

Economic Potential Analysis Of Sugar Palm Cultivation As A Source Of Sap In Jambu Malea Village, Tapango Sub-District

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ABSTRACT

This study was conducted to analyze the economic potential of sugar palm cultivation in supporting the palm sugar industry in Jambu Malea Village, Tapango Sub-district. The background of this research lies in the considerable potential of sugar palm trees as a source of raw material for palm sugar, which has a high market value. However, its development still faces challenges such as limited cultivation technology, restricted market access, and farmers' lack of knowledge.

The objectives of this study are to examine the income of palm sugar businesses, identify the economic potential of sugar palm cultivation, and assess its prospects for improving community welfare.

The research employed a quantitative approach using a survey technique. The sample was determined through a saturated sampling method, in which the entire population of palm sugar entrepreneurs, consisting of 10 individuals, was included as respondents. The data collected comprised production costs, revenue, and income, which were then analyzed descriptively by calculating the total cost, revenue, and business profit.

The results revealed that the average palm sugar production reached 429 kg per month with a selling price of IDR 18,000/kg, generating a total revenue of IDR 7,722,000. After deducting the total cost of IDR 1,986,733, the average net income obtained was IDR 5,735,267 per month. These findings indicate that sugar palm cultivation has significant economic potential and is feasible to be developed. Moreover, palm sugar enterprises contribute to increasing community income and hold the potential to support sustainable village development.

INTRODUCTION

Jambu Malea Village is one of the rural areas with highly promising agricultural-based economic potential, particularly through the utilization of sugar palm (*Arenga pinnata*) as a source of palm sugar production. This potential is not only evident from the abundant availability of sugar palm trees growing well in the area, but also from the increasing demand for palm sugar products, both for household consumption, the food and beverage industry, as well as pharmaceutical and alternative energy needs. Palm sugar is recognized as a high-value product that is environmentally friendly and plays an essential role in supporting local food security. Thus, sugar palm cultivation in Jambu Malea Village represents not only an economic opportunity but also a contribution to sustainable development based on local resources.

Globally, palm commodities have become an essential pillar of the economies of tropical countries such as Indonesia, Malaysia, and the Philippines. While oil palm serves as a major source of vegetable oil exports and coconut provides copra, sugar palm occupies a strategic position as a producer of sap processed into natural palm sugar. Unlike oil palm, which is often criticized for issues of deforestation, sugar palm is known to provide ecological benefits. Its fibrous root system contributes to groundwater conservation and prevents erosion, while its wide canopy enhances microclimate humidity (Yermia, 2024). Therefore, sugar palm contributes not only to the economy but also to ecological balance.

In Indonesia, sugar palm is widely distributed from Sumatra, Java, Kalimantan, Sulawesi, and Nusa Tenggara to Papua. Sulawesi is one of the main centers of palm sugar production, both for direct consumption and for processing into traditional beverages made from sap. This illustrates the strong ecological adaptability of sugar palm and its considerable potential for rural economic development (Nasution, Lubis, & Pane, 2024). Moreover, palm sugar holds unique socio-cultural significance. It is often used in traditional rituals, local culinary practices, and even symbolizes social solidarity within communities. Thus, palm sugar provides not only economic benefits but also strengthens local cultural identity.

Sugar palm (*Arenga pinnata* Merr.) belongs to the family Arecaceae (Palmae) and thrives in tropical regions of Southeast Asia. It can adapt to a wide range of ecological conditions, from lowlands up to 1,400 meters above sea level, with optimal growth between 400–800 meters. The ideal temperature for sugar palm growth is 20–28 °C, with humidity levels of 70–80% and annual rainfall ranging from 1,200 to 3,500 mm. Another advantage is its ability to grow on various soil types, from sandy clay to volcanic soils. Sap production is most optimal when cultivated in fertile soils rich in organic matter. While young palms can grow under shade, mature palms require full sunlight to maximize sap production. With this high adaptability, sugar palm is a strategic crop that can be developed across diverse rural conditions in Indonesia.

The main product of sugar palm is sap, which can be processed into molded sugar, palm sugar crystals, or liquid sugar. However, the level of value addition from sap processing in Indonesia remains relatively low, at less than 50% (Simatupang, Sinaga, & Gea, 2024). In fact, the potential for sap product diversification is considerable. Kolang-kaling (sugar palm fruit) contains bioactive compounds with antimicrobial and natural preservative properties (Arioen & Indriyani, 2024), and it can even be developed into eco-friendly edible films (Yermia et al., 2024). This demonstrates that sugar palm is a multipurpose plant with substantial potential to provide higher economic value if supported by technological innovation.

At the farmer level, sap tapping is still carried out traditionally, involving cleaning the inflorescence stalk, beating, slicing, and collecting the sap in bamboo containers once or twice daily (Atune et al., 2024). Environmental factors such as season, temperature, and humidity significantly affect the volume and quality of sap produced (Widarawati et al., 2024). To enhance efficiency and product quality, several innovations have been introduced. One example is the production of palm sugar crystals through stages of filtration, crystallization, sieving, drying, and packaging (Muflih et al., 2024). Additionally, vacuum evaporation technology allows for the production of lighter-colored liquid sugar, free from harmful Maillard reactions (Wiyono et al., 2021). Other modern technologies, such as the falling film evaporator, have also proven effective in concentrating sap at lower temperatures, thereby improving sugar quality and stability (Rizky et al., 2024).

From an economic perspective, sugar palm cultivation can be analyzed within the framework of farm management. Farm management involves the allocation of production factors such as land, labor, capital, and management with the goal of generating profit and supporting rural economies (Nurul et al., 2024). Economic analysis of farming emphasizes costs, revenue, income, and business feasibility. Costs are generally divided into fixed costs, variable costs, and total costs (Hutasoit et al., 2024). Revenue is derived from multiplying production output by the selling price, while income is the difference between revenue and costs (Simamora et al., 2024). Business feasibility is commonly measured using the R/C ratio, where the enterprise is considered viable if the value exceeds 1 (Situmorang et al., 2024).

Agricultural economic potential can be understood as the ability of a commodity to generate added value for farmers and communities through the optimal utilization of resources. Common indicators for measuring economic potential include productivity (Hidayat & Susanto, 2024), product prices (Simbolon et al., 2024), production costs (Hutasoit et al., 2024), and farmers' income (Saragih et al., 2024). Thus, the economic potential of sugar palm cultivation should not only be measured by production capacity but

also by product competitiveness, its contribution to labor absorption, and its impact on the local economy (Nasution et al., 2024).

Furthermore, economic indicators such as farmers' income, production costs, and profit are crucial in determining the success of sugar palm cultivation. Farmers' income is calculated as the difference between revenue and production costs (Ramadhan, 2023). Production costs refer to the total expenses incurred in producing goods (Gunawan, 2025; Lidia Sari, 2025), while profit is the difference between income and costs (Aprilianti, 2025; Kholifatunisa, 2025). These indicators allow for the measurement of sugar palm cultivation's contribution to improving farmers' welfare.

In addition, sugar palm development is highly relevant to the agenda of sustainable development. Within the framework of the Sustainable Development Goals (SDGs), sugar palm contributes to *No Poverty* by improving farmers' income, *Decent Work and Economic Growth* by creating rural employment opportunities, and *Climate Action* by supporting land and water conservation. Moreover, sugar palm aligns with sustainable agriculture principles, as it requires minimal chemical fertilizers and can thrive on marginal lands. Government support, including farmer empowerment programs, market access provision, and sap-based industry development, is crucial in enhancing the competitiveness of palm sugar in both domestic and international markets.

Socio-culturally, palm sugar plays an important role in rural community life. In addition to daily consumption, it is often used in traditional foods such as cakes, beverages, and herbal drinks. In certain regions of Indonesia, fresh sap is also consumed during traditional ceremonies. This indicates that palm sugar embodies not only economic value but also cultural and local wisdom. The integration of economic and cultural aspects makes sugar palm cultivation one of the leading commodities that deserves more intensive development.

Based on the above discussion, it is evident that sugar palm cultivation in Jambu Malea Village holds great potential in ecological, social, economic, and cultural aspects. However, its development still faces several challenges, particularly the limited knowledge of cultivation practices, restricted market access, and inadequate processing technology. Therefore, an in-depth analysis of the economic potential of sugar palm cultivation in Jambu Malea Village is necessary. This analysis is expected to identify existing opportunities and challenges, as well as formulate appropriate development strategies. In this way, the study not only contributes to scientific knowledge but also provides practical benefits for improving rural community welfare.

RESEARCH METHOD

This study was designed using a descriptive quantitative approach to analyze the economic potential of sugar palm cultivation as a source of sap in Jambu Malea Village, Tapango Sub-district, Polewali Mandar Regency. The quantitative approach was employed because this research emphasizes numerical data, particularly those related to production volume, costs, selling prices, revenues, and the income of palm sugar farmers/entrepreneurs. Meanwhile, the descriptive nature was intended to provide a factual and systematic illustration of the economic conditions of palm sugar enterprises in the field (Sugiyono, 2019). The research location was determined purposively, considering that Jambu Malea Village is one of the areas with a relatively high concentration of palm sugar entrepreneurs and significant development potential. The population consisted of all active palm sugar farmers/entrepreneurs, while the sampling was carried out purposively to ensure that the selected respondents were highly relevant to the research objectives. The study was conducted from July to September 2025, consisting of planning, field data collection, data verification, and analysis.

Data collection was carried out through three main instruments: observation, interviews using structured questionnaires, and documentation. Observation was conducted using a passive participation approach, in which the researcher was present in the field to observe activities such as sap tapping, palm sugar processing, and marketing, without being directly involved in the activities (Alwi, M., & Saleh, N.

2022). The interview technique used a structured questionnaire containing written questions regarding respondents' identity, cultivation techniques, production costs, production volume, selling price, and income levels (Safitri, N., Alwi, M., & Albar, A. (2025). The data obtained from the interviews were then combined with documentation such as village archives, production reports, sales records, and field photographs, which served as secondary data to complement and validate the primary data. Through this combination, the collected data were expected to be valid, accurate, and representative of the actual conditions of palm sugar enterprises in Jambu Malea Village (Albar, A., Saleh, N., Alwi, M., & Aswad, I. N. 2025).

The research procedure began with the planning stage, which included the preparation of research instruments and identification of respondents. The next stage was field data collection through observation, interviews, and documentation according to the established procedures. Data verification was then carried out by comparing the interview results with supporting documents to ensure the accuracy of the information. The verified data were subsequently analyzed using a farm management framework, which included calculating total revenue ($TR = Q \times P$), total production cost ($TC = FC + VC$), net income/profit ($\pi = TR - TC$), and business feasibility through the R/C Ratio (TR/TC). The feasibility criteria were determined based on the R/C Ratio, where $R/C > 1$ indicated profitability, $R/C = 1$ indicated break-even, and $R/C < 1$ indicated loss. Through this framework, the study was expected to provide a comprehensive overview of the economic potential of sugar palm cultivation in Jambu Malea Village, while also serving as a basis for formulating strategies for the sustainable development of palm sugar enterprises.

RESULTS AND DISCUSSION

RESEARCH FINDINGS

General Description of the Research Location

Jambu Malea Village is one of the villages in Tapango Sub-district, Polewali Mandar Regency, with a total area of 470 ha and an altitude of approximately 200 meters above sea level. The agroclimatic condition is characterized by an average annual rainfall of 1,450 mm, which is highly suitable for the growth of sugar palm (*Arenga pinnata*). The majority of the village population works as farmers, with rice, maize, and plantation crops as their main commodities. One of the prominent economic potentials in the village is the presence of sugar palm trees, which grow well in both household yards and forest edges. The sugar palm is intensively utilized through sap tapping activities, which are then processed into palm sugar (gula aren). This palm sugar product is marketed locally as well as to wider markets, providing a significant contribution to household income among farming families.

Respondent Characteristics

This research involved 10 sugar palm farmers actively engaged in sap tapping. The respondents' characteristics include age, education, tapping experience, and the number of productive trees owned.

Table 1. Characteristics of Sugar Palm Farmers in Jambu Malea Village

Characteristic	Category	Number (persons)	Percentage (%)
Age	20–29 years	2	20
	30–39 years	3	30
	≥ 40 years	5	50

Education	Elementary (SD)	5	50
	Junior High (SMP)	4	40
	Senior High (SMA)	1	10
Experience	< 5 years	2	20
	5–10 years	4	40
	> 10 years	4	40
Palm Trees	10–20 trees	3	30
	21–40 trees	5	50
	> 40 trees	2	20

Source: Jambu Malea Village Office, 2025

The data indicate that sap tapping is dominated by farmers aged ≥ 40 years (50%), with relatively low education levels, as most only completed elementary school (50%). However, long tapping experience (5–10 years and >10 years, each 40%) supports strong technical skills in managing production. The average ownership of 21–40 productive palm trees (50%) also reflects substantial production potential for most respondents.

Production Conditions and Farmers' Revenue

The findings revealed that the average sap yield per tree reached 10–15 liters/day. With an average of 25 productive trees, a farmer can produce 250–375 liters of sap/day, equivalent to approximately 42 kg of palm sugar. For the 10 respondents collectively, daily production reached about 420 kg, or around 12,600 kg/month.

The farm-gate price of palm sugar was IDR 18,000/kg. Thus, the average monthly revenue per farmer was IDR 7,722,000.

Table 2. Average Monthly Revenue of Sugar Palm Farmers

Description	Average Production (kg/month)	Price (IDR/kg)	Total Revenue (IDR/month)
Palm Sugar	429	18,000	7,722,000

Source: Primary Data, 2025 (processed)

Production Costs

Production costs consist of variable costs (supplementary materials, labor, transportation, fuel) amounting to IDR 1,864,000/month, plus fixed costs in the form of equipment depreciation amounting to IDR 122,733/month. Hence, the total average production cost was IDR 1,986,733/month.

Table 3. Average Monthly Production Costs of Sugar Palm Farmers

Cost Component	Cost (IDR)
Supplementary materials (plastic, lime, coconut)	450,000
Transportation	350,000

Labor	750,000
Fuel (firewood/fuel)	314,000
Equipment depreciation	122,733
Total Production Cost	1,986,733

Source: Primary Data, 2025 (processed)

Net Income and R/C Ratio Analysis

Table 4. Summary of Sugar Palm Farming Analysis in Jambu Malea Village

Component	Value (IDR/month)
Total Revenue (TR)	7,722,000
Total Production Cost (TC)	1,986,733
Net Income ($\pi = TR - TC$)	5,735,267
R/C Ratio ($TR \div TC$)	3.88

Source: Primary Data, 2025 (processed)

Criteria:

- $R/C > 1 \rightarrow$ Profitable
- $R/C = 1 \rightarrow$ Break-even
- $R/C < 1 \rightarrow$ Loss

Interpretation: The R/C ratio value of 3.88 indicates that every IDR 1 of production cost generates IDR 3.88 of revenue. This means that sugar palm farming in Jambu Malea Village is highly feasible and profitable to develop further.

DISCUSSION

The results of this study indicate that sugar palm farming in Jambu Malea Village has considerable economic potential to increase household income. Based on Table 2, the average farmers' revenue from palm sugar processing reached IDR 7,722,000 per month, with an average production of 429 kg/month and a selling price of IDR 18,000/kg. This figure illustrates that palm sugar is not merely a local commodity but also possesses strong economic competitiveness. When calculated annually, this revenue is equivalent to IDR 92,664,000, which is relatively higher than other traditional farming activities such as rice or maize in the Tapango region, which usually provide only seasonal income. This fact reinforces the view that farm diversification through sugar palm cultivation can generate more sustainable income and reduce dependence on seasonal crop cycles.

From the production cost perspective, as shown in Table 3, the average total cost incurred by farmers was IDR 1,986,733 per month. The largest component of costs came from labor (IDR 750,000), followed by supplementary materials (IDR 450,000), transportation (IDR 350,000), fuel (IDR 314,000), and equipment depreciation (IDR 122,733). This cost structure demonstrates that sugar palm farming is still labor-intensive, where labor plays a significant role in the overall production costs. The relatively high

labor cost aligns with the nature of palm sugar production, which requires intensive work both in sap tapping and sugar processing. However, compared to the revenue obtained, the production cost is relatively low, accounting for only about 25.7% of total monthly revenue. This indicates a high level of efficiency and confirms that sugar palm farming is highly prospective for further development.

Furthermore, the financial analysis presented in Table 4 shows that the farmers' net income reached IDR 5,735,267 per month after deducting production costs. This value confirms that sugar palm farming provides a substantial profit margin. The revenue-to-cost ratio (R/C ratio) of 3.88 further strengthens the evidence of financial feasibility, as every IDR 1 spent on production costs yields IDR 3.88 in revenue. In farm economic analysis, an R/C ratio above 2 generally indicates high feasibility; therefore, an achievement of 3.88 can be categorized as not only feasible but also highly profitable. In other words, sugar palm farming in Jambu Malea Village can be considered a form of sustainable farming system capable of supporting the economic resilience of farming households.

In addition, the study highlights important socio-economic implications. Most respondents were aged above 40 years, indicating that sap tapping activities are still dominated by senior farmers. This raises concerns about labor regeneration in the future. Nevertheless, the farmers' long experience in tapping and processing sap serves as valuable capital in maintaining product quality. The relatively low education levels of respondents, with most having only completed elementary school, indicate limited access to modern information and technology. Therefore, external support in the form of extension services and technical training from government and non-governmental organizations is essential to enhance farmers' capacity in managing their businesses more efficiently and innovatively.

From a broader economic perspective, sugar palm cultivation and processing in Jambu Malea Village can be viewed as a potential sector for strengthening local economies based on natural resources. Palm sugar products not only have a high selling value in local markets but also have the potential to penetrate regional and even export markets, considering the increasing trend of demand for natural and healthy food products (FAO, 2020). If this business is managed collectively through cooperatives or farmer groups, production scale could be increased, and farmers' bargaining power against middlemen and large traders would be strengthened. This finding is consistent with rural development theory, which emphasizes the importance of participatory management of local resources to enhance the economic independence of rural communities.

Therefore, the discussion of these findings not only confirms the financial feasibility of sugar palm farming in Jambu Malea Village but also opens opportunities for developing strategies to strengthen farmers' capacities, diversify products, and improve market access. Sugar palm farming has been proven to provide high profitability, cost efficiency, and significant potential for improving rural welfare if developed with the right and sustainable approach.

CONCLUSION

This study demonstrates that sugar palm cultivation and palm sugar processing in Jambu Malea Village, Tapango Sub-district, Polewali Mandar Regency hold highly promising economic potential. Farmers' average revenue reached IDR 7,722,000 per month with production costs of IDR 1,986,733, resulting in a net income of IDR 5,735,267. The R/C ratio value of 3.88 confirms that sugar palm farming is not only feasible but also highly profitable from a financial perspective. Therefore, sap tapping and palm sugar processing can serve as a primary source of household income for farmers while simultaneously strengthening the village economy.

Beyond financial aspects, this study also highlights the farmers' social conditions, where the majority of respondents were over 40 years old and had relatively low education levels, yet possessed long experience in managing sugar palm farming. This condition indicates the importance of external support in the form of agricultural extension, technical training, and technological innovation to enhance

productivity and sustainability. Strengthening farmer organizations and improving market access are also key factors in increasing the competitiveness of palm sugar products, both at the local and regional levels.

In conclusion, this study affirms that sugar palm cultivation in Jambu Malea Village not only contributes to increasing farmers' income but also plays a strategic role in rural economic development based on local potential. Therefore, the development of sugar palm farming requires greater attention through synergy among farmers, government, and other stakeholders to ensure sustainable economic benefits for rural communities.

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