SustainPalm
Enhancing Palm Oil Sustainability & Circularity

POLICY BRIEF

Development of an Oil Palm (*Elaeis guineensis*) Sugar Industry : Challenges and Opportunities

Development of an Oil Palm (*Elaeis guineensis*) Sugar Industry: Challenges and Opportunities”

Yessie Widya Sari, Aritta Suwarno, Wolter Elbersen, Dase Hunaefi, Dikky Indrawan, Y. Aris Purwanto, Erwinsyah

Key Issues

1. **Economic Potential and Agricultural Sustainability.** The oil palm sugar industry holds significant potential for regional economic growth and sustainable agricultural practices in Indonesia. Utilizing non-productive oil palm trunks offers new economic opportunities for farmers and producers by applying circular economy principles transforming plantation waste into high-value products.
2. **Challenges of the Oil Palm Replanting Cycle.** A major challenge in developing this industry is the dependency on the oil palm replanting cycle. Oil palm trunks are only available at specific times after trees are felled for replanting, typically every 25-30 years. This uncertainty in raw material availability can disrupt the sustainable supply of sap and the continuity of sugar production.
3. **Limited Production Technology.** The technology used by most oil palm sugar producers is still dominated by traditional methods. Co-crystallization with granulated sugar is often practiced to compensate for sap shortages, but this can reduce the efficiency and quality of the final product. Without access to modern and efficient technology, producers face difficulties in scaling up production capacity and in meeting quality standards required for competition in local and international markets.
4. **Suboptimal Market Access.** Inadequate market access remains a significant barrier to the growth of the oil palm sugar industry. Poor distribution infrastructure and limited product promotion constrain market expansion, thereby limiting the growth potential of producers in oil palm sugar-producing regions.

Summary

The oil palm sugar industry has significant potential to boost regional economies and support sustainable agriculture by utilizing oil palm trunks at replanting. However, significant challenges exist such as an unreliable raw material supply, underdeveloped production technology, and suboptimal market access for the gula produced. With support in modern technology, mapping of replanting cycles, and improved market access, the industry has the potential to grow further and bring substantial economic benefits to local producers and surrounding communities.



Introduction

Several palms can be tapped to produce a sugar containing sap that is cooked to produce the typical gula. These include the coconut palm (*Cocos nucifera*), the nipa palm (*Nypa frutican*). And the best known is sugar palm (*Arenga pinnata*). More recently oil palm (*Elaeis guineensis*) has also been tapped for sugar at replanting when the trees are usually ~25 years old. To produce sap, fronds are removed from the palm trunk and the top of the trunk is cut to keep the sap dripping. The sap is allowed to drip daily into a bucket for 4 to 6 weeks and collected daily. To prevent decay antibacterial compounds are added such as sodium bisulfite. The sap is cooked to generate gula with the distinctive unique taste favoured by consumers.

Oil palm sugar production is gaining momentum in several provinces in Indonesia, including North Sumatera (Serdang Bedagai), Riau (Kuantan Singingi, Siak, and Indragiri Hulu), North Sumatra, Jambi, West Kalimantan and East Kalimantan. At replanting typically 4 to 5 tons of sugar per ha and starch are present in trunks the amount of sugar and starch per trunk varies between palms and may be reduced under drought or haze conditions. If 1 to 2 tons of sugar can be tapped per ha and the replanting rate is 200,000 ha per year this amounts to 200,000 to 400,000 tons of oil palm gula that can be produced in Indonesia each year.

Issues and Challenges

1) Risk of Limited Raw Materials

Oil palm trunks are tapped at replanting typically after 25-30 years.

This long cycle directly affects the availability of sap, as the raw material for oil palm sugar production. The absence of detailed region-specific data on replanting schedules creates uncertainty for producers.

2) Pricing and Market of Palm Sugar from Oil Palm Trunks

Oil palm trunk sap is cooked to produce brown gula sugar. Generally, some white sugar is added to aid co-crystallization. White granulated sugar is more widely available in the market at a low price. To keep the price competitive, some producers reduce the ratio of palm trunk sap and increase the use of white sugar through co-crystallization techniques. While this approach lowers production costs, it can compromise the quality and authenticity of the final product ultimately weakening the market competitiveness and reputation of palm sugar derived from oil palm trunks.

Additionally, limited market access remains a significant barrier for oil palm sugar producers. Currently, the product predominantly serves the domestic market, with very limited information available on export activities.

3) Production Technology and Quality Control

The lack of modern technology application and limited skills in product processing leads to low productivity and quality. This condition hinders producers' ability to meet higher market standards in terms of both quantity and quality.

Moreover, the quality of palm sugar is highly dependent on the sap extracted from oil palm trunks. Variations in sap composition particularly sugar content directly influence the consistency and quality of the final product. Any decline in sap quality can result in inferior sugar, affecting both taste and market acceptance. This highlights the need for better quality control throughout the production chain, from sap harvesting to crystallization, to ensure the final product consistently meets consumer and market standards.

Discussion

The oil palm sugar industry holds significant potential to support economic and environmental sustainability through the utilization of non-productive oil palm trunks. However, challenges such as unpredictable raw material supply and reliance on traditional technology for sap harvesting and conversion of sap into sugar (gula) necessitates integrated solutions. Mapping the rejuvenation periodization and replanting calendars can provide better supply certainty for producers while also opening investment opportunities in this sector.

Additionally, co-crystallization technology offers a solution to enhance the quality and efficiency of palm sugar production. This technology allows producers to reduce their dependence on white sugar, which has been a competitive issue in terms of pricing and product quality. With more modern technology, producers can become more competitive in both domestic and international markets. Market access also presents a challenge that requires attention, as product promotion and distribution remain limited.

Strengthening distribution infrastructure and broader product campaigns can help increase market penetration and enhance the welfare of local producers. Integrating central and regional policies is key to optimizing local potential and ensuring the sustainability of the palm sugar industry in the future. With strategic actions such as technological advancement, market diversification, and better policy integration, this industry can develop into a more stable and sustainable economic sector.

Conclusion

The emerging oil palm trunks sugar industry has great potential to contribute to local economic growth and support environmental sustainability through the utilization of an underutilized resource. A region-based replanting calendar and structured mapping of oil palm plantations are crucial to ensuring raw material availability for oil palm sugar producers. With assured supply, producers can plan their production more effectively, while local governments can establish strategic areas for industry development.

Co-crystallization technology plays a crucial role in improving production efficiency and reducing reliance on white sugar. For small and medium scale producers, successful adoption of this technology will depend heavily on targeted support. Support from the Oil Palm Plantation Fund Management Agency (BPDPKS), particularly through research funding and technical training is essential to scale-up the adoption of this technology.

Policy Direction

1) Oil Palm Replanting Program as a Main Pillar

The Ministry of Agriculture has launched the Oil Palm Replanting Program (PSR) aimed at replacing aged and unproductive oil palm trees. This program not only supports oil palm productivity but also opens new opportunities for utilizing oil palm trunks as raw materials for producing palm sugar. The Coordinating Ministry for Economic Affairs has also mapped oil palm plantations older than 20 years as part of a national replanting program. This mapping is crucial to provide certainty regarding the availability of palm trunks for the oil palm sugar industry, allowing producers to plan their production more effectively. Additionally, local governments are expected to establish strategic areas for the development of palm sugar, enabling each region to optimize its local resource potential.

2) Establishment of a Replanting Calendar as a Sustainability Solution

The establishment of a replanting calendar by the Ministry of Agriculture is a significant step in ensuring the continuity of raw material supply for palm sugar production.

3) Financial Support through BPDPKS and Technological Research

The BPDPKS agency provides significant support for the replanting process and related industry development. In addition to providing financial assistance for the replanting process, BPDPKS supports the utilization of oil palm trunks for various industries, including oil palm sugar production.

This financial assistance is crucial for smallholders who often struggle to fund their plantation replanting processes.

Furthermore, BPDPKS funds research into the development of co-crystallization technology in oil palm sugar production, aimed at reducing dependence on white sugar as a mixing ingredient in the production process. Developing alternative materials to white sugar through co-crystallization technology is a strategic step to improve production efficiency and reduce costs, allowing producers to enhance their product competitiveness.

The application of co-crystallization technology in oil palm sugar production offers several advantages for producers, including:

- Raw Material Efficiency: By utilizing leftover oil palm sugar from previous batches, producers can maximize raw material use with minimal waste and lower production costs.
- Improved Product Quality: This technology can help maintain the consistency of oil palm sugar quality, as the co-crystallization process allows for a more uniform blending of sugar crystals.
- Reduced Dependence on White Sugar: With co-crystallization technology innovation that does not rely on white sugar use, producers can minimize additional costs often caused by fluctuations in white sugar prices, thereby enhancing production sustainability.

4) Integration of Central and Regional Policies for Local Potential Optimization

The integration of central and regional government policies needs to be enhanced to ensure the smooth development of the palm sugar industry. The central government, through the Coordinating Ministry for Economic Affairs and the Ministry of Agriculture, leads the mapping and scheduling of replanting, while local governments are expected to establish strategic areas for the development of oil palm sugar and provide support for local producers through policies that facilitate access to raw materials and technology.

5) Developing a clear business model

Developing a robust and inclusive business model is paramount to securing the adoption of oil palm sugar by the food, beverage, and ingredient industries. To gain the trust of these sectors, the model must convincingly guarantee a stable supply chain, consistent product quality, and competitive pricing. This is best achieved through a collaborative ecosystem that strategically leverages the unique strengths of different players. Large corporations can provide critical investment in advanced processing technology, research and development, and expansive distribution networks, signalling market stability. Small and Medium-sized Enterprises (SMEs) bring agility and innovation, pioneering niche products and applications that showcase the sugar's versatility.

At the heart of this model, farmer cooperatives are essential for organizing the collection of raw palm sap, ensuring sustainable practices, and empowering local communities. By integrating these three pillars corporate scale, SME innovation, and cooperative-based sourcing the business model will not only meet the rigorous demands of industrial buyers but also build a resilient, ethical, and appealing value chain from the farm to the final consumer.

Bibliography

Ajiputra, A. J. 2025. Enhancing circular economy practices: Mainstreaming the utilization of oil palm sugar production to improve circularity of oil palm residue in Indonesia. Master theses, Wageningen University, Environmental Systems Analysis. https://edepot.wur.nl/688290

Azizah N, Suyitno, Muslimin A. 2015. Carbohydrate, protein, and fat content in fermented palm sugar from oil palm trunks (Elaeis guineensis Jacq.). Jurnal Pangan dan Agroindustri. 3(1):142-149.

Dirkes, R. P. R. Neubauer and J. Rabenhorst. 2021. Pressed sap from oil palm (Elaeis guineensis) trunks: a revolutionary growth medium for the biotechnological industry? In BioFPR. P931-944.

Ikawati Z, Irianto H, Hartoyo S, Arifin M, Santoso D. 2018. Development of local economic strategies in utilizing palm trunks as raw material for palm sugar in Kutai Timur Regency. Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 6(1):1-10.

Mialet-Serra I., et al. 2006. THE TRANSITORY CARBON RESERVES IN TWO PALMS: THE COCONUT AND THE OIL PALMS. In Final Meeting of ATP Reserves n° 11/2002, November 8-9, 2006. In CIRAD – Lavalette, Montpellier, France.

Prasetyo B, Rustikawati R, Wardiyanto W. 2019. Value chain analysis of palm sugar and strategies to enhance product competitiveness in Pulorejo Village, Tasikmadu District, Karanganyar Regency. Jurnal Perspektif Pembiayaan dan Pembangunan Daerah. 7(3):200-208.

Sari RA, Arifin B, Supriyadi. 2017. Production of palm sugar from xylem sap of palm tree trunks. IOP Conference Series: Materials Science and Engineering. 180(1):012047.

Setiawan A, Handayani R, Suryanto D. 2021. Analysis of mineral content in palm sugar from oil palm trunks in Teluk Merbau Village, Siak Regency. Jurnal Ilmiah Mahasiswa Pertanian. 6(1):208-216.

Triana AS, Kumalasari RR, Saputra DG, Sunarti TC. 2019. Prediction of palm sugar production from oil palm trunks based on starch and glucose content in the upper part of the trunk. Jurnal Ilmu- Ilmu Pertanian Indonesia. 21(2):85-92.

Wibowo A, Arifin B, Mulyana R. 2018. Utilization of oil palm trunk waste as raw material for palm sugar production. Jurnal Teknologi Lingkungan. 19(1):77-84.

Yuniarti E, Amiruddin R, Syafitri E, Sari N. 2018. Analysis of palm sugar craft business from oil palm trunks in Buhur Village, Bireuen District, Bireuen Regency. Jurnal Ilmiah Mahasiswa Agribisnis Unsyiah. 3(2):1-13.

Zainal R, Yuliansyah A, Lubis M. 2021. Performance evaluation of palm sugar processing business in Kuantan Singingi Regency. Jurnal Ilmiah Mahasiswa Pertanian. 6(1):208-216.

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