality of the dried betel nuts ready for sale due to the uniformity of the

peeling process. During the betel nut peeling process, farmers face a high risk of accidents, and the processing capacity is relatively small. Observations from community service workers indicate that the manual peeling capacity for betel nuts is approximately 10-20 kg per person per day. Therefore, appropriate post-harvest equipment, such as a betel nut peeling machine, is needed to support the community's business in Kayee Lee Village, Aceh Besar Regency, which focuses on processing betel nuts into marketable products.

Method

The community service activities were carried out at the business premises of a farmer group producing betel nuts in Kayee Lee Village, Want Jaya District, Aceh Besar Regency. The activities included (1) coordinating and providing information to partners about the technology being implemented, (2) negotiating the production process, which will utilize a single machine, (3) providing presentations, demonstrations, and training on the use and maintenance of the technology being implemented, (4) providing assistance during the betel nut peeling process, (5) monitoring and evaluating the sustainability of the partners' businesses, (6) handing over the betel nut peeling machine to the partners.

This community service program is carried out using outreach, technology application, and technical guidance. The outreach program provides an understanding of the technology to be used. Implementation involves implementing a betel nut peeling machine. Technical guidance provides technical knowledge on how to use and maintain the technology. The mentoring and technical guidance are provided for one month of use of the betel nut peeling machine at the partner's location. This community service program is implemented in collaboration with the partner farmer group, the Kayee Lee Farmer Group, located in Kayee Lee Village, Ingin Jaya District, Aceh Besar Regency.

The machine, which was successfully designed and built, naturally had to first be subjected to the physical properties of the areca nut. The physical properties of the areca nut were measured using several parameters, including dimensions, cutting resistance, and angle of repose. Before designing the betel nut peeling machine, the dimensions of the betel nuts were first measured to provide a baseline for the physical shape of the betel nuts (Yang et al., 2024). These measurements included the length (major diameter) and width (minor diameter). The betel nut dimensions were measured on green, orange, and orange-brown betel nuts. Thirty betel nuts from each sample were taken.

Testing of the betel nut peeling machine was conducted after the design and assembly of the betel nut peeling machine were completed. The tests were conducted on the betel nut peeling machine and equipment at 1200 RPM. These tests were conducted three times for each betel nut ripeness variation, with 2 kg of betel nuts being loaded each time.

Monitoring is carried out to evaluate the success of community service activities. This is done to measure the level of success of the activities to ensure they align with the initial objectives. Indicators that the activities are in line with the community service plan are: (1) the areca nut peeling machine is functioning according to the initial plan, (2) the areca nut production is being produced according to the community service provider's instructions, (3) the areca nut peeling machine is being maintained to maintain its economic life and extend its use by the partners.

Result

This community service program is implemented through outreach, technology application, and technical guidance. This outreach also involves students participating in community service programs to assist with the activities. The outreach involves providing an understanding of the technology to be used. The implementation involves implementing a betel nut peeling machine. Technical guidance involves providing technical knowledge on how to use and maintain the technology. Technical guidance and mentoring are provided for one month during the use of the betel nut peeling machine at the partner's location (Figure 1).

Figure 1. Implementation of Activities and Partner Participation

Source: Private Documentation, 2025.

Community service was carried out by providing a betel nut peeling machine to be used by Kayee Lee's partners/farmer groups for their betel nut peeling business (Figure 2). It is hoped that Kayee Lee's partners/farmer groups will maintain the machine's condition to ensure its durability so that it can be used continuously for betel nut peeling. The strong cooperation of Kayee Lee's partners/farmer groups and the active participation of group members in this activity were very successful, ensuring everything went according to plan. The availability of appropriate technology has increased productivity compared to previous production in betel nut peeling.

Figure 2. Handover of Areca Nut Peeling Machine to Partners

Source: Private Documentation, 2025.

This product-based community service initiative has resulted in a betel nut peeling machine. This machine significantly assists betel nut farmers in increasing their production of high-quality betel nuts, thereby improving their welfare, especially in Gampong Kayee Lee, Ingin Jaya District, Aceh Besar. As an application of modern agricultural technology, the sustainable use of betel nut peeling machines in Kayee Lee Village, Ingin Jaya District, Aceh Besar, requires the guidance and support of experts with expertise in mechanical engineering. While the topics covered in these activities can vary, the use and maintenance of the betel nut peeling machines is unique and requires community participation. The right betel nut peeling machine operator for the village is essential for the use and maintenance of the machines, ensuring farmers can effectively use the betel nut peeling machines and extend their lifespan (Figure 3).

Figure 3. Initial Survey of The Potential of Betel Nut

Source: Private Documentation, 2025.

Discussion

This community service program began with the design of a betel nut peeling machine. The betel nut peeling machine is used to mechanically peel betel nuts. This product-based community service program successfully designed and built a betel nut peeling machine that is highly useful in the betel nut processing process (Figure 4). The successfully designed and built equipment required prior testing of the betel nut's physical characteristics. The physical properties of the betel nut were measured using several parameters, including betel nut dimensions, cutting resistance, and angle of repose (Adama et al., 2022).

Figure 4. The Process of Assembling a Betel Nut Peeling Machine

Source: Private Documentation, 2025.

Before designing the betel nut splitting tool and machine, the betel nut dimensions were first measured to provide a baseline for the physical shape of the betel nut. These measurements included the length (major diameter) and width (minor diameter) (Yusriah et al., 2014). The machine's capacity is 200 kg/hour, while manual labor can only produce 30 kg/day. The betel nut dimensions were measured on green, orange, and orange-brown betel nuts. 30 betel nuts were taken from each sample (Figure 5). This community service program will produce dried, peeled betel nuts, betel nut husk waste for compost and mulch, and betel nut candy. These additional products are designed to enable the community to utilize the betel nut harvest as a promising economic resource (Latap, 2015).

To improve the economic well-being of betel nut farmers, an appropriate tool/machine is needed, namely a betel nut peeling machine. This community service team provided appropriate technology in the form of a betel nut peeling machine in Kayee Lee Village, Ingin Jaya District, Aceh Besar Regency. This activity, combined with the implementation of a thematic community service program for USK students, aims to disseminate appropriate technology for the betel nut peeling machine in an effort to accelerate and improve the production process of farmer groups (Figure 6).

Figure 5. Machine Performance Test and Peeled Betel Nut Results

Source: Private Documentation, 2025.

The intended benefits of this activity include (i) streamlining the time and labor required for betel nut peeling, (ii) reducing the risk of workplace accidents, (iii) increasing betel nut farmers' turnover due to greater betel nut production capacity, and (iv) improving the quality of dry betel nuts ready for sale due to the uniformity of peeling using the machine. This technology is expected to boost the economic income of village residents.

Figure 6. Collaboration Between The Areca Nut Farmer Partners and The Community Service Team

Source: Private Documentation, 2025.

Conclusion

The results of the community service activities demonstrate the enthusiasm of the community and partners for the areca nut peeling machine, which can help improve the economic well-being of areca nut farmers. The use of this machine can reduce the risk of workplace accidents during the areca nut peeling process. For the machine to operate effectively and efficiently, it must be properly operated and maintained. Furthermore, the areca nut must be dried before peeling.

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Reference

Adama, J.C., Arocha, C.G., and Ogbobe, P.O., 2022. Determination of some physical properties, angles of repose, and frictional properties of a local variety of kernel and nut of oil palm. Nigerian Journal of Technology, 41(2), pp.365-369.

Anggraini, R., Sugiarti, T., & Oktafiani, A. 2023. Evaluasi Penanganan Panen dan Pasca Panen Padi di Desa Pinang Luar Kecamatan Kubu Kabupaten Kubu Raya (Evaluation of Rice Harvest and Post-Harvest Handling in Pinang Luar Village, Kubu District, Kubu Raya Regency). Innovative: Journal Of Social Science Research, 3(2), 7564-7678.

BPTP. 2012. Prospek Pengembangan Tanaman Pinang (Prospects for the Development of Areca Nut Plants). Balai Penelitian Tanaman Palma, 34(1).

Bulan, R., Rahmah, R., Hasan, A. R., & Sitorus, A. 2019. Design and construction of oil palm fronds (OPF) compost mixer machine type rotary double helix drum. In 2019 5th International Conference on Computing Engineering and Design (ICCED) (pp. 1-4). IEEE.

Bulan, R., Ayu E. S., and Sitorus A. 2020. "Effects of moisture content on some engineering properties of arecanut (Areca Catechu L.) fruit which are relevant to the design of processing equipment," INMATEH - Agricultural Engineering, vol. 60, pp. 61-70.

Bulan, R., Siregar, K., Lesdiana, S. R., Anwar, K., & Sitorus, A. 2021. Design and performance testing of areca nut thresher machine using solid triangle spike tooth type. In IOP Conference Series: Earth and Environmental Science (Vol. 922, No. 1, p. 012048). IOP Publishing.

Bulan, R., Siregar, K., Wardhana, M., Lubis, H., Thamren, D., Haris, O., & Sitorus, A. 2022. Experimental investigation into the performance of cutting betel nut machine via response surface methodology and desirability function. Engineering Solid Mechanics, 10(3), 253-262.

Bulan, R., Arianti, N. D., Yunus, A., Ibrahim, A., & Sitorus, A. 2023. Development of a chopper with performance optimization for areca nut frond using response surface methodology. Results in Engineering, 19, 101331.

Latap, N.S., 2015. Economic Assessment of Betel Nut (Areca cathecu) as Component in the Agroforestry (AF) Systems in Ifugao. International Journal of Science and Research, 4(6), p.1896.

Muin. 2015. Petani dan Permasalahan Petani (Farmers and Farmers' Problems): Rajawali Press. Jakarta.

Yang, B., Xu, Y., Kang, X., Kang, Z., Chen, W., Chen, W., Zhong, Q., Zhang, M., Pei, J. and Chen, H., 2024. Effect of steam explosion on the morphological, textural, and compositional characteristics of betel nut. Journal of Texture Studies, 55(1), p.e12809.

Yusriah, L., Sapuan, S.M., Zainudin, E.S. and Mariatti, M., 2014. Characterization of physical, mechanical, thermal and morphological properties of agro-waste betel nut (Areca catechu) husk fibre. Journal of Cleaner Production, 72, pp.174-180.