

# Development of Household Waste Diversification in Making Liquid Organic Fertilizer (LOF) for the Community of Tinggede Village, Sigi Regency

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## ABSTRACT

Tinggede village is known as an area that has a high demand for fruit and vegetable production, where most of the people are farmers. The goal is to provide knowledge and capability in diversifying domestic waste in making liquid organic fertilizer (LOF) to the community of Tinggede village, Sigi regency. The activity will be held in July 2024, for 3 days. There were 25 participants who attended, all of whom were members of the Ibu PKK. The results obtained, firstly, they understood about the importance of utilizing waste into use value, and the process of making LOF. During this session, they were listening focusly, some of the participants actively asked questions to the service team, and gave positive responses regarding the importance of this education. The second result was that the participants succeeded in making two types of LOF, namely one made from a combination of vegetables and rice washing water, and one made only from rice water. From interviews with participants, telling about the participants' experiences during routine checks for 2 weeks for this activity was very useful for them, because the LOF that had been made was successful, and could be used directly on plants. Based in there results, this service activity is considered to have achieved the expected target.

**Keywords:** Diversification, Domestic Waste, Liquid Organic Fertilizer

## INTRODUCTION

Tinggede village, located in Marowola sub-district, Central Sulawesi has a great potential in the agricultural sector. Abundant agricultural production, mainly thanks to soil fertility and a favorable climate, allows the community to cultivate various food commodities such as rice, which is the main commodity in the region. However, many villagers still rely on synthetic fertilizers to maintain soil fertility. The use of these synthetic fertilizers, while increasing agricultural yields in the short term, poses a number of long-term negative environmental and health impacts.

According to interviews with Tinggede village head, farmers routinely use synthetic fertilizers to support soil fertility. In fact, research shows that continuous use of fertilizers result in degraded soil quality. Bai at el. (2019) explained that synthetic fertilizers rich in nitrogen, phosphorus, and potassium can reduce the content of organic matter in the soil and disrupt the balance of importance microorganisms. This results in a decline in soil quality, which in turn reduces agricultural productivity.

Runoff of synthetic fertilizers containing nitrogen and phosphorus can pollute water bodies, causing eutrophication, which is excessive algae growth. As the algae die and decay, the oxygen in the water decreases,

creating dead zones that damage aquatic ecosystems. Carpenter et al. (1998) emphasized that nutrient pollution from synthetic fertilizers degrades water quality in many regions.

Not only the environment, the use of synthetic fertilizers also has an adverse impact in human health. The nitrate content of fertilizers accumulating in groundwater can cause health problems such as methemoglobinemia in infants, known as blue baby syndrome. Ward et al. (2005) also linked nitrate exposure to an increased risk of stomach cancer and reproductive health problems in adults.

On the other hand, the people of Tinggede village also produce a lot of organic waste, especially from the leftover vegetables and fruits that housewives sell everyday almost in front of their respective houses. Unfortunately, this waste has no beneficial value for the community, although it has great potential as raw material for liquid fertilizer. Vegetable and fruit waste has rich nutrients that can be processed into fertilizers that are environmentally friendly, cheap, affordable, and safe for plants. Rustam et al. (2023) highlighted that fertilizers derived from natural material such as these do not contain harmful substances such as lead and mercury and can increase soil fertility.

Rice washing water, which is widely available in the homes of rural farmers, also contains macronutrients, namely N, P, K, and Mg for plant growth (Sifaunajah et al., 2022). Hairuddin et al. (2018) found that the content of carbohydrates, vitamin B1, and various minerals in the wastewater from rice helps to increase the height of agricultural plants.

The phenomenon in the community shows that the potential of this organic material is not optimally utilized. Organic waste such as vegetable scraps and rice washing water are often thrown away with other garbage, even though these materials can be used as fertilizers that are more nature-friendly than synthetic ones.

Based on this condition, it is very important to do community service to provide education and skills to the people of Tinggede village regarding the utilization of domestic waste from vegetables, fruit peels, and rice water, to be processed as liquid organic fertilizer. This can reduce dependence on synthetic fertilizers and create more sustainable agriculture and support environmental and human health.

## **MATERIALS AND METHODS**

The implementation of community service activities was carried out in the Tinggede village community through housewives (PKK) totaling 25 people. This was recommended by the head of Tinggede village in order to manage their respective household waste, which is generally vegetable and fruit waste from selling products, and rice washing water from rice washing activities.

Data collection techniques in the service are socialization, training, and evaluation. Each of the three has an instrument to collect data.

Socialization is the initial stage of service that aims to introduce the concept, benefit, and urgency of the program to the target community. The technique is in the form of participatory observation or direct observation of community participation and response socialization. The instrument is an observation sheet to record community participation and interaction.

Training is the second phase of activities, aiming to make the community skilled and knowledgeable in waste management or conducting other empowerment activities. Activities in data collection use direct observation, which is taken throughout the training to assess active participation, difficulties encountered, and participants' ability to practice new skills. The instrument was an observation sheet to record the engagement and effectiveness of the training.

Evaluation is the last stage of the activity, carried out to assess the overall success of the service program and the impact of the socialization and training that has been carried out. The data collection technique used in focus

group discussion (FGD). This FGD is used to collect qualitative data from a group of participants about their experiences during the program, the perceived impact, and input to improve the shortcomings found during the training.

Making LOF requires tools, materials, and manufacturing steps. The tools used are a 15 l bucket, baking pan, stirrer, knife, and cutting board. While the materials needed are a mixture of vegetable waste, fruit waste and rice water waste. Additional materials are EM4, and molasses. The manufacturing steps start with putting 10 l of rice washing water into a bucket, then adding EM4, and molasses of 100 ml each. The next step is to add a mixture of vegetable pieces and fruit peels that have previously been chopped as much as 3 kg. All ingredients are stirred until evenly mixed. After two days, open the bucket cover for a few minutes. The goal is to release the gas formed. Then, close it again. Perform open and close activities until the eighth day. If it smells typical of tempeh then fermentation is successful.

## RESULTS AND DISCUSSION

The service activity has been completed, located at the Tinggede village office, where the target activities are housewives who live near the village office. Most of them do not have knowledge about the existence of innovations in the utilization of household waste that can be used as material for making LOF. This activity was carried out for 3 days with the attendance of 25 people, which is described in detail in the following sections.



Figure 1. Material presentation

The first day of service activities, Saturday, July 6 2024, was attended by 25 housewives, and 4 of the service teams as resource persons, and assisted by 3 students. The activity started from 13.00 to 16.00 WITA, with an agenda in the form of socialization, namely providing knowledge to the mothers who attended. The material delivery lasted for 2.5 hours, from 13.30 to 16.00 WITA regarding the importance of diversifying household waste in the form of vegetable scraps, fruit peels, and rice washing water, environmental problems with household waste which is generally just thrown into garbage and causes many environmental problems, opportunities for utilizing household waste for agriculture and even for entrepreneurship and simple LOF making procedures. In addition to the presentation of the material, the mothers were also asked to prepare vegetable scraps of fruit peels, and rice washing water which would later be used for making LOF on the second day.

The visible impact of the first day of socialization was an increase in knowledge and environmental awareness. The socialization introduces the basic concepts of waste management and the benefits of LOF for local agriculture. As a result, the Tinggede village community better understands the importance of sustainable waste management, including the direct benefits that can be felt, such as reducing environmental pollution and improving agricultural quality through the utilizations of organic waste.

In addition to the community being aware of the environment, socialization also has an impact on changing attitudes toward waste. Before socialization, the community tended to view waste as something useless and

only to be thrown away. After socialization, there was a shift in attitude where waste especially organic waste, began to be seen as a resource that could be reused. According to Gasperz (2014), effective socialization can change the paradigm of the community from throwing away waste to utilizing it for productive activities.



Figure 2. Participants listening

The second day of service was Saturday, July 13 2024. The activity started from 09.00 to 13.0 WITA. The activity agenda was training in making LOF from vegetable scraps, and rice washing water brought by the mothers, and those prepared by the service team. The practice of making LOF lasted for 4 hours, where during the LOF making process, the mothers were always accompanied by the service team. 2 types of LOF was then stored at the village office and awaited fermentation for the next 2 weeks.



Figure 3. Making LOF

The impact of the training activities on the second day was that the community had technical skills in making LOF. The community members who participated in the training gained skills in the processing organic waste into LOF through a fermentation process. As a result, they were able to produce LOF independently in their homes by utilizing kitchen waste and agricultural residues. Research by Wicaksono et al. (2020) showed that practical training conducted on an ongoing basis can improve the technical capabilities of the community in organic waste management.

The last day of service activities was Saturday, July 27, 2024. The activity lasted for 2 hours. The agenda of the activity was to evaluate the results of the LOF that had been fermented by the mothers who were in charge of checking the LOF. Previously, with the direction of the service team, the mothers were asked to open the container cover every day during the fermentation time to avoid gas buildup in the ongoing fermentation process. The process of opening the cover was only done for a few moments and then closed tightly again. After that, the LOF was tested to be watered to plants at the Village Office. During the activity, the service team asked for the willingness of the mothers to tell about the LOF checking process and their experience in making LOF. In addition to getting experiences from the mothers directly, the servants also provided additional

information about the research data that LOF made from a combination of vegetable waste and rice washing water has better quality than LOF made only from rice washing water.



Figure 4. Successfully made LOF

The impact of the evaluation activities on the third day was to assess the effectiveness of the program. Through the evaluation, the effectiveness of the socialization and training in changing community behavior and skills can be measured. The impact is seen in the community's success in applying the LOF making method and their level of satisfaction with the results achieved. This evaluation provides important feedback for future program improvements, as well as ensuring that the objectives of the service are optimally achieved (Creswell, 2014).

From the implementation of the service activities described above, satisfactory results were obtained and according to the target. This can be seen from several things, namely 1) the activity was attended by a large number of participants, 2) the enthusiasm of the participants who asked questions, responded, and were active, 3) the novelty and relevance of the information for the participants, 4) the results of LOF can be used directly for plants, 5) easy and simple LOF making procedures, 6) the motivation of the participants to try again to make LOF at home, because in addition to easy procedures, the tools and materials needed are also available. The six characteristics seen during the activity show that the implementation of this service activity was successful and became the basis or benchmark for implementing the activity.



Figure 5. LOF is poured onto the plants

The implementation of this service activity was attended by housewives who were not busy at home and lived close to the Tinggede Village office. According to our observations, they were generally enthusiastic about participating in the activity from the beginning to the end. Even so, we admit there is one thing that is in line with expectations. On the second day, the number of participants decreased. Based on information from the mothers, on the same day there were activities elsewhere, so there was a division of participants who attended two activities at the same time. This was also evident on the first day, when we were informed that the Village Office was always busy with outside socialization activities. The reduced number of participants on the second day also resulted in less household waste being brought. Even so, the service team anticipated this by bringing vegetables, and rice washing water, so that the volume of materials was sufficient to make LOF. In addition, the participants who attended took the initiative to live stream on Instagram, so that other participants could later watch the video again at a later time. They admitted that they were used to always documenting the activities they participated in.

Another interesting thing that can be observed is that almost all participants are active in asking questions if there is something unclear from the delivery of the service team and responding to answers from the team. This was seen from the first, second, and even third day. They were also open to receiving suggestions or feedback, even friendly to share their experiences. This makes the atmosphere of the service activities closer and warmer.

Although the process is quite long, the mothers remain diligent and earnest so that the LOF can finally be directly used as plant nutrition. They felt greatly helped by this activity. The use of synthetic fertilizers is not only risky in terms of producing residues on plants, making the soil hard, but also often the mothers admit that they need to spend quite a lot of money to buy synthetic fertilizers sold in stores.

The socialization and training activities in this service reflect the theory of community empowerment proposed by Chambers (1983) and Zimmerman (2000). In empowerment theory, active participation of the community in activities related to increasing the capacity of themselves and the community is very important. Socialization activities provide initial knowledge that changes the community's perception of waste as something of economic and environmental value. This process is in line with Chambers' concept which states that empowerment starts with increasing people's awareness and knowledge so that they can control local resources and improve their living conditions.

This empowerment theory is also supported by Ife and Tesoriero's (2006) research, which emphasizes that active participation and strengthening local capacity are key to the success of empowerment programs. In the training activities, the community acquired practical skills to manage waste into LOF. This process increases the sense of control over their own environment and provides a real impact on social and economic well-being, as has been shown in a study by Gasperz (2014), where empowerment through waste management increases community participation and strengthens social networks.

The activity of diversifying household waste into LOF is in accordance with the theory of sustainable waste management proposed by Tchobanoglous et al. (1993) and Williams (2005). Both experts emphasize the importance of a holistic approach to waste management that includes reduction, reuse, and recycling. In this community service program, household waste, especially organic waste, is reused through a fermentation process to become liquid fertilizer, which is in line with the hierarchy of sustainable waste management.

Research by Fatimah et al. (2018) shows that the use of LOF as a substitute for chemical fertilizers improves environmental sustainability by reducing the negative impacts of chemical use and maintaining the balance of the soil ecosystem. This training program that focuses on making LOF from household waste supports this theory by utilizing waste as a resource that can be reused productively, thus helping to reduce the volume of waste generated in Tinggede Village.

The results of this service activity are in line with previous research on the impact of community-based waste management and local empowerment. For example, research by Nurhadi (2019) showed that training in

organic waste management and LOF production can open up economic opportunities for rural communities, create new sources of income, and improve their economic welfare. The program also shows that waste management activities can be integrated into local practices with sustainable results, which is in line with the research findings by Wicaksono et al. (2020) on local wisdom-based innovations in waste management in villages.

The evaluation activities conducted in this program also support research by Anwar (2013), which emphasizes the importance of evaluation in ensuring the sustainability and effectiveness of community empowerment programs. The evaluation results show that the application of simple technologies such as LOF making is well received by the community and has become part of their daily practices, strengthening the long-term impact of the program.

The use of LOF as a substitute for synthetic fertilizers for plant growth and improving soil quality. This is in accordance with research by Hapsari, et al (2023), LOF made from rice water has a high nitrogen content so that it is an alternative solution in efforts to improve soil quality. In addition, the benefits of LOF from both rice and vegetable washing water can also fertilize plants (Hanifa et al., 2022). So, after this activity, with the knowledge and skills that were finally obtained, as well as experiencing direct benefits, the mothers wanted to try making LOF again in their respective homes. They also hope that this service activity can be made a routine agenda at the Village office so that other residents can gain the same knowledge and skills.

LOF has significant advantages over synthetic fertilizers in improving plant fertility. LOF contains various nutrients derived from organic materials such as agricultural waste, animal manure, and crop residues that have decomposed naturally. The nutrients contained in LOF tend to be released slowly and sustainably, thus providing a steady supply of nutrients for plants. This is different from synthetic fertilizers that usually release nutrients quickly, but the impact is often short-term. LOF also contains various beneficial microorganisms that can increase the absorption of nutrients by plant roots (Widyastuti & Santoso, 2023).

In addition to its benefits for plants, LOF also has a positive impact on soil quality. The use of LOF can increase the organic matter content in the soil, which helps to improve soil structure and increase the soil's capacity to retain water. This is especially important in lands that tend to experience degradation or erosion. LOF also enrich soil microbial activity that plays a role in organic matter decomposition and nutrient cycling. Thus, the use of LOF can create a healthier and more fertile soil environment in the long run, in contrast to synthetic fertilizers which in the long run can cause a decrease in soil quality due to the accumulation of chemicals that do not decompose properly (Nugraha & Rahman, 2022).

In addition to providing direct benefits to plants and soil, the use of LOF is also more environmentally friendly compared to synthetic fertilizers. Synthetic fertilizers often contain chemicals such as nitrates and phosphates that can pollute groundwater and cause eutrophication in water bodies. LOF, on the other hand, are derived from organic materials that are biodegradable and leave less harmful residue in the environment. In addition, LOF helps recycle organic waste thereby reducing the impact of pollution caused by agricultural or industrial waste disposal (Wijaya & Prasetyo, 2023).

LOF made from a combination of vegetables, fruits, and rice water tend to be richer in macro and micronutrients needed by plants. Vegetables and fruits contain various nutrients such as nitrogen, phosphorus, potassium, and other micro elements that play an important role in supporting the photosynthesis process and plant growth. This combination enriches the nutrient content in the LOF, providing a better balance between macro and micronutrients than single ingredient organic fertilizers. In addition, rice water contains starch and carbohydrates that can stimulate the growth of soil microorganisms, which function to accelerate the decomposition process and increase soil microbiological activity (Wardhani & Rahman, 2022).

The application of LOF made from this combination can significantly increase plant growth in terms of height, number of leaves, and biomass compared to LOF made from a single ingredient. The combination of

vegetables, fruits, and rice water also improves soil quality by increasing organic matter levels, soil aeration, and microbial activity that contribute to long-term soil fertility (Anggraini & Suryani, 2023).

Rice water contains nutrients that are beneficial for plants, especially carbohydrates that can help soil microorganisms multiply (Wardhani & Rahman, 2022). However, in terms of macronutrients such as nitrogen, phosphorus and potassium, rice water tends to be more limited (Prasetyo & Nugroho, 2023). Some studies show that LOF made from rice water alone can indeed provide benefits in terms of improving soil structure and increasing soil microbial populations, but its effect on plant growth is not as great as LOF containing other nutrient-rich organic materials such as vegetables and fruits (Wardhani & Rahman, 2022).

Although rice water LOF improves soil quality by encouraging microorganism activity, its effect on plant growth is lower than that of combined LOF (Anggraini & Suryani, 2023). The growth of plants treated with rice water LOF alone showed slower development, especially in terms of biomass formation (Prasetyo & Nugroho, 2023).

Vegetable-based LOF contains more nitrogen, phosphorus and potassium than rice water. Vegetables are rich in organic nutrients that can be processed by soil microorganisms to be converted into a form that is more easily absorbed by plants (Prasetyo & Nugroho, 2023). The use of LOF made from vegetables alone has a fairly good impact on plant growth because vegetables contain nutrients needed to support vegetative growth, especially nitrogen which helps the growth of leaves and stems (Anggraini & Suryani, 2023).

However, compared to combined LOF, the effect of vegetable-only LOF was less than optimal. The use of vegetables alone as LOF ingredients does increase plant growth, but the nutrient content is not as complex as in combination LOF that add fruits and rice water as additional sources of carbohydrates and nutrients. Recent research has shown that vegetable-based LOF provide better plant growth results than rice water alone, but still below combined LOF (Anggraini & Suryani, 2023).

## CONCLUSION

The community service activities that have been carried out in Tinggede Village have achieved the expected targets, namely the community has knowledge about the utilization of household waste (vegetable scraps, fruit peels, and rice washing water) as ingredients in making LOF; and the community has been able to make LOF and use it for plant nutrition around the environment.

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