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Production Improvement and Sugarcane-based Product Diversification of SMEs Yodhatama, Cendono Village, Kandat Sub-District, Kediri District

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Abstract

Cendono Village is a sugarcane-producing village with sugarcane areas reaching 50% of agricultural land. The distinctive sugarcane products of Cendono Village are green sugarcane juice drinks and green sugarcane syrup, managed and produced by a productive youth group called Yodhatama. The processed products of this productive youth group are manufactured through a third-party manufacturing system at BUMDES Makmur Abadi, Bendosari Village, Blitar, which is 29.1 KM away, resulting in an ineffective process. In this Doktor Mengabdi program, Cendono Village is being developed with a sugarcane-based business through the concept of "one village multi-products". Activities conducted include equipment facilitation, training and assistance in implementing aseptic sterilization and hot filling, product diversification, and process standardization. Equipment facilitation includes sugarcane peelers, sugarcane grinders, sterilization tanks, filling tanks, and micro scale. Diversification of green sugarcane processed products includes cup-packaged sugarcane juice drinks, jelly drinks, and jelly candies. Production training is conducted with equipment facilitation in the form of food dehydrators and cup sealers. Quality control and consistency are achieved through the development of Standard Operating Procedures (SOPs) and the implementation of Good Manufacturing Practices (GMP). Marketing is carried out by assisting partners in online market expansion strategies and appropriate and attractive labeling.

Keywords: Aseptic packaging; Green sugarcane; Hot filling sterilization; Product diversification; Standardization.

INTRODUCTION

Kediri Regency is a district located in East Java Province, Indonesia. It comprises 26 sub-districts, 1 urban village, and 343 rural villages. Geographically, Kediri Regency has a diverse topography, ranging from lowlands to mountainous areas, which contributes to its rich natural resources. This geographical condition also provides agrarian advantages, making agriculture the primary livelihood of the local population. One of the largest crops cultivated in the area is sugarcane. According to Sari (2018), Kediri produces the second-highest amount of sugarcane in the region, with a total yield of 117,835 tons, following Malang. This sugarcane production is generally processed into various sugar-based products. Sugarcane juice that does not meet the quality standards of sugar factories can be processed into various other products.

Cendono Village is one of the 12 villages located in the Kandat sub-district, Kediri Regency. In terms of territorial characteristics, Cendono Village is primarily agrarian, with sugarcane plantations covering 50% of its agricultural land. The type of sugarcane grown in Cendono is known as green sugarcane. The flavor and sensory properties of green sugarcane juice are distinct compared to other varieties, making it particularly suitable for producing a refreshing sugarcane juice beverage. "Ijo" sugarcane juice is rich in sucrose, which is

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typically used as a sweetener. Additionally, green sugarcane juice contains phytochemical compounds, including phenolic compounds, flavonoids, tannins, alkaloids, saponins, steroids, triterpenoids, and policosanol (Widiawati & Qodri, 2023). These bioactive compounds give the juice various health benefits, such as antioxidant, antihyperglycemic, antihypercholesterolemic, antiproliferative (anticancer and antitumor), antifibrotic, and antithrombotic activities, which are essential in preventing heart disease and inflammation (Haq, 2021).

The potential of green sugarcane, which dominates the agricultural landscape of Cendono Village, inspired Mr. Faizal Ahmad Adhyriza, S.AP, in 2018, to consider processing the sugarcane into a value-added product. Previously, most of the sugarcane from Cendono Village was sold to sugar companies for processing into white or brown sugar. Mr. Faizal recognized the opportunity to utilize the abundant and inexpensive raw sugarcane to create products with higher economic value, leading to the establishment of the Yodhatama Small and Medium Enterprises (SME). In 2019, Mr. Faizal coordinated with the Kediri Regency Cooperative and Micro Business Office and received training on sugarcane processing. In March 2023, a partnership agreement was signed between the Faculty of Agricultural Technology, Brawijaya University, Malang, and the Cendono Village Government, focusing on education, research, community service, and the improvement of human resources.

Currently, Yodhatama SME is limited to producing green sugarcane juice and syrup, packaged in PET bottles. However, the production of these two sugarcane-based products faces equipment-related constraints. Yodhatama processes sugarcane at BUMDes Makmur Abadi in Bendosari Village, Sanankulon Sub-district, Blitar Regency. Each production batch processes between 50 to 100 kilograms of sugarcane, which is first crushed to extract the juice, then filtered using a cloth, and cooked in a pressure cooker. Afterward, the juice is cooled in stainless steel tanks (feeder) with fans to lower the temperature. The next day, the SME returns to Bendosari Village, Blitar, to carry out bottling and labeling processes. This dependency on external facilities hampers the efficiency of Yodhatama's production.

Another issue faced by Yodhatama SME is the limited variety of sugarcane-based products. The development team proposed producing green sugarcane juice in cup packaging for individual, single-use servings. Additionally, jelly drinks and jelly candies could target the children's market. The production process for sugarcane juice and jelly drinks in cup packaging requires the hot filling technique, for which Yodhatama needs training and guidance.

At present, the production process for green sugarcane juice and syrup remains limited and lacks standardization. Yodhatama SME has not yet implemented Standard Operating Procedures (SOPs), resulting in inconsistent product shelf life. The establishment of SOPs should include identifying critical control points to ensure that the products are safe for consumption. The sugarcane processing will eventually be conducted independently in Cendono Village, without relying on BUMDes Makmur Abadi-Blitar. The production process must comply with Good Manufacturing Practices (GMP) according to Indonesian BPOM Regulation No. HK.03.1.23.04.12.2206 of 2012 concerning Good Food Production Practices for Household Industries.

Currently, green sugarcane juice and syrup products are marketed locally, primarily around Cendono Village and Kediri City. Yodhatama SME aspires to expand its market reach. The SME's product, under the brand name Cennira, has already obtained a marketing authorization (MD) from BPOM, opening opportunities for wider distribution. In addition to marketing authorization, attractive and comprehensive product labeling is crucial for marketing success. The labeling must comply with BPOM Regulation No. 31 of 2018. The improvement of labeling is also a focus of the development team as a

promotional tool to demonstrate the quality of the SME's products, thereby expanding its market. Exploring online retail platforms is essential for broader marketing, and the SME requires assistance in registering on these platforms.

MATERIAL AND METHOD

Location of Community Service Activities

The research was conducted at the Food Processing Technology Laboratory, Faculty of Agricultural Technology, Universitas Brawijaya, and the production site of "ijo" sugarcane juice products at Yodhatama SME, located in Cendono Village, Kandat Sub-district, Kediri Regency. The research spanned a period of two months, from July 2024 to August 2024, with a focus on enhancing the production autonomy of Yodhatama SME. This was achieved by providing equipment such as a sugarcane grinder, UV sterilization cabinet, pressure cooker, food dehydrator, and cup sealer. Additionally, training and mentoring were conducted in the application of aseptic sterilization and hot filling techniques, quality control through the development of Standard Operating Procedures (SOPs), implementation of Good Manufacturing Practices (GMP), online marketing planning, and product diversification, specifically for "ijo" sugarcane jelly candy and jelly drink.

Materials and Equipment

The materials used in the study included green sugarcane juice, plain agar powder (Swallow Globe Brand), carrageenan (Nutrijell plain), water, cold water, sodium benzoate, sugar, and potassium sorbate. The equipment used included a stove (Rinnai), pot, 120 mL plastic cups, 500 mL plastic measuring cups, stirring spoons, analytical balance (Mettler Toledo ML54, Switzerland), food dehydrator, cup sealer, 50 L pressure cooker (Nagami), sugarcane grinder, and UV sterilization cabinet. The equipment was partially used at the Food Processing Technology Laboratory of the Faculty of Agricultural Technology, Universitas Brawijaya, and some were acquired through equipment orders.

Community Service Activities

Product Diversification of Green Sugarcane

Product diversification involved the development of jelly drink and jelly candy from "ijo" sugarcane. The general process of making "ijo" sugarcane jelly drink includes mixing sugarcane juice with water, agar, carrageenan, preservatives (sodium benzoate), and stirring until well blended; boiling the solution and maintaining the boil for 10 minutes before turning off the stove; pouring the hot solution into cup packaging (hot filling); sealing the cups; shocking with cold or ice water; and applying labels. For jelly candy, the steps involved mixing agar with "ijo" sugarcane juice and stirring until well blended; boiling the solution; pouring the agar mixture into square molds; cooling and freezing; cutting the solidified agar into cubes; placing the cubes on a tray lined with plastic; and drying the cubes using a food dehydrator for 16 hours.

Packaging Diversification of Green Sugarcane Juice

Packaging diversification was done by introducing a 120 mL cup option, offering a lower-priced variant. The production process of "ijo" sugarcane juice in cup packaging utilized hot filling sterilization technology. The hot juice was poured into the cups, sealed using a cup sealer, and cooled by immersing the cups in ice or cold water. The cups were then dried with a cloth and labeled.

Development of Standard Operating Procedures (SOP) and Implementation of Good Manufacturing Practices (GMP)

GMP development involved direct observation of Yodhatama SME's production site, identifying critical points that needed attention, particularly concerning sanitation during the production process. Observations of the production process also informed the creation of SOPs to ensure product quality and consistency. The established GMP and SOP will be compiled into a comprehensive SOP and GMP Manual.

Product Label Improvement

The team assisted and guided the partner in improving their product labels to comply with BPOM Regulation No. 31 of 2018. Although the partner had a design for their cup packaging, the label did not yet meet the regulatory requirements. Label deficiencies included incorrect expiration date format, inaccurate ingredient listing, and the improper display of the product registration number (P-IRT or BPOM).

Online Marketing

Online marketing was conducted via social media, specifically on Facebook Marketplace. The green sugarcane processed products were listed and promoted in food and beverage buying and selling

groups across the Kediri Raya region, thus expanding the marketing reach efficiently and widely.

RESULT AND DISCUSSION

Product Diversification of Jelly Drink

cool (heat shock); 5) Dry the cups with a cloth and apply the labels. The process of making jelly drinks is illustrated in Figure 1. The third step involves the use of hot filling packaging technology, which

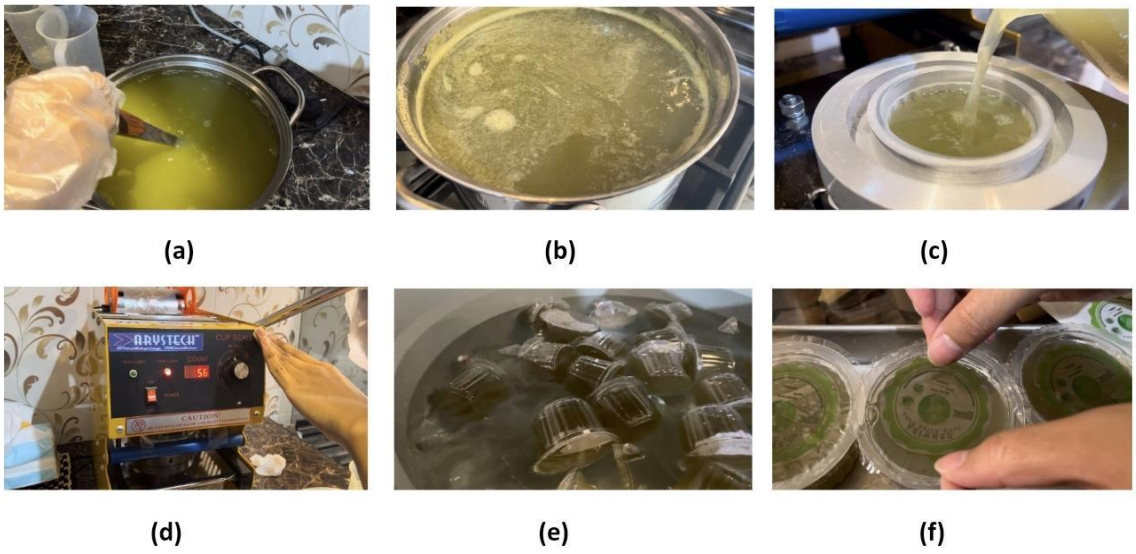

Figure 1. Production Process of *Sari Tebu Ijo* Jelly Drink. a) Mixing; b) Cooking; c) Pouring; d) Packaging; e) Cooling; f) Labeling.

The products produced by Yodhatama SME include Sari Tebu Ijo (Green Sugarcane Juice), Small Cup Sari Tebu Ijo, Sirup Tebu Ijo (Green Sugarcane Syrup), Nata Tebu Ijo (Green Sugarcane Nata), and Green Sugarcane Kombucha. The team selected processed products that align with the production capacity of Yodhatama SME to streamline the manufacturing process. One of the products developed is a jelly drink made from Sari Tebu Ijo. The processing of sugarcane juice into jelly drinks serves as an alternative method to extend the shelf life of sugarcane juice (Yowandita, 2018). The achievement indicator for this activity is the addition of a new product, the jelly drink, to Yodhatama SME's offerings.

The processing steps for turning Sari Tebu Ijo into jelly drinks are as follows: 1) Mix Sari Tebu Ijo with water, agar, carrageenan, preservatives (sodium benzoate), and stir until well mixed; 2) Boil the mixture and maintain the boil for 10 minutes, then turn off the heat; 3) While still hot, pour the mixture into cup packaging (hot filling), and then seal using a cup sealer; 4) Submerge the cups in ice or cold water to

ensures both the safety and quality of the product by sterilizing both the product and its packaging. The processed Sari Tebu Ijo jelly drink is then packaged in 120 mL cups made of PP5 material, as shown in Figure 1.

Figure 2. Jelly Drink in Cup Packaging 120 ml PP5

The dissemination of the Sari Tebu Ijo jelly drink production process was held at the Cendono Village Hall on July 23, 2024, targeting the Yodhatama SME business operators. Each participant received a sample during the session, allowing them to fully understand the taste of the jelly drink. The participants demonstrated enthusiasm during the dissemination, as indicated

by their active engagement throughout the event. The successful execution of this dissemination at Yodhatama SME contributed to the success of the activity. The equipment provided by the organizing team was based on the specific requests and needs of Yodhatama SME. Additionally, Yodhatama SME will receive a manual on jelly drink production to support their operations.

Product Diversification of Jelly Candy

jelly candy production process is illustrated in Figure 3. The processed sugarcane jelly candy is then packaged in 300 mL PET jars, as shown in Figure 4.

The dissemination of the Sari Tebu Ijo jelly candy production process was held at the Cendono Village Hall on July 23, 2024, targeting the business operators of Yodhatama SME. Each participant received a sample during the session, allowing them to better understand the sensory

Figure 3. Production Process of *Sari Tebu Ijo* Jelly Candy. a) Mixing; b) Pouring; c) Cutting; d) Arranging; e) Drying.

The product development of Yodhatama SME has previously focused on liquid products such as kombucha and sugarcane juice. The organizing team aimed to create processed products that align with the skills and capabilities of Yodhatama SME, simplifying the production process. One of the products introduced is jelly candy made from Sari Tebu Ijo (Green Sugarcane Juice). The achievement indicator for this activity is the addition of jelly candy as a new product from Yodhatama SME. Jelly candy was chosen due to its simple production process and affordable ingredients.

The processing of Sari Tebu Ijo into jelly candy involves the following steps: 1) Add agar to Sari Tebu Ijo and stir until evenly mixed; 2) Cook the mixture of Sari Tebu Ijo and agar until it reaches a boil; 3) Pour the agar mixture into a square mold;
Cool and freeze the mixture; 4) Cut the hardened agar into cubes; 5) Place the cubes on a plastic-lined tray; 6) Dry the cubes using a dehydrator for 16 hours. The characteristics of the jelly candy. The participants showed enthusiasm during the dissemination, as evidenced by the number of questions asked throughout the event. This dissemination activity at Yodhatama SME contributed to the success of the program. Therefore, the equipment grant was based on the requests and needs of Yodhatama SME. Additionally, Yodhatama SME will receive a module on jelly candy production to support their operations.

Figure 4. Jelly Candy in PET Packaging

Packaging Diversification of Sari Tebu Ijo

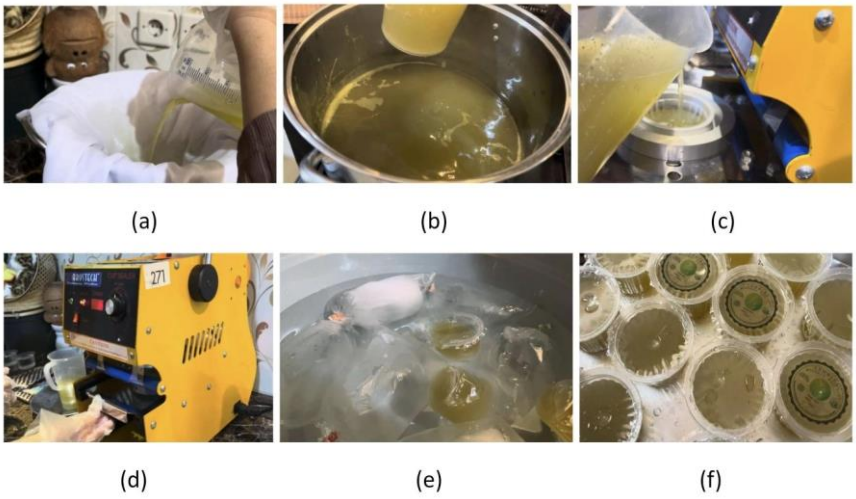

Figure 6. Production Process of Sari Tebu Ijo in Cup Packaging. a) Filtration; b) Cooking; c) Pouring; d) Packaging; e) Cooling; f) Labeling.

One of the challenges faced by Yodhatama SME is the large volume of the bottle packaging used for Sari Tebu Ijo, which is 250 mL, exceeding a single serving size. This packaging also results in a higher product price compared to the 120 mL cup packaging. The indicator of success for this activity is the increase in packaging variations for Sari Tebu Ijo as a product of Yodhatama SME. The diversification of Sari Tebu Ijo in cup packaging is intended to create single-serving, individually packaged products. The production process for Sari Tebu Ijo in cup packaging uses hot filling sterilization technology. Therefore, the partners need to be trained and supported in applying hot filling techniques for the diversification of Sari Tebu Ijo packaging in cups. The diversification of Sari Tebu Ijo in cup packaging can be seen in Figure 5.

Figure 5. Cup Packaging for Green Sugarcae Juice

The processing of Sari Tebu Ijo begins with extracting the sugarcane juice using a sugarcane grinder. The juice is then filtered through a cloth and transferred to a pressure cooker for heating until it reaches a boil, where it is maintained for 15 minutes, then the heat is turned off. After cooking, a preservative (sodium benzoate) is added and mixed thoroughly. While still hot, the Sari Tebu Ijo is poured into cup packaging and sealed with a cup sealer using a plastic lid. The cup packaging is then cooled by immersion in ice water or cold water, after which it is dried with a cloth and labeled. The processing steps can be seen in Figure 6.

The packaging process for Sari Tebu Ijo in cup packaging involves transferring the sterilized sugarcane juice, which is still hot from the heating process, into the cups. Packaging must be carried out while the Sari Tebu Ijo is still in a vaporous state. The cups are sealed tightly while the product is still hot, and then cooled or subjected to heat shock treatment to prevent the growth of mesophilic microbes that could cause spoilage. When the hot sugarcane juice is poured into the cups, a vacuum or airless condition is created in the head space after cooling. The high filling temperature affects the vacuum condition in the empty space of the cup packaging. The high

temperature of the sugarcane juice causes the formation of water vapor that displaces air in the empty space of the cup, filling the space with hot water vapor. After cooling, the water vapor condenses, creating a vacuum and anaerobic condition in the head space. This prevents the growth of aerobic microbes that require oxygen to thrive (Hariyadi, 2015). In this technique, pre-sterilization of the packaging is unnecessary because microbes are inactivated by the heat of the product during packaging. The packaging used must withstand high temperatures, specifically plastic containers with a 5 PP (Polypropylene) code. Plastic with the 5 PP (Polypropylene) code is resistant to high temperatures and is considered very safe for use as food and beverage packaging (Rachman et al., 2023).

The dissemination of Sari Tebu Ijo cup packaging production was held at the Cendono Village Hall on July 23, 2024, targeting the business operators of Yodhatama SME. The participants showed enthusiasm during the dissemination on the diversification of Sari Tebu Ijo in cup packaging, as evidenced by the numerous questions asked throughout the session. The service team provided Yodhatama SME with equipment grants for Sari Tebu Ijo production, including a sugarcane grinder, pressure cooker, cup sealer, and UV sterilization equipment. Additionally, Yodhatama SME will receive a module containing information on Sari Tebu Ijo cup packaging diversification to support their production.

The packaging process for *Sari Tebu Ijo* in cup packaging involves transferring the sterilized sugarcane juice, which is still hot from the heating process, into the cups. Packaging must be carried out while the *Sari Tebu Ijo* is still in a vaporous state. The cups are sealed tightly while the product is still hot, and then cooled or subjected to heat shock treatment to prevent the growth of mesophilic microbes that could cause spoilage. When the hot sugarcane juice is poured into the cups, a vacuum or airless condition is created in the head space after cooling. The high filling temperature affects the vacuum condition in the empty space of the cup packaging. The high temperature of the sugarcane juice causes the formation of water vapor that displaces air in the empty space of the cup, filling the space with hot water vapor. After cooling, the water vapor condenses, creating a vacuum and anaerobic condition in the head space. This prevents the growth of aerobic microbes that require oxygen to thrive (Hariyadi, 2015). In this technique, pre-sterilization of the packaging is unnecessary because microbes are inactivated by the heat of the product during packaging. The packaging used must withstand high temperatures, specifically plastic containers with a 5 PP (Polypropylene) code. Plastic with the 5 PP (Polypropylene) code is resistant to high temperatures and is considered very safe for use as food and beverage packaging (Rachman et al., 2023).

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Standard Operating Procedures (SOP) and Good Manufacturing Practices (GMP) Guidelines

The Yodhatama SME faces various challenges in maintaining consistent and standardized quality. This issue is a common obstacle when starting a business, particularly in the food production sector. Consistent and standardized quality can enhance consumer trust in the product. This challenge can be addressed by implementing Standard Operating Procedures (SOP) and Good Manufacturing Practices (GMP). In the food industry, GMP encompasses various aspects, including personal hygiene, facility sanitation, process control, and the handling of raw materials

and finished products. The goal of proper SOP and GMP implementation is to prevent contamination, maintain quality, and ensure consumer product safety (Anshari et al., 2022). To address these issues, SOPs and a GMP guideline book have been developed as a guide for implementing GMP at Yodhatama SME.

The GMP guideline book aims to facilitate the implementation of SOPs and GMP for business operators by providing clear guidance and instructions. In addition to the guideline book, a dissemination session on GMP implementation was conducted at the Cendono Village Hall, attended by SME operators and village officials. The dissemination included an introduction to GMP and an outline of priority actions that SMEs can take to implement GMP. The goal of the dissemination and distribution of the GMP guideline book is to support SMEs in achieving high-quality production in accordance with established standards.

Figures 7. GMP Guidelines

Label Improvement

Labeling on packaging is crucial for consumers as it helps attract buyers and informs them about the product type and the ingredients used. Although the partner has a design for the cup packaging, the label does not yet comply with the regulations set forth in KaBPOM Regulation No. 31 of 2018. The label discrepancies include incorrect expiration dates, composition listings, and registration numbers (P-IRT or BPOM). The team assisted and guided the partner in correcting the labels to ensure they meet the requirements of KaBPOM Regulation No. 31 of 2018.

Online Marketing

The primary online marketing platform chosen is Facebook Marketplace for several reasons: 1) It is easier compared to other platforms as it does not require personal data registration such as an ID card, and there is no lengthy verification process (Pakar, 2021); 2) It provides easy access to buyers as there is no need for regular content creation such as videos or live product marketing, as seen with other media (TikTok, Instagram, or Shopee). Products can be easily promoted through groups that already have thousands of members, allowing for broad promotional reach without the need for frequent content updates; 3) It targets buyers within the same area. Given that production is still small-scale, sales are focused around Kediri, making Facebook Marketplace an optimal choice for quick sales. As production scales up, online marketing can be expanded by joining food and beverage buy-and-sell groups in other cities or through other marketplaces such as Tokopedia and Shopee.

Marketing through Facebook Marketplace involves joining several local food and beverage buy-and-sell groups in Kediri, creating product listings in the selling section with details such as price, product description, seller contact information, and more. Products can then be marketed or uploaded simultaneously to multiple groups, making online marketing more efficient with a wider reach. Products can be relisted after a few days or weeks, keeping them visible at the top of group listings, allowing for continuous and easy marketing. However, as Yodhatama SME's production of green sugarcane products is still not self-sufficient, the quantity of products is limited and production times are unpredictable. Thus, the

focus remains on offering products to local souvenir shops, waiting for orders, or other offline sales rather than online sales. Therefore, online marketing through Facebook Marketplace is still a future plan or option once production volumes increase.

IMPACT OF ACTIVITIES

The impact of the activities mentioned can be summarized as follows:

1. **Product Diversification and Economic Value**:
   a) **Increased Product Range**: By introducing new products such as jelly drink and jelly candy, and diversifying packaging options to include cup formats, UMKM Yodhatama has expanded its product offerings. This diversification has made the products more attractive and affordable for consumers, potentially leading to increased sales and market share.
   b) **Enhanced Economic Value**: The introduction of these new products and packaging options has the potential to boost the economic value of UMKM Yodhatama's offerings, making them more competitive in the market and contributing to the overall financial health of the business.
2. **Quality and Safety Assurance**:
   a) **Technological Advancements**: The use of hot filling technology and UV sterilization has improved the safety and shelf life of the products, ensuring that they meet quality standards and are free from microbial contamination.
   b) **Standardization**: The development and implementation of Standard Operating Procedures (SOP) and Good Manufacturing Practices (GMP) have provided a framework for maintaining consistent product quality and ensuring compliance with safety regulations.
3. **Broader Marketing and Visibility**:
   a) **Improved Marketing Strategies**: The shift to online marketing via platforms like Facebook Marketplace, coupled with better label compliance, has increased the visibility and reach of UMKM Yodhatama's products. This broader marketing effort has facilitated greater consumer engagement and has the potential to attract a larger customer base.
   b) **Enhanced Consumer Trust**: With labels conforming to BPOM regulations, consumer trust in the products is likely to increase, as clear and accurate labeling provides assurance of product authenticity and safety.
4. **Capacity Building and Sustainability**:
   a) **Ongoing Development**: Continuous training and support for UMKM actors, along with regular monitoring of SOP and GMP adherence, will help in further developing their capacities and ensuring long-term sustainability of their production practices.
   b) **Sustained Impact**: The improvements in production practices, product quality, and marketing strategies are expected to contribute to the sustained growth and effectiveness of UMKM Yodhatama's operations.

Overall, the activities have had a positive impact on UMKM Yodhatama by enhancing product diversity, improving quality and safety, expanding marketing efforts, and building long-term capacity and sustainability.

CONCLUSION

The conclusion of this activity is that the diversification of green sugarcane products and packaging carried out by UMKM Yodhatama and the Universitas Brawijaya Service Team demonstrates significant potential in enhancing the economic value and competitiveness of local products. By developing products such as jelly drink, jelly candy, and diversifying the packaging of green sugarcane juice into cup formats, UMKM Yodhatama is able to offer more appealing and affordable product variations to consumers. Furthermore, the implementation of hot filling technology and UV sterilization, along with the establishment of SOP and GMP, are crucial steps in ensuring product quality and safety. Additionally, broader marketing efforts supported by label improvements in accordance with BPOM regulations and exploring online store options are essential for maintaining production sustainability and effectiveness. It is recommended to continue developing the capacity of UMKM actors through ongoing training and monitoring the application of SOP and GMP.

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