Contents lists available at openscie.com
E-ISSN: 2829-4521
Indonesian Journal of Community Services Cel
DOI: 10.70110/ijcsc.v4i3.123
Journal homepage: https://ijcomcel.org

Production of Liquid Organic Fertilizer from Various Organic Waste Sources for Vegetable Cultivation in Bulotalangi Timur Village, Gorontalo

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ARTICLE INFO

Article History:
Received 22 October 2025
Revised 18 December 2025
Accepted 22 December 2025
Published 24 December 2025

Keywords:
Community service,
Farmers empowerment,
Liquid organic fertilizer,
Waste utilization.

ABSTRACT

Background: Bulotalangi Timur Village is dominated by vegetable farmers who rely heavily on chemical fertilizers, making them vulnerable to fertilizer shortages that can negatively affect crop productivity. Although organic fertilizers derived from organic waste offer a sustainable alternative, farmers' knowledge and skills regarding their production and application remain limited.

Aims: This activity aimed to improve farmers' knowledge and skills in producing liquid organic fertilizer (LOF) from organic waste as an environmentally friendly approach to enhance crop productivity and support sustainable village development.

Method: The activity was conducted in Bulotalangi Timur Village, Bulango Timur District, Bone Bolango Regency, Gorontalo Province, in October 2023. It consisted of three stages: planning, implementation, and evaluation. The implementation employed training methods that combined socialization and participatory demonstrations to facilitate hands-on learning.

Results: The training program was implemented smoothly and received a very positive response from participants, as indicated by their high level of enthusiasm and satisfaction. Participants expressed a strong expectation for the continuation of similar activities in the future. However, several challenges were identified, including limited initial awareness of organic waste utilization and scheduling constraints that led to relatively low participation rates.

To cite this article: Yusrina, S. Z., Putra, M. R. A., Saragih, D. P., Damanik, R. S., Sinambela, E., Azwar Lahusin, A., Sumiahadi, A. (2025). Production of Liquid Organic Fertilizer from Various Organic Waste Sources for Vegetable Cultivation in Bulotalangi Timur Village, Gorontalo. *Indonesian Journal of Community Services Cel*, 4(3), 82–89.

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1. Introduction

Bulotalangi Timur Village is located in Bone Bolango Regency, where the majority of residents are engaged in vegetable farming. One of the main constraints faced by the community in crop cultivation is limited access to fertilizers in adequate quantities at affordable prices. In response to this issue, a proposed solution through this community service activity is training in the production of liquid organic fertilizer (LOF) derived from organic waste, a form of organic fertilizer. The use of organic fertilizers is intended to reduce or even substitute dependence on chemical fertilizers. Organic fertilizers originate from plant or animal materials that have undergone specific processing stages, and their nutrient content can be utilized to support plant growth and cultivation.

Liquid organic fertilizer (LOF) is a solution composed of organic materials derived from plant residues, animal waste, and household waste, containing more than one essential nutrient element (Widyastuti *et al.,* 2022; Pratiwi & Hartati 2022; Muzakki *et al.,* 2023; Marpaung *et al.,* 2025). LOF does not cause soil degradation or plant damage even when applied repeatedly (Hadiswito, 2012). LOF offers several advantages, including higher effectiveness and efficiency in plant applications. Nutrients contained in liquid fertilizers are more readily available and easily absorbed by plant roots. Application can be carried out through soil drenching or foliar spraying onto plant leaves or stems (Pardosi *et al.,* 2014). In addition, LOF also functions as a plant growth stimulant (Asmawanti *et al.,* 2022).

The application of LOF in vegetable cultivation has been proven to enhance plant growth and yield (Fahrurrozi *et al.,* 2022). Previous studies have reported that LOF produced from organic waste can provide effects comparable to or even superior to inorganic fertilizers in terms of growth and productivity of various vegetable crops, including celery (Lalla, 2018), sweet corn (Kalay *et al.,* 2020), tomatoes (Afianto *et al.,* 2020), chinese cabbage (Marasabessy & Tanasale, 2020), bok choy (Pandaleke *et al.,* 2023), carrots (Sacita & Rahman, 2023), and lettuce (Tussadiyah & Sumiahadi, 2024; Yati & Sumiahadi, 2024), bok choy (Rekanta & Sumiahadi, 2025).

Liquid organic fertilizers play a crucial role in supporting sustainable agriculture and rural development (Alkatiri *et al.,* 2024; Aprilia *et al.,* 2025). In a village context, the production and utilization of LOF represent a potential economic opportunity. Villages can develop organic-based agricultural programs, explore local resource potential for fertilizer production, and assist farmers in implementing sustainable farming practices. Such community empowerment initiatives not only contribute to healthier agricultural outputs but also strengthen the local economy and improve the overall welfare of rural communities. With appropriate implementation strategies, LOF can serve as a key component in establishing an environmentally friendly and resilient agricultural system (Choirunnisa *et al.,* 2024).

Therefore, the utilization of organic waste–based LOF in Bulotalangi Timur Village represents a strategic effort to enhance community welfare. This initiative is expected to generate sustainable positive impacts, particularly in improving household economic resilience. The primary objective of this community service activity is to provide farmers with knowledge and practical skills related to organic fertilizers and LOF production, enabling them to independently produce fertilizers to increase crop productivity and strengthen farmer self-reliance in supporting sustainable village development.

2. Methods

This activity was conducted at the Agricultural Extension Center (BPP) of Bone Bolango Regency, Gorontalo Province, in October 2023. The program focused on the production of liquid organic fertilizer (LOF) utilizing locally available organic waste. Through this activity, the implementing team sought to provide practical and sustainable solutions to support agricultural productivity, enhance farmer self-

reliance, and maintain environmental sustainability. This initiative is expected to contribute to the development of more sustainable agricultural practices in Bulotalangi Timur Village. The implementation of the activity was carried out through the following stages:

2.1 Program Planning

The planning stage is the foundation of all activities. At this stage, the team conducted a survey of partner locations to identify partner needs. The survey results identified that: 1) farmers experience obstacles in accessing affordable and sufficient fertilizer; 2) farmers lack sufficient knowledge and skills regarding organic fertilizer production; 3) training through demonstrations on making POC from organic waste is needed. Next, the team developed a work program that included objectives, targets, implementation methods, and required resources. The team also designed an activity schedule, including implementation times, task allocation, and organic waste collection.

2.2 Coordination with partners

After the program plan was developed, the team coordinated with partners, namely farmers in East Bulotalangi Village and the Bone Bolango Regional Development Planning Agency (Bappeda Litbang) (acting as a mediator between the team and the farmers). During this coordination, the program objectives and expected roles of the partners were explained. Bappeda Litbang Bone Bolango assisted in preparing the venue and mobilizing participants (partner farmers) to ensure the program ran smoothly.

2.3 Program implementation

The LOF production activity was conducted at the East Bulotalangi Agricultural Extension Center. This stage represented the implementation phase of the planned community service program. The agenda of the activity consisted of the following components:

a. Opening Session

The activity began with an opening session delivered by the head of the implementation team, followed by an introduction of the team members to the participants. During this session, the objectives of the activity and the expected benefits of the program for the local community were clearly explained.

b. Introduction to LOF from Organic Waste

Participants were introduced to various types of organic waste, including animal manure, crop residues, and other biodegradable household waste. This session discussed the potential of these organic materials to be processed into liquid organic fertilizer (LOF), the benefits of LOF for crop cultivation, and the basic principles and stages involved in producing LOF from organic waste.

c. LOF Production Training

The LOF production training was conducted using participatory and demonstration-based methods. Participants were actively involved in each step of the LOF production process, including the preparation and mixing of previously collected organic waste materials. This hands-on approach was intended to enhance participants' understanding and skills, enabling them to independently produce LOF for agricultural use.

2.4 Program Evaluation

The program evaluation used observation and interview methods to analyze program challenges encountered during implementation. Furthermore, the evaluation was conducted to determine partner satisfaction with the program. This evaluation is crucial for identifying any shortcomings in the training program and serves as a decision-making tool for the program's sustainability.

3. Results and Discussion

This training program aimed to provide participants with practical knowledge and skills in producing liquid organic fertilizer (LOF) from organic waste. The production of LOF is highly recommended due to several advantages, including: (a) the availability of raw materials, (b) the simplicity of the production process, and (c) ease of application in crop cultivation (Ahmad *et al.,* 2024).

The training participants consisted of vegetable farmers from East Bulotalangi Village. The activity was implemented using a structured training approach. The program began with a presentation discussing organic waste, its potential for conversion into LOF, the benefits of LOF for agricultural production, and the procedures involved in producing LOF from organic waste. The training was then continued with a practical demonstration of LOF production, starting from the preparation of organic materials to the production process and application methods.

The demonstration was conducted using a participatory approach, actively involving participants at each stage of the LOF production process. This approach was intended to enhance participants' understanding and skills, thereby enabling them to independently produce and apply LOF in their farming activities. The activities carried out during the program implementation phase are as follows:

3.1 Organic Waste Sortation

Activities at the East Bulotalangi Agricultural Extension Center involve collecting organic waste from villagers, including animal manure, crop residue, and domestic waste (Figure 1). The collected waste is then sorted by category and weighed according to requirements for use as raw material for the production of LOF.



Figure 1. Organic Waste Accumulation

3.2 Preparation of tools and materials

The training was conducted using simple tools and materials for easy understanding and imitation. The materials used were organic waste, molasses or brown sugar, EM4, and water. The only tools required were a knife, a cutting board, a barrel or container with a lid, and a sieve. The team guided the preparation of the tools and materials, while explaining the characteristics and functions of each tool and material (Figure 2).



Figure 2. Preparation of Making LOF

3.3 The LOF Making Process

After the collection and sorting of waste materials, the next stage involves the decomposition of organic raw materials through a fermentation process. Fermentation is carried out in a sealed barrel or container for a specific period, depending on the type of organic material used. The procedure for producing liquid organic fertilizer (LOF) is relatively simple, making it easy to implement at the farmer level. The stages of LOF production are as follows: (a) preparing organic waste by cutting it into small pieces, (b) placing the chopped organic materials into a tightly sealed plastic container, (c) adding brown sugar or molasses along with clean water, (d) allowing the mixture to ferment for 3–7 days, and (e) filtering the fermented solution to obtain LOF, which is then ready for application (Nur *et al.,* 2018).

Participants were directly involved in each stage of the practical demonstration of LOF production following the initial demonstration by the facilitators (Figure 3).



Figure 3. The LOF Making Demonstration

The finished liquid organic fertilizer (LOF) can be stored in a sealed container and used as a nutrient source for plants. Proper dosage and adherence to application guidelines are essential to optimize its

effectiveness. LOF can be applied to the growing medium by diluting the fertilizer with water at a ratio of 1 L of LOF to 4 L of water. For direct application to plants, LOF is diluted at a ratio of 10 mL LOF to 990 mL of clean water and applied by spraying onto the plant canopy (Panjaitan *et al.,* 2022). During the activity, the team also distributed samples of LOF that had been prepared in advance as part of the demonstration process (Figure 4).



Figure 4. LOF Sample

3.4 Program Evaluation

This series of activities, ranging from the initial assessment of partner needs to the implementation of liquid organic fertilizer (LOF) production training, received a positive response from the participants. Based on interviews conducted with participants, the results indicated that they were satisfied with the activities and expressed hope that similar programs would be continued in the future to assist farmers in addressing the agricultural challenges they encounter. However, observational findings also revealed several constraints during the implementation of the program. These constraints included: (1) limited prior knowledge and education among participants regarding organic waste management and LOF production, which made it difficult for them to fully absorb the material delivered within a relatively short training period; and (2) challenges in determining a suitable schedule that allowed all farmers to attend the activity, resulting in a relatively low level of participant attendance and involvement.

3.5 Partnership

Partners, consisting of farmers from East Bulotalangi Village and the Regional Development Planning, Research, and Innovation Agency (Bappeda Litbang) of Bone Bolango Regency, were actively involved from the preparatory stage through to the sustainability of the program. The participation of farmer partners was manifested in several forms, including: (a) assisting in the preparation of organic waste as well as the tools and materials required for the implementation of the activity; and (b) actively participating as trainees in the counseling and training sessions. Meanwhile, the participation of Bappeda Litbang Bone Bolango was realized through: (a) the provision of venues and supporting facilities for the implementation of the activities; (b) coordination in preparing farmer participants and arranging schedules to ensure their attendance at counseling and training sessions; and (c) collaboration with the implementation team in facilitating counseling and training activities on liquid organic fertilizer (LOF) production for the local community.

4. Conclusions

This activity was successfully implemented and provided meaningful educational benefits to the community of East Bulotalangi Village regarding the production and utilization of liquid organic fertilizer (LOF). Through this program, farmers not only acquired theoretical knowledge about the use of organic waste as raw material for LOF but also gained direct practical experience in producing LOF independently. The participants expressed satisfaction with the activity and conveyed their expectation that similar programs would be continued in the future. Overall, this activity has the potential to serve as part of a collective effort to enhance farmer welfare and self-reliance, while simultaneously reducing negative environmental impacts and supporting the development of sustainable agriculture.

5. Acknowledgement and Funding Information

We would like to thank the Bone Bolango Regional Development Planning Agency (Bappeda Litbang) for their facilitation and support in ensuring the smooth running of this activity. We would also like to thank the farmers of East Bulotalangi Village who actively participated in the event from start to finish.

6. Conflict of Interest Declaration

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

7. Author Contribution Statement

All authors contributed equally to the conduct community service project, data analysis, and writing and preparation of this article.

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