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TRAINING ON AMBON BANANA FRUIT RIPENING PROCESSING IN BANANA FRUIT SELLERS IN TAWANGMANGU

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ABSTRACT

Banana is a climacteric fruit that continues to ripen after harvesting, and the ripening process plays a crucial role in determining its market value, taste, and consumer safety. In Tawangmangu, a highland region of Central Java, many banana fruit sellers still employ traditional and unsafe methods for ripening, including the use of non-food-grade chemicals. This community service program aimed to enhance the knowledge and practices of 10 local banana sellers by providing participatory training on natural and safe ripening techniques, with a focus on Ambon bananas (Musa paradisiaca var. sapientum). The training combined theoretical education with hands-on practice in using ethylene-based and hygienic ripening methods. Pre- and post-test evaluations revealed a significant increase in participants' understanding of postharvest physiology and food safety. Furthermore, 80% of the sellers demonstrated the ability to construct and apply low-cost ripening chambers using local materials, and reported reduced fruit spoilage, improved customer satisfaction, and increased marketability. The program successfully bridged the knowledge gap and introduced a practical, low-resource solution aligned with sustainable development goals. This model has the potential to be replicated in other rural agricultural markets to improve food safety and support local economic empowerment.

Keywords: *Banana Ripening, Ambon Banana, Postharvest Training, Food Safety, Community Service, Tawangmangu*

INTRODUCTION

Banana (Musa spp.) is one of the most important tropical fruits globally and holds a significant place in Indonesia's horticultural sector. Among the various banana cultivars, Ambon banana (Musa paradisiaca var. sapientum) is widely favored for its sweetness, fragrance, and nutritional content. Tawangmangu, a mountainous sub-district in Central Java, is a region known for its cool climate and fertile volcanic soil, which makes it suitable for banana cultivation and trade. However, despite the high demand for bananas,

postharvest handling practices, particularly ripening methods, remain underdeveloped in rural markets like those in Tawangmangu (Mulyani & Yuliana, 2020).

Ripening is a physiological process marked by changes in texture, color, aroma, and flavor, driven by the production of ethylene gas. This natural process can be influenced through both traditional and technological interventions. However, improper handling during ripening can lead to fruit damage, inconsistent quality, and even health risks if non-food-grade chemicals are used (Winarno, 2020). Many banana sellers in traditional markets still depend on unsafe practices such as exposure to kerosene fumes or unregulated chemicals, which not only reduce banana quality but can also endanger consumers.

In rural areas like Tawangmangu, fruit sellers play a vital role in the agricultural supply chain. Most of them operate small-scale businesses with limited access to proper postharvest training and food safety knowledge. Their reliance on traditional knowledge without scientific guidance contributes to inconsistency in fruit ripening, leading to spoilage and financial losses (Sari & Nugroho, 2021). This issue reflects a broader problem of knowledge gaps between agricultural technology advancements and local market practices.

Improving the ripening process is critical, especially for bananas, which are climacteric fruits that continue to ripen after harvesting. Controlled ripening with the use of ethylene, either naturally produced or applied in a regulated environment, has proven to improve fruit quality and extend shelf life (Zhang et al., 2018). Unfortunately, the application of such techniques remains minimal among local sellers due to limited training and infrastructure.

Natural and safe ripening methods offer several advantages, including preserving fruit integrity, enhancing appearance, and ensuring consumer safety. By avoiding harmful substances and adopting standardized postharvest practices, sellers can not only increase their profits but also gain consumer trust, which is crucial in competitive markets (FAO, 2019). Furthermore, promoting these practices supports national food safety programs and contributes to public health.

Community service in the form of practical training is an effective solution to bridge the knowledge gap. Training programs enable local sellers to understand the science behind ripening, adopt simple technologies, and apply hygienic handling practices. The active involvement of sellers in learning sessions also fosters a sense of ownership and willingness to change behavior (Gunawan & Mustika, 2022). Thus, community-based

capacity building is essential in rural economic development. This community service activity was designed to respond to the urgent need for knowledge dissemination in fruit postharvest processing. By focusing on ten banana sellers in Tawangmangu, the program provided direct, hands-on training in safe and efficient Ambon banana ripening techniques. The selection of this region and participant group was based on the observation that improper ripening was common and caused substantial economic loss.

Additionally, this activity is aligned with the Sustainable Development Goals (SDGs), particularly Goal 12 (Responsible Consumption and Production), which promotes sustainable food systems. Introducing safe ripening methods helps reduce food waste, improve product safety, and ensure that consumers receive high-quality fruits. Moreover, training empowers local sellers to be more competitive and responsible in their business practices (UNDP, 2021).

The activity also builds upon the theoretical framework of postharvest technology and rural entrepreneurship. According to Setiawan (2021), empowering micro-entrepreneurs through training not only increases product value but also creates multiplier effects in rural economies. Proper postharvest management can significantly reduce losses and improve food system efficiency, especially in perishable commodities like bananas.
Previous studies have shown that ripening chambers, ethylene gas applications, and proper temperature and humidity control can be adopted even in small-scale settings (Rahman et al., 2020). By adapting these methods using locally available materials, sellers can achieve consistent results without large capital investment. The key lies in knowledge transfer and training tailored to the needs and capacity of the participants.

The initiative carried out in Tawangmangu is expected to serve as a pilot for broader replication. By documenting the methods and outcomes, other regions with similar socio-economic contexts can benefit from the experience. Furthermore, collaboration with agricultural extension offices and local cooperatives can enhance the sustainability of the intervention. In conclusion, the introduction of safe and effective banana ripening techniques through community service is both timely and impactful. This program demonstrates how academic institutions can contribute to community development through science-based solutions to practical problems. The focus on Ambon bananas and local fruit sellers in Tawangmangu highlights the intersection of postharvest innovation, public health, and rural economic empowerment.

METHOD

This training took place in Tawang Mangu and was attended by 10 banana traders who process bananas from raw to ripe. The training adopted a participatory educational approach, emphasizing the active involvement of beneficiaries—namely, banana fruit sellers in Tawangmangu. This method was chosen to ensure that knowledge transfer occurred in a two-way interactive process, where participants could engage directly through dialogue, demonstrations, and collaborative problem-solving. Such an approach aligns with adult learning theory (andragogy), which underscores the importance of experience-based and self-directed learning for adult participants (Knowles, Holton, & Swanson, 2015).

The program was conducted in Tawangmangu, a sub-district in Karanganyar Regency, Central Java, known for its fruit trade, especially Ambon bananas. This location was selected due to the prevalence of improper ripening practices among local fruit sellers, including the use of non-food-grade substances and unhygienic storage conditions, which compromise both fruit quality and consumer health (Winarno, 2020). Ten banana fruit sellers were purposively selected as program participants. The selection criteria included: (1) actively selling bananas in the Tawangmangu traditional market, (2) having never participated in formal postharvest handling training, and (3) demonstrating willingness to attend all training sessions. The purposive sampling method was considered appropriate for community service projects where targeted intervention is required for maximum impact (Sugiyono, 2018).

Prior to the intervention, a needs assessment was carried out through direct observation and informal interviews. This preliminary investigation revealed that 70% of the sellers used outdated and unsafe ripening techniques, such as placing bananas in closed containers with kerosene fumes or other unknown chemicals. These practices often led to uneven ripening, poor taste, and even food safety risks, highlighting the urgent need for capacity building in safe ripening technologies (Sari & Nugroho, 2021).

The training program was designed in three main stages: (1) theoretical education, (2) hands-on practice, and (3) knowledge and skills evaluation. The materials delivered included: basic physiology of banana ripening, natural ethylene production and application, risks associated with harmful chemicals, and the creation of simple ripening chambers using affordable and locally available materials (Zhang, Yu, & Chen, 2018; FAO, 2019). During the theoretical session, participants learned about the climacteric nature of bananas,

the role of ethylene gas in the ripening process, and best practices for ensuring uniform and safe ripening. This session was supported by printed leaflets, visual infographics, and discussion forums to enhance understanding, especially for participants with limited formal education backgrounds. The practical component of the training involved the demonstration of a small-scale ripening chamber setup. Sellers were taught how to create and operate a low-cost "mini ripening box" using materials such as wooden crates or plastic containers, combined with naturally ripening fruits like papayas or bananas to stimulate ethylene release. This method was tailored to their local context and economic capacity, making it easy to adopt and replicate (Rahman, Islam, & Haque, 2020).

Participants were then given time to construct their own versions of ripening setups under supervision. The process encouraged group discussion, collaborative learning, and direct problem-solving. This approach helped reinforce learning through immediate application, which is a critical factor in skill-based training for adult learners (Gunawan & Mustika, 2022). To assess the effectiveness of the training, both pre-test and post-test assessments were administered. The pre-test consisted of 10 multiple-choice questions assessing knowledge of ripening methods, while the post-test included both theoretical and practical components. Results were analyzed descriptively to measure knowledge gains and skills acquisition among participants.

Furthermore, semi-structured interviews were conducted at the end of the training to gather qualitative feedback on the perceived usefulness, applicability, and challenges of implementing the new techniques. These interviews helped identify which aspects of the training were most effective and where further support might be needed (Miles, Huberman, & Saldaña, 2014). To ensure sustainability, a WhatsApp group was created to facilitate ongoing communication between the facilitators and participants. This platform serves as a space for follow-up consultations, troubleshooting, and knowledge sharing. In addition, participants were encouraged to collaborate with local agricultural extension officers for continued mentoring and access to updated postharvest technologies.

The participatory training model used in this program has proven to be an effective method for empowering small-scale entrepreneurs, especially in rural areas. By providing direct, practical knowledge in a culturally and economically appropriate manner, the program achieved its objective of improving safe banana ripening practices among 10 fruit sellers in Tawangmangu.

RESULTS AND DISCUSSION

The training on safe ripening techniques for Ambon bananas conducted in Tawangmangu provided both qualitative and quantitative insights into the knowledge and practices of the 10 participating banana fruit sellers. Overall, the results indicated a positive transformation in understanding, skill application, and behavioral change among the respondents.

Of the 10 participants, 6 were female and 4 were male, with ages ranging from 28 to 56 years. Most had been selling bananas for more than 5 years, indicating extensive practical experience but limited exposure to formal postharvest education. Only two participants had previously attended any form of agricultural training, highlighting the importance of targeted interventions such as this PKM activity (Gunawan & Mustika, 2022). Preliminary knowledge assessments showed low awareness of proper ripening techniques. The average score from the pre-test was 42%, indicating a limited understanding of ethylene's role, the dangers of unregulated chemicals, and basic hygiene practices in fruit storage. This confirms findings from Sari and Nugroho (2021), who observed that small-scale sellers often rely on inherited, non-scientific ripening methods.

After the training, the average post-test score increased to 86%, demonstrating a significant improvement in knowledge acquisition. All participants could accurately describe the natural process of banana ripening, the role of ethylene, and could list at least three safe methods to induce ripening without harmful chemicals. This improvement validates the effectiveness of the participatory educational approach (Knowles et al., 2015). During the hands-on session, 8 out of 10 participants successfully assembled a basic mini ripening chamber using locally available materials. These chambers maintained an enclosed space conducive to ethylene build-up and minimized contamination risks. Participants appreciated the simplicity and affordability of the model, which made it easily adoptable for small-scale operations. Through follow-up interviews, 9 participants expressed strong intent to shift from chemical-based methods to natural techniques. The primary motivators included customer satisfaction, better appearance of ripened bananas, and fewer complaints regarding taste and safety. This aligns with behavioral change theories which emphasize the role of knowledge and perceived benefits in influencing practices (Ajzen, 1991).

Within two weeks after the training, 6 sellers reported that customers noticed the improved taste and appearance of the bananas. Three participants noted an increase in

customer loyalty and repeat purchases. This supports findings by Rahman et al. (2020), who observed that naturally ripened bananas tend to be more uniform and appealing to consumers. Several participants noted a decrease in the percentage of bananas lost due to premature rotting or uneven ripening. Previously, sellers reported 10–15% spoilage during the peak season; after the training, spoilage rates dropped to under 5% for most of the participants. This outcome highlights the economic value of proper postharvest handling practices (FAO, 2019).

Another important behavioral change observed was the implementation of better hygiene during storage. Sellers began using clean mats, avoided storing bananas on bare floors, and ensured proper ventilation. These changes are essential not only for banana quality but also for food safety and public health (Winarno, 2020). Two participants voluntarily shared the training outcomes with neighboring sellers. This suggests a ripple effect, where trained individuals act as informal educators in their communities. Such peer-to-peer learning is crucial in sustaining long-term behavioral change and expanding the reach of limited-resource interventions (Gunawan & Mustika, 2022).

Interestingly, female participants were more proactive in the discussion and application stages, possibly due to their dual role as household managers and food providers. This supports previous literature that emphasizes the role of women in food safety and postharvest practices in traditional markets (UNDP, 2021). Despite the positive outcomes, some participants faced difficulties in consistently implementing the new techniques. Two sellers lacked access to proper storage containers and needed capital to purchase basic tools. This suggests that future programs should include small-scale grants or tool packages to facilitate full adoption (Setiawan, 2021).

Participants responded positively to the use of infographics, demonstration videos, and printed manuals. Visual learning tools were particularly helpful for those with limited reading ability or formal education. This reflects the importance of using multimodal instructional strategies in community-based training (Miles, Huberman, & Saldaña, 2014). The establishment of a WhatsApp group created a sense of ongoing support and accountability. Participants frequently used the platform to ask questions and share experiences. Digital mentoring is a cost-effective way to sustain training outcomes in rural and low-resource settings (Zhang et al., 2018).

This program supports several Sustainable Development Goals, particularly SDG 12 (Responsible Consumption and Production) and SDG 3 (Good Health and Well-being).

By replacing harmful chemical practices with safe, natural alternatives, the project contributes to healthier food systems and consumer protection (UNDP, 2021). Given the success of this small-scale intervention, similar training programs could be replicated in other horticultural regions with minimal cost. The involvement of local government units and agricultural extension agents would help scale the impact. Furthermore, integrating such training into local policy frameworks on food safety and MSME development would ensure long-term sustainability.

CONCLUSION

The community service program conducted in Tawangmangu demonstrated the significant impact of targeted training in improving the postharvest practices of small-scale banana fruit sellers. By focusing on the safe and natural ripening of Ambon bananas, the training successfully bridged the knowledge and practice gap among 10 selected participants. The intervention led to a remarkable increase in understanding of banana physiology, the role of ethylene in ripening, and the dangers of using harmful chemicals. Post-training evaluations revealed that participants were able to adopt low-cost, effective ripening techniques using accessible local materials. Beyond the acquisition of knowledge, behavioral changes were also evident, including improved hygiene practices, reduced spoilage, and greater customer satisfaction. The success of the training confirms the relevance of participatory and context-sensitive educational models in rural empowerment and agricultural development. This initiative has contributed to broader goals of promoting food safety, enhancing economic resilience among local sellers, and supporting sustainable postharvest management practices. Moreover, it aligns with national and global targets such as the Sustainable Development Goals (SDGs), particularly those related to responsible production and health promotion.

RECOMMENDATION

The training model developed in this program should be replicated in other horticultural regions with similar challenges. Local governments and agricultural institutions are encouraged to adapt and adopt this model to promote safe fruit handling practices at a wider scale. Provision of Postharvest Starter Kits. Future programs should consider distributing basic postharvest kits (e.g., ripening boxes, thermometers, hygiene materials) to participants to ensure full adoption of the techniques learned during training.

Capacity Building through Continuous Mentoring Establishing formal mentoring systems involving agricultural extension officers or university partners can help maintain the momentum of behavioral change and provide troubleshooting support for sellers post-training. Integration into Local Policy and Education Training content should be incorporated into local entrepreneurship programs, MSME development initiatives, and vocational training curriculums to ensure sustainability and policy relevance. Monitoring and Impact Evaluation. Longitudinal studies should be conducted to monitor the long-term effects of the training on seller income, fruit quality, and consumer health outcomes. Data gathered can help refine future program designs. Strengthening Peer-to-Peer Learning Sellers who have successfully adopted the techniques should be empowered to become community facilitators or peer educators to spread knowledge organically within their market networks. By implementing these recommendations, future initiatives can expand the benefits observed in Tawangmangu and contribute more broadly to the development of safe, sustainable, and profitable fruit trading practices across Indonesia.

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