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Improving the Skills of the Subak Giri Kusuma Tirta Group in Mengani Village, Bangli, in Processing Waste into Quality Organic Fertilizer

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A B S T R A C T

This community service program aimed to empower the "Subak Giri Kusuma Tirta" farmer group in Mengani Village, Bangli, by equipping them with the knowledge and skills to produce high-quality liquid organic fertiliser from waste. The ultimate goal was to improve the quality of their intercropped plants. The activity was implemented in two key stages: a theoretical and practical training session on waste processing, and a final evaluation through a post-test questionnaire. The training was met with strong enthusiasm, with participants actively engaging in discussions and demonstrations. The findings indicated a substantial improvement in participant knowledge, as 95% of respondents reported a full understanding of the material and methods presented. The survey also showed high levels of satisfaction, with 85% of the 15 participants expressing great satisfaction with the training. Notably, 100% of the farmer group expressed interest in applying this new technology to their own farms, signifying a strong motivation to adopt sustainable practices. This successful intervention offers a replicable model for enhancing agricultural quality through effective waste management.

Contribution to Sustainable Development Goals (SDGs):
SDG 2: Zero Hunger
SDG 12: Responsible Consumption and Production
SDG 13: Climate Action
SDG 15: Life on Land

1. INTRODUCTION

1.1. Research Background

Mengani Village is one of the villages located in the Kintamani District with a total area of 427 hectares. It has a population of 1,055 people, consisting of 535 male residents and 519 female residents, with a total of 230 family heads (KK). The administrative boundaries of Mengani Village are as follows: north, Batukaang Village; east, Binyan Village; south, Tukad Campuan Village; west, Belok Village. In terms of topography and land contour, the area is generally hilly, situated at an altitude between 800 to 1000 meters above sea level, with an average temperature ranging from 25 to 30 °C. Mengani Village comprises 230 family heads, with the majority of its residents working as farmers or farm labourers [1]. The Subak Giri Kusuma Tirta Farmer Group is one of the farmer groups located in Mengani Village. Mengani Village has potential natural resources, serving as a central producer for Siam oranges, coffee, and vegetables obtained from the intercropping of orange and coffee plants with various types of vegetables. This combination of short-term and long-term crops is used to ensure sustainable family income, as coffee and oranges are harvested once a year, while vegetables like chili peppers have a faster yield and can be harvested multiple times from a single plant.

Farmers have widely practised intercropping cultivation, but it has not been managed effectively. The Siam orange plants are less fertile, the fruit quality is still low, and the fruits are often dry and pithy (low water content). Meanwhile, the quality of the vegetables produced is also still low. This is caused by a lack of intensive maintenance, particularly in terms of fertilisation, resulting in low soil nutrients. On the other hand, the high price of fertiliser leads farmers to use chicken manure that has not fully decomposed. This sometimes causes pollution, especially by attracting swarms of flies and increasing fungal attacks on the plants. Furthermore, many organic materials are considered waste, when in fact they could be used as a liquid organic fertiliser to help address the issue of expensive inorganic fertilisers. The partner's problems are that they lack knowledge on how to increase the productivity of their orange and vegetable crops. They lack the knowledge and skills to process organic waste into quality, economically valuable organic fertilizer. They lack the equipment to process agricultural waste into liquid organic fertilizer. With the right equipment, the partners could produce quality, economically valuable organic fertilizer products to support the productivity of both their fruit and vegetable crops. Although various liquid organic fertilisers are freely sold on the market, the development of liquid organic fertilisers needs to be enhanced using local materials that have so far been considered waste. In reality, these materials are organic compounds containing various nutrients essential for plant growth and production. Processing this discarded organic waste into fertiliser is necessary to address soil nutrient deficiencies and mitigate the shortage of inorganic fertilisers due to their high cost. This can ultimately improve the quality of fruits and vegetables and reduce production costs.

These problems must be addressed immediately by improving cultivation practices through the correct and proper application of organic fertilizers, both solid and liquid [2]. Nutrient management through fertilisation is crucial for optimising plant growth and yield [3]. Ref [4] adds that successful fertilization increases nutrient uptake by plants, thereby addressing nutrient deficiencies.

Liquid organic fertilizer can be produced by utilizing natural organic materials that contain nutrients beneficial for plant growth and development. This fertiliser can be made using easily obtainable natural ingredients, such as banana stems, Gliricidia sepium leaves (also known as gamal leaves), cow manure, cow urine, citrus waste, and coffee husk waste. These materials serve as sources of macro- and micronutrients and provide various forms of organic matter. Until now, these materials have largely been discarded as waste [5].

Liquid fertilizer from cow urine not only contains growth stimulants that can be used as plant growth regulators, but its distinctive smell can also prevent the arrival of various plant pests and act as a botanical pesticide [6]; [7]. Ref [8] found that spraying liquid organic fertilizer from cow urine waste at a concentration of 15 ml/l yielded the highest results (13.20 kg and 126.32 g), representing an increase of 81.32% and 28.14% compared to the control (7.28 kg and 98.58 g).

Gamal leaves (Gliricidia sepium) have various functions, including as animal feed, green manure, botanical pesticide, herbal medicine, and construction material. The leaves are rich in nutrients and can help improve plant growth while preventing pest and disease attacks. Gamal leaves are used as green manure: They are used to fertilise the soil. The leaves can be processed into compost or liquid organic fertilizer to accelerate the decomposition of nutrients. Liquid organic fertilizer from Gamal leaves can enhance plant growth and production. Gamal leaves as a botanical pesticide: The leaves can be used as a botanical pesticide because they contain active compounds that can control plant pests and diseases. Extracts from Gamal leaves can kill pests such as aphids, caterpillars, and other insects. Botanical pesticides derived from Gamal leaves are relatively safe for the environment and humans [9].

The reason farmers in Mengani Village do not use these waste materials for liquid organic fertiliser is their lack of understanding regarding the processing methods, application techniques, and the nutrients contained within these waste materials. In reality, producing their own fertilizer using this organic waste could reduce production costs and increase profits for the farmers. Therefore, the Farmer Group needs to receive socialisation and training on processing waste into high-quality, economically valuable fertiliser, moving towards environmentally friendly and sustainable agriculture.

Until now, the partners have lacked knowledge and skills regarding the processing of organic waste. For example, sintrong leaves (Crassocephalum crepidioides) are considered weeds and are simply discarded. In fact, if this waste is processed using appropriate technology, it can be transformed into a high-quality liquid organic fertiliser with economic value [10].

2. MATERIALS AND METHODS

The community service activity, which involved processing organic waste into high-quality fertiliser, was conducted directly at the Mengani Village Hall in Kintamani District, Bangli Regency, on Sunday, July 19, 2025. The training was held from 09:00 AM Central Indonesian Time (WITA) until completion and involved the Subak Giri Kusuma Tirta Farmer Group. The Subak Giri Kusuma Tirta Farmer Group was chosen as the subject of this service because they are expected to absorb the knowledge provided to further develop the use of organic fertiliser made from waste available in their surroundings, which has so far been considered discarded. The implemented service program was exploratory and qualitative in nature, conducted through the following stages: observation, socialization, product introduction, training execution, and product evaluation. The stages of the community service activity for processing organic waste into liquid fertilizer and compost for the Subak Giri Kusuma Tirta Farmer Group are presented in Table 2.

Table 2. Stages of Community Service Activities for Processing Organic Waste into Liquid Fertilizer and Compost for the Subak Giri Kusuma Tirta Farmers Group

No.	Activity	Output
1.	Observation and Identification	To assess the condition and potential of the gardens in Mengani Village, Kintamani, Bangli, and to identify existing problems.
2	Socialization Regarding the Benefits of Organic Fertilizer for Intercropping Plants	Providing an understanding of the benefits and functions of organic fertilizers in intercropping; and the activities to be carried out include the

		types and objectives of the activities.
3.	Introduction to Organic Waste Processing Innovations and Explanations	Introduction to innovation in processing organic waste into fertilizer; materials used and required;
4.	Training on Making Liquid Organic Fertilizer and Compost	Training participants are able to carry out the manufacture of Liquid Organic Fertilizer products in accordance with established procedures.
5.	Evaluation	Evaluate the results of previously produced liquid organic fertilizer to identify any deficiencies. Find solutions to address these deficiencies, resulting in a ready-to-use product.

3. RESULT AND DISCUSSION

The outcome of this community service initiative is that the Subak Giri Kusuma Tirta Farmer Group was highly interested and enthusiastic about participating in the training and hands-on practice of processing organic waste into liquid fertiliser and compost. Through education and mentoring, it is expected that there will be an increase in skills to enhance the productivity and quality of their intercropping yields. The education and training were conducted through counselling on the technology for processing organic waste into high-quality fertiliser, as well as direct practical sessions. In this activity, the team leader, Ir. I Nengah Suaria, M.Si, acted as the main speaker, supported by team members and three assisting students.

The implementation of the community service was carried out according to the predetermined activity methods, namely: 1) Observation and Identification. 2) Socialization regarding the benefits and programs for processing and utilizing waste. 3) Introduction to the innovation of organic waste processing and explanation. 4) Training on making liquid organic fertilizer and compost. 5) Evaluation. The first stage of the activity began with observations and identifications conducted at the start of the service, which involved monitoring and gathering information about the village's potential and the farmers' gardens. Furthermore, it involved exploring the problems and innovations needed to further develop the village's potential. Based on the observation results, several pieces of information were obtained about the problems frequently encountered by the community. The information gathered is as follows: Intercropping cultivation has been widely practised by farmers in Mengani Village; however, it has not been managed properly, resulting in low yields from the intercropping system. This is caused by a lack of intensive maintenance, particularly in fertilisation, resulting in low soil nutrients. On the other hand, the high price of fertiliser leads farmers to use chicken manure that has not fully decomposed, thereby causing environmental pollution. Furthermore, many organic materials are considered waste, when in fact they could be used as a liquid organic fertiliser to help address the issue of expensive inorganic fertilisers.

Based on the observation results, it can be concluded that the identified problems are the lack of development and innovation in processing waste into organic fertilizer in the form of renewable products. Furthermore, there is a lack of education regarding the processing of waste that is often considered discarded, when in fact this waste can be processed into high-quality fertiliser. This fertiliser can be used to improve soil fertility that has been degraded due to excessive use of inorganic fertilisers. The results of the garden observation activities in Mengani Village, Kintamani District, Bangli, are presented in Figure 1.

Fig. 1. Results of garden observation activities in Mengani Village, Kintamani District, Bangli

Based on the observation results, several pieces of information were obtained regarding problems frequently encountered by the community, namely That Citrus cultivation and agribusiness have not been able to provide adequate prosperity, and the quality of the citrus fruit remains low. This is caused by the farmers' still low level of knowledge in responding to technological developments for proper and correct cultivation practices, particularly in terms of balanced fertilization to achieve high-quality yields. On the other hand, the price of inorganic fertilizer is high and sometimes unavailable on the market. Consequently, farmers only apply livestock manure (from chickens or cows) that has not fully decomposed. This sometimes causes environmental pollution, including unpleasant odours, attracts swarms of flies, and increases fungal attacks on plants.
Furthermore, organic materials are abundant, such as agricultural waste, including coffee husks scattered in the gardens.
Rotten and dropped citrus fruits attacked by fruit flies. Banana stems (as farmers often plant bananas as garden fences). Sintrong leaves (Crassocephalum crepidioides), which have so far been considered weeds in citrus plantations.

Based on the observation and identification of these problems, the formulated solutions consist of: 1) Providing education on the processing and utilization of organic waste. This waste, which has previously been discarded, can be transformed into beneficial liquid fertiliser and compost. This can be used to improve the fertility of degraded soil, reduce production costs, and enhance the productivity and quality of intercropped yields, which are safe for consumption. 2) Providing training and hands-on practice on how to process waste into quality fertilizers, such as liquid organic fertilizer and compost, sourced from discarded waste. 3) Providing knowledge on the application methods for the liquid organic fertilizer produced from processed waste onto the intercropped plants.

The second stage involved socialisation on the training process for processing and utilising discarded organic waste as fertiliser, which was conducted on July 19, 2025. This socialization activity was attended by 15 members of the Subak Giri Kusuma Tirta Farmer Group from Mengani Village. This stage was the initial step in providing a good understanding of organic waste processing and product innovation. The presented

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material briefly discusses fertiliser, its benefits, and the efficacy of the nutrients contained within organic waste for plant growth in an intercropping system. The material was delivered by the Community Service Team, assisted by three students. The socialisation activity was conducted to provide participants with an in-depth understanding of the benefits and efficacy of the produced fertiliser, as well as its business opportunities. It aimed to promote a community mindset focused on the use of organic fertilizer to achieve high-quality, safe-to-consume yields. The socialisation process for processing and utilising waste into liquid organic fertiliser and compost, along with the handover of donated equipment and materials, is presented in Figure 2.

Fig. 2. Socialization regarding the processing and utilization of waste into liquid organic fertilizer and compost as well as the donation of tools and materials used.

Following the socialisation, the activity proceeded to the third stage, which involved an introduction to the materials and equipment necessary for the organic waste processing procedure. This stage aimed to empower the community by providing knowledge on processing organic waste into innovative products—compost and POC (Liquid Organic Fertiliser)—that have economic value. The materials needed for making compost consist of organic waste, rice husks, leftover animal feed, and livestock manure.

Stages of Processing Organic Waste into Liquid Organic Fertilizer: 1) Shredding: Shred the materials for the liquid organic fertilizer using a shredder machine. Materials to be shredded include gamal leaves, banana stems, citrus waste, and lemongrass stalks and leaves. Preparing the Activator Solution: Prepare a fermentor/activator solution (e.g., Biomol, Biome, Agrodyke). 2) Mixing: Pour cow urine and manure into a large 150-liter drum. Add the fermentor solution and the shredded materials while stirring to ensure an even mix. 3) Sealing: After the mixture is well combined, seal the drum tightly. 4) Fermentation: Ferment for one month. Place the drum in a cool area away from direct sunlight. Stir the mixture every week. 5) Filtering and Storage: After fermenting for one month, filter the liquid organic fertilizer and transfer it into airtight storage containers. The introduction to the waste processing innovation, an explanation of the required tools and materials, and the processing procedure are presented in Figure 3. The resulting liquid organic fertilizer, stored in jerricans and bottles, is presented in Figure 4.

Fig. 3. Introduction to waste processing innovation and explanation of the tools and materials required and processing procedures.

Fig. 4. Results of liquid organic fertilizer stored in storage containers such as jerry cans and storage bottles

The evaluation results of the mentoring program's success, viewed from the participants' enthusiasm, were very satisfying and encouraging. Qualitatively and descriptively, this was reflected in their high spirits and hard work during the hands-on practice session. While practicing directly, they were highly enthusiastic about discussing various issues related to the problems they face. To measure the success of the counselling session, an evaluation was conducted by distributing questionnaires to participants. The results of this activity showed an overall increase in knowledge, with 90% of respondents stating they fully understood the material and counselling methods provided on how to process organic waste into quality fertiliser, and the remaining 10% stating they understood the material to some extent. This means no respondents stated they did not understand or had a poor understanding. Out of the 15 respondents who participated in the counselling, 85% stated they were very satisfied, and the remaining 15% stated they were satisfied with their participation in the counselling activity.

Eighty-five per cent of respondents stated they were very interested, and the remaining 15% stated they were interested in practising the methods in their own homes. This means that 100% of the participants from the farmer group are interested in improving their skills and applying the waste processing technology to produce quality fertilizer products, aiming to enhance the yields of their intercropping cultivation

4. CONCLUSION

Based on the community service activities that have been carried out, it can be concluded that the successfully implemented activities are: (1) The education and training on processing waste into liquid organic fertilizer and compost ran smoothly according to plan; (2) The results from the questionnaires filled out by the members of the Farmer Group "Subak Giri Kusuma Tirta" in Mengani Village show an overall increase in knowledge: 90% of respondents stated they fully understood, and the remaining 10% stated they understood the provided material and counseling methods. This means no respondents stated they did not understand or had a poor understanding. Out of the 15 respondents who participated in the counselling, 85% stated they were very satisfied, and the remaining 15% stated they were satisfied with their participation in the counselling activity. Eighty-five per cent of respondents stated they were very interested, and the remaining 15% stated they were interested in practising the process of converting waste into liquid organic fertiliser and compost in their own homes. This means that 100% of the participants from the Farmer Group "Subak Giri Kusuma Tirta" in Mengani Village are interested in improving their skills and applying technology to process waste into high-quality fertiliser products. This aims to reduce environmental pollution and improve soil fertility in their intercropping cultivation systems.

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