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Community Empowerment through Intercropping of Roselle and Green Mustard in Mekar Wijaya Kusuma Women Farmers Group

I Gusti Bagus Udayana[1*], Made Sri Yuliartini[2], Anak Agung Sagung Putri Risa Andriani[3], Ni Luh Putu Sulis Dewi Damayanti[4], Ni Kadek Desy Andya Dewi[5], Sii Khairiyah binti Mohd. Hatta[6], Aida Firdaus[7], Kadek Nandika Aryantha Satya Satya[8], I Made Rhagyil Nandhikesvara[9], I Komang Suwedi[10]

[1,2,3,4,5,8,9]Universitas Warmadewa
[6,7]Universiti Teknologi MARA
[10]Badan Pengelola Perkebunan (BPP) Kintamani Barat
Corresponding Author: I Gusti Bagus Udayana bagusudayana64@gmail.com

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A B S T R A C T

Banjar Tinungan, Apuan Village, Baturiti District has fertile land with cool climate conditions. Agricultural potential in Apuan Village includes coffee plants, organic vegetables, and various medicinal plants. Objectives of the activityThis for partners is an increase in knowledge and skills of partners/communities in intercropping rosella flowers with sgreen awi, and processing cow dung as organic fertilizer to substitute the use of inorganic fertilizers. The methods used to achieve this goal are through outreach, outreach, mentoring, training, and technology application through direct field practice. The target output of this activity is to increase the knowledge and skills of partners/communities in intercropping rosella flowers with sgreen awi, and processing cow dung as organic fertilizer to substitute the use of inorganic fertilizers in partner/community areas.

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INTRODUCTION

Community empowerment has become a central pillar of sustainable rural development, particularly in the agricultural sector, where farmers' welfare is closely linked to access to knowledge, resources, and collective action. Empowerment is not merely about increasing production, but about strengthening the capacity of communities to make informed decisions, manage local resources effectively, and improve their overall quality of life. In this context, successful community empowerment requires active collaboration among government institutions, universities, and local communities to ensure that development processes are inclusive, participatory, and equitable. In Indonesia, the importance of village-based empowerment is formally recognized through Law No. 6 of 2014 on Villages, which emphasizes improving community welfare and quality of life through participatory development and the optimization of local potential (Rauf et al., 2021). This legal framework provides a strong foundation for empowerment initiatives that encourage community independence through structured programs, supportive policies, and continuous mentoring aimed at strengthening knowledge, skills, attitudes, and awareness (Wijaya et al., 2021).

Apuan Village, located in Baturiti District, Tabanan Regency, Bali, represents an area with considerable agricultural potential due to its favorable agroecological conditions. The village is characterized by fertile soils, a cool climate, and relatively high rainfall throughout the year, making it highly suitable for the cultivation of various agricultural commodities. These environmental conditions support the growth of horticultural crops, coffee plants, organic vegetables, and a range of medicinal plants that are traditionally cultivated by local farmers. Among the diverse commodities grown in the area, roselle (Hibiscus sabdariffa L.) and mustard greens have emerged as promising crops due to their adaptability to local conditions, nutritional value, and increasing market demand. However, despite this potential, their cultivation has not yet been optimized within an integrated and sustainable farming system.

Roselle is widely recognized as a multifunctional plant with high economic and health value. Various studies have reported that roselle contains abundant phytochemical compounds, including phenolics, flavonoids, tannins, alkaloids, saponins, and organic acids, which contribute to its antibacterial, anti-inflammatory, antioxidant, antidiabetic, and antihypertensive properties (Nurnasari & Khuluq, 2017). In addition, the high anthocyanin content found in roselle calyces makes it particularly attractive for use as a functional food ingredient and as a natural anti-aging compound (Malinda & Syakdani, 2020). These properties position roselle not only as an agricultural commodity but also as a value-added crop with potential applications in food, beverage, and health-related industries. Meanwhile, mustard greens are an essential leafy vegetable widely consumed in Indonesia, known for their high content of vitamins A, C, and K, as well as important minerals such as calcium and iron, all of which play a vital role in supporting human health and nutrition.

Despite the natural advantages and crop potential in Apuan Village, local agricultural practices are still dominated by monoculture systems. This approach often leads to inefficient land use, reduced biodiversity, and limited opportunities for product diversification. In addition, farmers in the village tend to rely heavily on inorganic fertilizers to maintain crop productivity. At the same time, locally available organic resources, particularly livestock waste such as cow dung, remain largely underutilized. This situation presents both an environmental challenge and an opportunity for sustainable agricultural improvement. Numerous studies have demonstrated that organic fertilizers derived from cow manure can significantly improve soil structure, enhance nutrient availability, and stimulate soil biological activity, while also reducing the negative environmental impacts associated with excessive use of chemical fertilizers (Fau & Harefa, 2022; Singh et al., 2020; Lal, 2020).

Figure 1. Rosella Flower Plants and Green Vegetables in Apuan Village

Intercropping systems offer a viable alternative to conventional monoculture practices by promoting more efficient use of land and resources. Through the simultaneous cultivation of two or more crops on the same plot, intercropping can improve yield stability, reduce pest and disease pressure, and enhance overall system resilience (Wijayanti et al., 2013; Brooker et al., 2015). When combined with organic fertilization, intercropping systems can support environmentally friendly farming practices that align with the principles of sustainable agriculture.

Based on these considerations, the International Community Service program was designed to empower the "Mekar Wijaya Kusuma" Women Farmers Group in Apuan Village through the implementation of a roselle–mustard intercropping system integrated with the utilization of cow dung as organic fertilizer. This program aimed not only to improve agricultural productivity but also to strengthen the technical skills, organizational capacity, and environmental awareness of the participants. By adopting participatory and locally adapted agricultural practices, the program sought to enhance economic resilience, promote sustainable resource management, and contribute to long-term community empowerment in rural Bali.

IMPLEMENTATION AND METHODS

This International Community Service program was implemented using a participatory, practice-oriented, and community-based approach, designed to ensure effective knowledge transfer, technology adoption, and long-term sustainability of the introduced agricultural practices. The program was carried out in Banjar Tinungan, Apuan Village, and involved 20 active members of the "Mekar Wijaya Kusuma" Women Farmers Group as direct beneficiaries. Women farmers were selected as the primary partners due to their central role in household food security, small-scale farming activities, and community-based agricultural management.

Problem Identification

The initial phase of the program focused on problem identification and needs assessment, which served as the foundation for designing relevant and context-specific interventions. Data collection was conducted through in-depth interviews, field observations, and focus group discussions (FGDs) involving group members and local stakeholders. These activities aimed to explore existing farming practices, identify key constraints, assess available local resources, and understand the expectations and priorities of the partner community.

Through this participatory diagnostic process, several critical issues were identified, including the dominance of monoculture cropping systems, limited knowledge of intercropping techniques, high dependence on inorganic fertilizers, and underutilization of locally available cow dung as organic fertilizer. At the same time, the assessment revealed strong local potential in terms of land suitability, availability of livestock waste, and high motivation among women farmers to adopt more sustainable and income-generating agricultural practices. This stage ensured that the program interventions were aligned with real field conditions, socially acceptable, and responsive to community needs, thereby increasing the likelihood of successful implementation and adoption.

Extension and Capacity Building

Based on the results of the problem identification stage, extension and capacity-building activities were designed to strengthen the technical and organizational competencies of the women farmers. Extension activities were delivered through direct counseling sessions, interactive discussions, and participatory learning methods. The main topics covered included roselle–mustard intercropping systems, organic fertilizer production using cow dung, appropriate fertilizer application techniques, and basic farmer group management.

Participatory extension approaches were deliberately emphasized to encourage active involvement, knowledge sharing, and experiential learning among participants. Such approaches are considered effective in enhancing farmers' understanding, confidence, and willingness to adopt new technologies, particularly among women farmers who often benefit from collaborative and hands-on learning environments (Davis et al., 2012; Food and Agriculture Organization, 2019). By positioning farmers as active learners rather than passive recipients, the extension activities aimed to foster a sense of ownership and responsibility toward the introduced innovations.

Provision of Inputs and Equipment

To support the practical implementation of the introduced technologies, the program provided essential agricultural inputs and supporting equipment to the partner group. These included roselle and mustard seeds, composting materials, bioactivators (EM-4), molasses, plastic mulch, sprayers, and simple agricultural tools. The provision of inputs was intended not only to facilitate immediate application but also to reduce initial financial barriers that often hinder technology adoption among smallholder farmers. The distribution of inputs was accompanied by clear explanations regarding their proper use, dosage, and maintenance to ensure efficiency and safety. This approach helped bridge the gap between theoretical knowledge and practical application, enabling participants to directly implement what they had learned during extension sessions.

Hands-on Training and Field Practice

Practical experience proved to be a critical component in strengthening both technical competence and self-confidence among the participating women farmers. While theoretical explanations provided foundational knowledge, direct engagement in field-based activities enabled participants to internalize and apply new concepts more effectively. All field practice activities were conducted under the close supervision of program facilitators and agricultural experts, ensuring that participants received immediate guidance, correction, and feedback throughout the learning process. This approach minimized technical errors while simultaneously building participants' confidence in handling agricultural tasks independently.

During the hands-on sessions, participants were actively involved in every stage of implementation, including land preparation, plot layout design for roselle–mustard intercropping, production of organic fertilizer using cow dung, and appropriate fertilizer application techniques. Rather than observing demonstrations passively, participants worked collaboratively to prepare planting beds, determine crop spacing, and arrange plant combinations according to intercropping principles. This direct involvement fostered a deeper understanding of spatial arrangement, crop compatibility, and nutrient management within integrated farming systems.

In the organic fertilizer training, participants practiced preparing compost by mixing cow dung with bioactivators and molasses, followed by proper composting and maturation procedures. They then applied the finished compost to planting beds at recommended rates, allowing them to directly observe differences in soil texture, moisture retention, and early plant response. These practical exercises helped farmers understand not only the how, but also the why behind organic fertilizer use, particularly its role in improving soil health and supporting sustainable crop growth..

Figure 2. Field Practice

Monitoring and Evaluation

Monitoring and evaluation were conducted continuously throughout the program to assess progress, identify constraints, and provide timely technical assistance. Monitoring activities included regular field visits, informal discussions with participants, and observation of crop development and fertilizer application practices. Mentoring was provided to address technical difficulties and reinforce correct implementation.

Evaluation focused on several key indicators, including the level of technology adoption, improvement in technical understanding, strengthening of group organization, and perceived benefits related to productivity, cost efficiency, and potential income enhancement. Feedback from participants was also collected to assess program relevance and satisfaction. This iterative monitoring and evaluation process ensured that the program remained adaptive, responsive, and effective in supporting sustainable agricultural practices and community empowerment.

RESULTS AND DISCUSSION

The implementation of the community service program resulted in substantial improvements in technical competence, organizational capacity, and the adoption of sustainable agricultural practices among members of the "Mekar Wijaya Kusuma" Women Farmers Group. One of the most notable outcomes was the high level of participation, with 100% of members actively involved in all stages of the program, including extension sessions, hands-on training, and field implementation. This level of engagement reflects strong motivation, openness to innovation, and trust in the introduced technologies, which are critical factors for the success of community-based agricultural interventions.

In terms of technical capacity, approximately 90% of participants demonstrated a good understanding and were able to independently apply roselle–mustard intercropping techniques and organic fertilizer production using cow dung. Participants showed improved skills in land preparation, crop arrangement, compost formulation, and fertilizer application. The high adoption rate indicates that the participatory and practice-oriented approach effectively facilitated knowledge transfer and reduced barriers to technology uptake. Farmers were not only able to follow instructions during training sessions but also showed confidence in replicating the techniques on their own plots, suggesting strong potential for sustainability beyond the program period.

The utilization of cow dung as organic fertilizer marked a significant shift in farming practices within the community. Previously underutilized livestock waste was transformed into a valuable input, reducing farmers' dependence on inorganic fertilizers. This transition contributed to improved soil conditions, as observed through better soil structure, increased moisture retention, and healthier crop growth. These findings are consistent with previous studies demonstrating that organic fertilization enhances soil biological activity, nutrient cycling, and long-term soil health, thereby supporting more sustainable agricultural systems (Reganold & Wachter, 2016; Singh et al., 2020). In addition to environmental benefits, the use of locally available organic inputs also helped

reduce production costs, which is particularly important for small-scale women farmers..

Figure 3. Extension for Members of Farmer Groups

Beyond technical improvements, the program also contributed to strengthening organizational capacity within the women farmers group. Approximately 80% of participants showed improved understanding of basic group management practices, including task allocation, simple planning, and collective decision-making. Participants became more aware of the importance of coordination, role distribution, and shared responsibility in managing group-based agricultural activities. Enhanced organizational capacity is essential for ensuring continuity of activities, collective marketing efforts, and access to external support programs.

Strengthening women's roles in agricultural decision-making emerged as an important outcome of the program. Increased participation and confidence among women farmers have broader implications for household welfare and community resilience. Previous research has shown that empowering women in agriculture positively influences household income, food security, and sustainable resource management (Doss et al., 2018). In Apuan Village, the active involvement of women farmers in planning and implementation processes fostered a sense of ownership and leadership, which is expected to support long-term adoption of sustainable practices.

The introduction of the roselle–mustard intercropping system further enhanced land-use efficiency and production resilience. By cultivating two complementary crops simultaneously, farmers were able to optimize limited land resources while reducing risks associated with crop failure. Intercropping also contributes to ecological benefits such as improved canopy structure, reduced weed pressure, and more efficient use of nutrients and sunlight. These outcomes align with agroecological research highlighting intercropping as an effective strategy for enhancing system stability, productivity, and resilience in smallholder farming systems (Altieri et al., 2017; Brooker et al., 2015).

Overall, the integration of intercropping systems with organic fertilizer utilization represents a practical, low-cost, and environmentally friendly model for community-based agriculture. The approach is highly relevant for rural areas with similar agroecological conditions and availability of local organic resources. By combining technical innovation, participatory learning, and organizational strengthening, the program demonstrates a replicable pathway for promoting sustainable agriculture while empowering women farmers as key agents of rural development.

CONCLUSIONS AND RECOMMENDATIONS

The International Community Service program successfully enhanced the capacity of the "Mekar Wijaya Kusuma" Women Farmers Group in implementing roselle–mustard intercropping systems and producing organic fertilizer from cow dung. The program improved technical competence, organizational management, environmental awareness, and economic potential. The participatory approach and utilization of local resources proved effective in promoting sustainable agriculture and improving community welfare.

Future programs should focus on strengthening market access and product diversification, particularly for roselle-based products. Continuous mentoring and collaboration with local governments and private stakeholders are recommended to ensure sustainability and scalability. Integrating digital marketing strategies may further enhance income generation and group resilience.

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