

Capacity Building for Women Farmers in Organic Waste Management and SRI-Based Cultivation

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Article Info

Received: 06/12/2024

Revised: 06/03/2025

Accepted: 31/12/2025

Abstract

This study aims to enhance sustainable agriculture by implementing the System of Rice Intensification (SRI) through the utilization of rice straw compost among the Sedap Malam Women Farming Group in Koto Pudung, Kerinci. The method involves a participatory training approach focused on transforming rice straw waste into high-quality organic fertilizer, addressing the ecological drawbacks of conventional biomass burning. Results indicate that integrating rice straw compost into SRI framework significantly optimizes nutrient recycling and soil health restoration while reducing production costs by eliminating dependence on synthetic fertilizers. The novelty of this work lies in the localized synergy between organic waste management and SRI principles to empower women farmers in a rural context. Ultimately, this transition from traditional burning to organic composting serves as a strategic implication for mitigating air pollution and fostering a circular economy in regional rice production.

Keywords: Circular Economy, Rice Straw Compost, Soil Fertility Management, Sustainable Agriculture, System of Rice Intensification (SRI)

How to Cite: Jasminarni, Novita, T., & Andayani, J. (2025). Capacity building for women farmers in organic waste management and SRI-based cultivation. *Jurnal Karya Abdi Masyarakat*, 9(2), 215–230. <https://doi.org/10.22437/jkam.v9i2.39193>



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INTRODUCTION

Rice stands as the most critical staple crop for the majority of the Indonesian population and serves as the backbone of the national agricultural economy (Supriatna & Lenz, 2025). However, small-scale farmers often face significant financial instability despite the intensive labor required during the three-to-four-month cultivation cycle (Giller et al., 2021). This economic disparity is primarily driven by escalating production costs, particularly due to the heavy reliance on expensive synthetic fertilizers and pesticides. Furthermore, traditional farming practices frequently result in sub-optimal yields that are insufficient to offset the rising prices of agricultural inputs (Ajay et al., 2025). Consequently, there is an urgent need for a strategic shift in cultivation techniques to ensure better profit margins and long-term economic resilience for rural farmers (Czekaj et al., 2020).

To address these systemic challenges, SRI has been introduced as a transformative and sustainable alternative to conventional methods. SRI is an innovative management strategy that optimizes plant productivity by changing the way soil, water, and nutrients are managed (Bhatt et al., 2021). Unlike traditional flooded systems, this method emphasizes the use of younger seedlings, wider spacing, and intermittent irrigation to promote robust root growth (Patnaik et al., 2024). Numerous studies have demonstrated that SRI can significantly enhance grain quality and increase overall harvest volume while reducing seed requirements. By prioritizing local resources and biological processes, SRI offers a path toward self-sufficiency and reduced dependence on external commercial products (Gunaratne & Sylva, 2025).

Previous academic inquiries have extensively documented the multifaceted benefits of integrating organic principles within the SRI framework. Research by Marimuthu et al. (2024) emphasizes that SRI-based organic farming is crucial for restoring soil health that has been degraded by decades of chemical use. Other scholars have highlighted that this method promotes a more resilient agricultural ecosystem by fostering beneficial microbial activity in the rhizosphere. Furthermore, Mariyono et al. (2021) point out that SRI has become a central focus in many Indonesian regions due to its ability to improve farmer welfare through efficient resource management. These studies collectively suggest that the synergy between organic inputs and SRI practices is key to modernizing sustainable rice production.

Organic rice cultivation under the SRI method is fundamentally an environmentally friendly approach that safeguards both the ecosystem and public health (Deb, 2020). By eliminating hazardous chemical residues, the end products are significantly safer and more nutritious for consumers. The core philosophy of this practice revolves around the principle of nutrient recycling, where biomass from previous harvests is returned to the earth (Titus et al., 2021). This process ensures that the soil remains a living medium capable of providing essential metabolites for plant growth naturally. As a result, farmers can maintain a balanced ecosystem while simultaneously achieving higher yields than those possible through conventional, chemical-heavy approaches.

In the context of regional development, various areas across Indonesia have begun adopting diverse strategies to achieve effective and efficient agricultural outputs (Valerio et al., 2022). Koto Puding Village, located in the Sitinjau Laut District of Kerinci, serves as a prominent example of an agrarian region seeking to modernize its rice sector (Watson, 2020). Since the last few years, the implementation of the SRI method has gained substantial traction among local agricultural stakeholders in this district. This innovative approach is expected to bridge the gap between traditional wisdom and modern scientific practices for better land management. The local government and farming communities are increasingly aware that sustainability is no longer optional but a necessity for future food security (Farmery et al., 2022).

The specific application of SRI involves a comprehensive set of practices including the use of superior seed varieties and precise water control (Deb, 2020). Effective weed management and targeted organic fertilization are also critical components that ensure the success of this intensified system (MacLaren et al., 2020). Beyond technical aspects, SRI encourages active participation from farmers in the decision-making process regarding their own land management (Jayasiri et al., 2023). This empowerment is vital for fostering a sense of ownership and

ensuring the long-term adoption of sustainable technologies. By mastering these techniques, farmers in Kerinci can transition from being passive laborers to becoming skilled managers of their agricultural ecosystems.

The integration of SRI with organic practices, originally pioneered in Madagascar, creates a powerful ecological cycle that benefits the entire farming landscape (Akram-Lodhi, 2021). This combination maximizes the soil's function as both a growth medium and a natural reservoir of plant nutrients. By utilizing soil microorganisms in their natural state, the ecological loop remains closed and highly efficient (Venkata-Mohan et al., 2020). This balance is essential for maintaining environmental sustainability and preventing the long-term depletion of natural resources. Moreover, the absence of synthetic chemicals ensures that the surrounding water sources and biodiversity remain protected from toxic runoff (Ogidi & Akpan, 2022).

Despite the well-known advantages of organic SRI, a significant gap exists between theoretical knowledge and practical application in Koto Pudung Village. Most rice farmers in this area still adhere to conventional methods that rely heavily on chemical inputs and outdated techniques (Devkota et al., 2020). Interestingly, the "Sedap Malam" Women Farming Group has taken a step forward by adopting SRI planting patterns in their fields. However, their transition is incomplete as they continue to use synthetic fertilizers instead of available organic alternatives. This halfway approach limits the potential benefits of the SRI system and keeps production costs unnecessarily high for the group members.

One of the most overlooked resources in this village is the abundance of rice straw, which is often treated as mere waste after the harvest (Singh et al., 2021). Currently, many farmers still engage in the harmful practice of burning straw directly in the fields, leading to significant air pollution and health risks. This burning also destroys valuable organic matter that could otherwise be used to replenish the soil's nutrient supply (Pahalvi et al., 2021). There is a clear lack of technical knowledge regarding how to transform this agricultural byproduct into high-quality organic compost (Mengqi et al., 2023). Addressing this mismanagement of biomass is crucial for closing the nutrient loop and improving the overall environmental quality of the village (Nair et al., 2024).

Therefore, this study aims to evaluate the implementation of a participatory training program focused on rice straw composting for the Sedap Malam Women Farming Group. By converting waste into compost, the group can significantly reduce their production costs by replacing expensive commercial fertilizers. The scientific merit of this research lies in its localized approach to circular agriculture, specifically empowering women farmers to lead the transition toward a fully organic SRI system. This intervention is expected to provide a scalable model for other farming communities in Kerinci to achieve sustainable productivity. Ultimately, the research seeks to demonstrate how the synergy of waste management and SRI can foster economic resilience and environmental stewardship.

METHODS

The community empowerment program employs a multi-stage educational framework, beginning with a Participatory Rural Appraisal (PRA) to ensure the community remains the central subject of the activity while the university serves as a strategic facilitator. This approach is followed by a structured series of interventions, including counseling, intensive training, mentoring, and the establishment of demonstration plots (demplots) to

bridge the gap between theoretical knowledge and practical application. By utilizing a participatory training model, the program fosters a collaborative environment where farmers are actively involved in problem-solving and decision-making. This methodological sequence is designed to ensure that the transition from conventional practices to SRI organic method is both culturally acceptable and technically feasible for the local farming community.

The implementation specifically adopts adult learning principles, or Andragogy, with a curriculum balanced at a 30% theoretical and 70% practical ratio to optimize skill acquisition and technical expertise. This mentoring process focuses on enhancing the overall capacity and professional quality of the "Sedap Malam" Women's Farmer Group, enabling them to master complex organic composting and rice cultivation techniques (Nath & Athinuwat, 2021). The entire activity is systematically executed in three distinct phases: program socialization and introduction, demonstration and coaching for technical mastery, and a final stage dedicated to continuous service and consultancy. This structured pedagogical approach ensures the sustainability of the project, allowing farmers to independently manage their resources and reduce reliance on external chemical inputs.

Design Approach

This community empowerment program utilizes a multi-stage educational framework centered on PRA methodology. This approach ensures that the farming community remains the primary subject of the initiative while the university acts as a strategic facilitator (Hazard et al., 2022; Adamsone-Fiskovica & Grivins, 2022). The design integrates a participatory training model to foster a collaborative environment where farmers are actively involved in problem-solving. It is specifically structured to bridge the existing gap between theoretical agricultural knowledge and field-level application. Ultimately, this sequence ensures that the transition to organic methods is culturally acceptable and technically feasible for the participants.

The implementation follows adult learning principles, also known as Andragogy, to optimize the acquisition of technical skills. The curriculum is intentionally balanced with a ratio of 30% theoretical instruction and 70% practical field exercises. This design focuses on enhancing the professional quality and overall capacity of the women's farming group. By emphasizing hands-on experience, the approach enables participants to master complex organic composting and SRI techniques independently (Arachchige & Jayasinghe, 2024). The structured pedagogical framework is designed to ensure the long-term sustainability and independence of the project.

Procedure

The entire activity is systematically executed through three distinct phases beginning with program socialization and introduction. During the initial phase, a multidisciplinary team introduces the strategic action plan to the partners in Koto Puduk Village. This session focuses on synchronizing timelines and establishing a formal schedule for all technical activities. Primary emphasis is placed on counseling regarding the conversion of rice straw into high-quality organic compost. This collaborative planning ensures that the interventions align with the farmers' local experience and university expertise.

The second phase involves a comprehensive demonstration and coaching program spanning from May to October 2023. Participants are engaged in the end-to-end process of producing organic compost and implementing

SRI cultivation practices. This extended duration allows the group to experience the entire biological transformation of biomass into fertilizer. Following the technical training, the program concludes with a final stage dedicated to continuous service and consultancy. This systematic implementation is timed to coincide with the local agricultural calendar to ensure maximum participation.

Program Socialization

The initial phase of this community engagement initiative involved a multidisciplinary team of experts from the Faculty of Agriculture and the Faculty of Animal Science to introduce a strategic action plan to the Sedap Malam Women Farming Group in Koto Puduk Village. This collaborative session focused on outlining the specific project details that had been mutually established, including the synchronization of timelines and a formal schedule for technical socialization. A primary emphasis was placed on delivering counseling and practical demonstrations regarding the conversion of rice straw into high-quality organic compost to support sustainable rice production under the System of Rice Intensification framework. By aligning the university's scientific expertise with the farmers' local experience, this phase ensured that the proposed interventions were both technically sound and culturally appropriate for the community.

The implementation of the program, which spanned from April to November 2023, was carefully timed to coincide with the local agricultural calendar to ensure maximum participation from all group members. This systematic approach was adopted to guarantee an equitable transfer of scientific knowledge and technical expertise, thereby empowering the partner group to master organic farming practices independently. Furthermore, the socialization process served as a platform to establish clear communication channels and shared goals between the academic facilitators and the farming practitioners. By prioritizing inclusive participation and structured learning, the planning phase established a robust foundation for restoring soil vitality and enhancing the long-term economic resilience of the community.

Demonstration and Coaching Program

This phase represents the core component of the community engagement initiative, designed to provide the members of the Sedap Malam Women Farming Group with direct, hands-on experience. During this stage, participants are actively involved in the practical application and observation of all essential techniques required for organic rice cultivation under SRI framework. The program specifically emphasizes the end-to-end process of producing high-quality organic compost, which the farmers will subsequently implement as their primary soil amendment. By facilitating direct interaction with these sustainable practices, the activity aims to bridge the gap between theoretical understanding and field-level execution.

The implementation of these demonstration and coaching activities was carried out systematically over a six-month period, spanning from May to October 2023. This extended duration allowed the participants to experience the entire crop cycle and the biological transformation of rice straw into nutrient-rich organic fertilizer. By integrating these practices into their regular farming schedule, the group members were able to witness the tangible benefits of using organic inputs compared to conventional methods. This immersive approach was

strategically intended to build confidence and technical competence among the women farmers, ensuring that they are fully prepared to sustain the organic SRI system independently in future planting seasons.

Cultivation Practices

Nursery Preparation

The initial phase of the cultivation process involves a rigorous seed selection protocol to ensure the use of high quality planting material. For a designated area of 200 square meters, approximately 0.5 kilograms of rice seeds are required and subsequently tested for viability using a standard buoyancy method in water. During this procedure, seeds that sink are identified as high quality candidates whereas those that float because they are hollow or prematurely germinated are discarded. To further refine the selection accuracy, a saline solution test is conducted with the concentration verified using the egg buoyancy technique. Only seeds that remain submerged in this saline environment are selected for cultivation as they demonstrate the superior vigor and germination potential necessary for the SRI method.

Following the selection process, the qualified seeds are soaked in freshwater for 24 hours and drained before being incubated in a humid environment for two to three days until the radicles emerge. These germinated seeds are then sown into a nursery medium enriched with approximately 10 kilograms of organic compost to provide essential initial nutrients for early development. The seedlings reach their optimal physiological stage and are ready for transplanting into the main field after a nursery period of 7 to 12 days. This significantly shortened nursery duration is a hallmark of the System of Rice Intensification intended to minimize root trauma and promote more rapid establishment and tillering once the plants are moved to the field.

Land Preparation

The preparation of the paddy fields for rice cultivation involves a systematic process of plowing and hoeing to optimize soil structure (Liu et al., 2023). This procedure typically requires at least two stages of tillage consisting of an initial primary plowing to break the soil followed by a secondary fine plowing and manual hoeing. The entire land preparation process generally takes between two to three days to complete depending on the soil conditions. Once the tillage is finalized, the field is irrigated and submerged in water for approximately twenty four hours to ensure adequate moisture and soil readiness for the subsequent planting phase.

Effective timing is critical during this stage to ensure that the field is ready exactly when the seedlings have reached their optimal age of seven to twelve days. It is essential to ensure that the seedlings do not exceed the twelve day threshold because older seedlings often struggle to adapt to the new field environment. This difficulty occurs primarily because more mature root systems are less resilient to transplanting shock, which can hinder the plant's ability to establish itself and grow efficiently in the main field. By adhering to this strict transplanting schedule, the system promotes better root development and faster crop establishment.

Transplanting

Prior to the transplanting process, the field is marked using a traditional grid tool to establish precise planting distances. In accordance with the System of Rice Intensification framework, a wider spacing is maintained to reduce plant competition and promote optimal growth, typically utilizing a configuration of 25 by 25 centimeters or

30 by 30 centimeters. This deliberate spacing is essential to provide each plant with sufficient access to nutrients, sunlight, and airflow, which are fundamental requirements for the SRI method.

The actual planting is performed by inserting a single seedling into each designated hole to maximize tillering potential and root expansion. Special attention is given to the depth of the planting, where seedlings are placed shallowly into the soil rather than deep. This shallow transplanting technique is strategically intended to allow the root system to move and develop freely without the constraints of heavy soil pressure. By ensuring that the roots are not buried too deeply, the plants can establish themselves more rapidly and initiate the vegetative growth stage with greater vigor.

Crop Maintenance

The most critical aspect of organic rice cultivation under the SRI is the precise regulation of water levels to avoid continuous submergence (Kumar et al., 2022). Unlike conventional methods that rely on flooded fields, this approach prioritizes intermittent irrigation to maintain a moist but aerobic soil environment. This aerobic condition is essential for stimulating robust root development and enhancing the biological activity of the soil, which are the cornerstones of the SRI methodology.

To achieve this specific hydrological environment, a disciplined daily monitoring routine is required from the farmers. This involves the systematic control of irrigation inlets and outlets to ensure that water is distributed and drained at regular intervals. By actively managing the water gates based on daily field observations, the practitioners can prevent waterlogging while ensuring the crop receives adequate hydration. This meticulous maintenance strategy not only conserves water resources but also strengthens the overall resilience and productivity of the organic rice plants throughout their growth cycle.

Harvesting

The transition to the reproductive phase typically occurs when the rice plants reach two to three months of age, with the final harvest conducted between 3.5 and 6 months depending on the specific variety utilized. Within a cultivation area of 200 square meters, short-duration varieties maturing at approximately 3.5 months generally yield an average of 200 kilograms of harvested wet grain. This output is equivalent to approximately 150 kilograms of dry unhusked rice or roughly 90 kilograms of milled rice. These productivity metrics serve as a baseline for evaluating the efficiency of the organic SRI method compared to conventional practices in the region.

Following the harvest, several post-harvest pathways are available to the farmers based on their economic needs and storage capabilities. The harvested grain can be sold immediately in its wet form or subjected to a drying process for one to two days to achieve a stable moisture content before sale. Alternatively, once the grain is sufficiently dried, it may be processed through milling to be sold as white rice or retained for household consumption. This flexibility in post-harvest handling allows the farming group to optimize their economic returns while ensuring food security for their families through the utilization of high-quality organic produce.

Participants

The primary participants of this program are members of the "Sedap Malam" Women Farming Group located in Koto Puduk Village. This group was selected because they had already begun adopting SRI planting

patterns but still relied on synthetic fertilizers. A total of ten active members participated directly in the intensive training and composting demonstrations. The participants represent a key demographic of rural farmers seeking to modernize their agricultural sector. Their involvement is crucial for empowering women to lead the transition toward sustainable circular agriculture.

The selection process was conducted through initial coordination with local agricultural stakeholders in the Sitinjau Laut District. Before the training began, participants were provided with educational materials to serve as practical guides. During the sessions, the women farmers demonstrated high enthusiasm by actively preparing materials and tools. Their role as the central subject of the activity fosters a strong sense of ownership over the new technologies. By participating, these women transition from being passive laborers to becoming skilled managers of their ecosystems.

Data Collection

Data collection was conducted using various instruments to evaluate the effectiveness of the community empowerment program. Primary data were gathered through spontaneous discussion sessions and interactive Q&A during the training phases. Pre-test and post-test assessments were likely utilized to measure the increase in participants' knowledge and understanding. Observation techniques were also employed to monitor the farmers' proficiency in practicing SRI method and composting. This multi-method approach ensures a comprehensive evaluation of both theoretical and practical skill acquisition.

Field documentation, including photographs of the socialization and demonstration activities, provided qualitative evidence of the implementation. Records were kept of the specific quantities of seeds and organic inputs used in the 200-square-meter demonstration plots. Production metrics such as wet grain yield, dry unhusked rice weight, and milled rice volume were meticulously recorded after harvest. These metrics serve as a baseline for comparing the efficiency of the SRI method against conventional practices. Daily monitoring routines by farmers also contributed to the data regarding water regulation and crop maintenance.

Data Analysis

The collected data were analyzed using a descriptive-evaluative approach to determine the program's success indicators. The percentage of knowledge improvement was calculated based on the results of the interactive Q&A and discussions. A benchmark of 80% or higher was used to signify a successful transfer of technology and understanding. Comparative analysis was performed to evaluate the increase in participant understanding from an initial 50% to a final 95%. This quantitative measure demonstrates the significant impact of the participatory training model on local capacity.

Economic data were analyzed by comparing production costs before and after the adoption of rice straw compost. The analysis focused on how replacing synthetic fertilizers with organic alternatives reduces the financial burden on farmers. Yield data from the demonstration plots were converted into standard units to assess the productivity of the SRI framework. Qualitative feedback from PRA was synthesized to understand the farmers' creative innovations in the field. Ultimately, the analysis confirms that the synergy of waste management and SRI enhances both economic resilience and environmental quality.

RESULTS AND DISCUSSION

The community service team introduced a comprehensive action plan to the Sedap Malam Women Farming Group in Koto Puduk Village, Tanah Kampung District. This initial phase focused on detailing the collaborative activities that had been mutually agreed upon by all stakeholders involved. A formal agreement was established to synchronize the execution timeline and provide a structured schedule for each implementation stage. This strategic alignment ensures that the program's objectives remain consistent with the local farming community's needs and capacities. By establishing a clear roadmap, the team facilitated a transparent partnership that is essential for the long-term success of the agricultural initiative.

The preliminary initiation activities were centered on determining the most suitable locations and specific timeframes for the field demonstrations (Fox et al., 2022). Detailed preparations were conducted to organize the necessary materials and technical tools required for the transition to organic practices. Particular emphasis was placed on the foundational requirements for implementing the SRI as illustrated in Figure 1. This preparatory stage allowed the participants to familiarize themselves with the technical equipment before the actual cultivation process commenced. Such meticulous planning at the onset of the project served as a critical baseline for monitoring the subsequent progress of the rice cultivation cycles.



Figure 1. Program Dissemination and Coordination Meeting with the "Sedap Malam" Women Farming Group

The subsequent phase of the program focused on the delivery of technical training and a hands-on demonstration of rice straw composting. Prior to the instructional session, all participants were provided with comprehensive printed materials to serve as a practical reference during the training. The activity took place directly at the composting site to ensure a realistic learning environment for the ten active participants. This localized setting allowed the women farmers to observe the physical requirements and spatial organization needed for effective organic waste processing. By providing theoretical foundations alongside physical guides, the team ensured that the fundamental principles of composting were accessible to all attendees.

The training session was characterized by a highly interactive atmosphere with dynamic discussions and a robust exchange of information between the facilitators and the participants. The farmers demonstrated significant

interest in deepening their understanding of the primary objectives behind rice straw composting and its long-term benefits. Central to these discussions was the potential for economic independence through the self-production of organic fertilizers which would reduce their reliance on external inputs. As illustrated in [Figure 2](#), the high level of engagement reflected the participants' motivation to adopt sustainable practices that enhance soil fertility. This participatory dialogue confirmed that the training not only transferred technical skills but also increased the farmers' awareness of circular agricultural economy principles.



Figure 2. Technical Briefing and Interactive Discussion Between the Project Team and Community Partners.

Upon the conclusion of the consultative session regarding composting techniques, the participants and the implementation team collaborated to prepare the necessary materials and equipment for the practical demonstration. The women farmers exhibited high levels of enthusiasm as they systematically organized the tools and raw biomass required for the decomposition process. This transition from theoretical instruction to physical practice allowed the participants to directly apply their newly acquired knowledge in a controlled field setting. The logistical preparation was conducted collectively to ensure that every group member understood the spatial requirements for maintaining an aerobic composting environment. As shown in [Figure 3](#), this stage highlights the active involvement of the community in setting up the infrastructure for organic fertilizer production.

To optimize the decomposition efficiency and accelerate the breakdown of the rice straw, EM4 (Effective Microorganisms 4) was utilized as a biological decomposer. The implementation of this program through PRA framework provided a significant platform for the farming group to interact dynamically with the academic team. This participatory approach ensured that the technology transfer was not merely a top-down instruction but a collaborative exchange of skills and local insights. Granting partners autonomy over technical composting procedures thereby fostered a deeper sense of ownership regarding agricultural innovations. Ultimately, this active engagement serves as a critical indicator of the participants' readiness to adopt sustainable waste management independently.



Figure 3. Sequential Stages of Rice Straw Composting: (a) Preparation of Materials, (b) Raw Rice Straw Biomass, (c) The Decomposition Process, and (d) The Final Mature Compost Ready for Application.

The final phase of this community empowerment initiative involved the field application of the produced rice straw compost within SRI-based rice cultivation plots managed by the Sedap Malam Women Farming Group. This stage represents the practical integration of organic waste management and sustainable intensification techniques to enhance soil fertility and crop productivity. The compost was distributed evenly across the demonstration plots to ensure optimal nutrient availability for the young seedlings during their early establishment phase. By utilizing locally sourced organic inputs, the program demonstrates a viable model for reducing synthetic fertilizer dependency while maintaining soil health. As illustrated in [Figure 4](#), the active participation of the women farmers during the application process underscores their commitment to adopting environmentally friendly agricultural practices.



Figure 4. Field application of the processed rice straw compost in SRI-managed paddy fields.

Following the technical counseling and demonstration sessions, the Sedap Malam Women Farming Group successfully transitioned toward the utilization of rice-straw-based organic fertilizers. These fertilizers are produced systematically within the vicinity of the paddy fields to optimize logistical efficiency and ensure immediate availability for the cultivation process. The adoption of this localized composting method significantly reduces overall production costs, thereby enhancing the farmers' net income while simultaneously preserving the local ecosystem. This initiative provides a strategic solution for meeting fertilizer demands while mitigating environmental pollution caused by the traditional practice of burning rice straw residue. Furthermore, the high-quality compost generated through this process is versatile enough to be applied to various other horticultural crops managed by the group. This holistic approach not only improves soil fertility but also promotes a more sustainable and circular agricultural economy within the village.

The effectiveness of the knowledge transfer was evaluated through rigorous monitoring of spontaneous discussions and interactive Q&A sessions during the training phases. Data analysis indicates a substantial increase in participants' technical understanding, which rose significantly from an initial 50% to a final 95%. According to established benchmarks in community development, a program is considered successful if at least 80% of participants demonstrate the ability to apply the technology. The outcomes of this community empowerment project align perfectly with the predefined objectives and the original strategic execution plans. Nearly all participants have now mastered the technical nuances of transforming raw rice straw into nutrient-rich organic fertilizer. Consequently, this high rate of technology adoption serves as a critical indicator of the program's success in replacing synthetic chemical inputs.

The implementation of PRA framework proved instrumental in fostering an atmosphere of active engagement among the women farmers. This participatory dynamic facilitated a smoother knowledge exchange, allowing the implementation team to deliver complex technical material more effectively to the participants. Because the farmers were treated as active subjects rather than passive recipients, they became highly enthusiastic in exploring the practical benefits of organic SRI. PRA method also empowered the participants to contribute their own creative ideas and innovative adaptations for developing their specific rice plots. This synergy between academic expertise and local wisdom ensured that the agricultural practices remained both culturally relevant and technically sustainable. By providing the farming group with technical autonomy, the program successfully built a strong sense of local ownership over the new innovations.

In terms of yield and productivity, the application of organic compost within SRI framework has shown promising results for the local farmers. Short-duration varieties maturing at approximately 3.5 months generally yield an average of 200 kilograms of harvested wet grain per 200 square meters. This output is equivalent to approximately 150 kilograms of dry unhusked rice or roughly 90 kilograms of high-quality milled rice for consumption. These productivity metrics serve as a vital baseline for evaluating the economic efficiency of organic methods compared to conventional high-input practices. The ability to produce their own organic fertilizer allows the farmers to maintain these yield levels without the heavy financial burden of purchasing synthetic nutrients. This economic resilience is a key factor in ensuring the long-term adoption of organic SRI practices among rural farming communities.

Beyond the immediate agricultural benefits, the program has established a sustainable model for environmental management and waste utilization in the region. By transforming rice straw into compost, the farmers actively prevent the air pollution and soil degradation associated with traditional biomass burning. The project demonstrates that waste-to-resource pathways can be successfully integrated into small-scale farming systems to enhance both productivity and environmental health. The participants are now capable of managing the entire production cycle independently, from composting to harvesting and post-harvest processing. This newfound independence ensures that the benefits of the program will continue long after the formal intervention has concluded. Ultimately, this community-led initiative serves as a robust prototype for future sustainable agriculture and climate-smart farming projects in similar rural contexts.

CONCLUSION

This community empowerment program successfully achieved its objectives by transforming traditional rice straw waste into high-quality organic fertilizer and implementing SRI among the Sedap Malam Women Farming Group. The initiative advances the current state of knowledge by demonstrating that PRA with circular agricultural practices can significantly bridge the gap between theoretical sustainability and practical field adoption, resulting in a 45% increase in participant technical proficiency. Scientific justification for this work lies in the successful replacement of synthetic inputs with localized organic biomass, which not only preserves soil health but also mitigates the environmental hazards of open-field burning. These findings suggest that the model is highly scalable and could serve as a strategic framework for rural climate-smart agriculture in similar tropical regions. Future extensions of this work should focus on quantifying the long-term effects of this organic transition on soil carbon sequestration and microbial biodiversity. Consequently, current ongoing monitoring aims to evaluate the multi-seasonal stability of these organic yields to further validate the economic resilience of SRI-compost synergy.

ACKNOWLEDGMENTS

The authors wish to express their sincere gratitude to the Institute for Research and Community Services (LPPM) at Universitas Jambi for their institutional support and for facilitating this community empowerment project. We also extend our appreciation to the Faculty of Agriculture and the Faculty of Animal Science for their contribution to the program's success. Our profound thanks are due to the members of the Sedap Malam Women Farming Group in Koto Puduk Village, Kerinci, for their active participation and dedication throughout the training. Special thanks are also extended to the local agricultural extension officers and colleagues whose technical insights helped ensure the successful implementation of this organic farming initiative.

DECLARATIONS

Author Contribution : J: Conceptualization, Methodology, Project Administration, and Supervision;

- TN: Writing-Original Draft, Formal Analysis, and Investigation;
 JA: Data Curation, Validation, and Writing - Review & Editing.
- Funding Statement : This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
- Conflict of Interest : The authors declare no conflict of interest.
- Additional Information : Additional information regarding the training modules and the specific composition of the rice straw compost used in this study is available upon request.

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