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Fermentation method for vegetable waste into liquid organic fertilizer in Malangsuko Village

Ratna Juwita[1], Anindyah Sutra Karury[1], Muhammad Firdaus[1], Rendra Maulana Zaki[1], Nikmatul Fitriyah[1], Meutya Nuraini[1], Algafari Bakti Manggara[2]

[1]Department of Applied Science, Faculty of Mathematics and Natural Sciences, [2]Department of Chemistry, Faculty of Mathematics and Natural Sciences, State University of Malang
Jl. Cakrawala No. 5, Malang, East Java, 65145

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ABSTRACT

Malangsuko Village is one of the villages that produces quite a lot of horticultural crops such as vegetables. However, with this potential, Malangsuko village faces challenges in the use of inorganic fertilizers and the lack of organic waste management, especially vegetable waste which can pollute the environment. Seeing the existing potential and as a solution to these problems, the need for organic fertilizer can be made by utilizing vegetable waste in Malangsuko village. This activity aims to process organic waste from vegetable waste into liquid organic fertilizer (POC). The method of implementing this community service is carried out by training and mentoring the processing of organic waste into liquid organic fertilizer using the fermentation method. The results of the training and mentoring were an increase in partner skills, namely PKK women in Malangsuko village, in making POC by 55%. The potential for processing organic waste in the form of vegetable waste into POC that can be produced by partners is two sacks of vegetable waste per day (± 50 Kg), so that the amount of POC that can be produced by partners is 250 L per day.

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1. INTRODUCTION

Malangsuko Village is located in the Tumpang District, Malang Regency, East Java Province, covering an area of 268.36 hectares. The majority of the population works as farmers (Haryuni et al., 2021). Malangsuko is one of the key agricultural suppliers in East Java, with the agricultural sector playing a significant role in economic development (Ramdhany, 2018). Malang Regency is well-known for producing horticultural commodities such as cabbage, mustard greens, tomatoes, and various other vegetables. Cabbage is one of the most produced crops in Malangsuko, reaching 125,413 quintals per year (Wardhani, 2021). During the harvest season, the cabbage waste, including leaves damaged by pests and unfit for sale, is usually left to rot in the agricultural fields or discarded in the nearest waste disposal site (Rasmito, 2019). This vegetable waste needs to be optimally utilized.

The partner group for this community service is the productive economic group, consisting of the Malangsuko Village PKK (Family Welfare Program) women, who play an important role in supporting

✉ Corresponding Author: **: Ratna Juwita:** Tel. +62 341 551312 | E-mail: ratna.juwita.fmipa@um.ac.id

agriculture, especially in organic waste processing. Based on the situational analysis, there has been no agricultural organic waste processing, and some vegetables like cabbage and mustard suffer quality degradation during the rainy season. These crops are damaged by pests like caterpillars, worms, and become more prone to decay, leading to a reduced harvest and lower prices. Typically, farmers in Malangsuko use solid organic fertilizer made from plant residues and animal manure (Paksi et al., 2022; Fauzan et al., 2023). Some farmers also use inorganic fertilizers to protect crops from pests, as they are considered more practical and readily available. However, inorganic fertilizers, made from chemical substances, have negative environmental and health impacts. These can be replaced with environmentally friendly organic fertilizers (Siregar, 2023).

Given these conditions, farmers in Malangsuko need relatively affordable pesticides and have a demand for innovation in making natural pesticides. The abundance of organic waste from vegetable waste (Sulistyaningsih, 2020) can be used to meet the need for organic fertilizers in vegetable farming in Malangsuko. Therefore, training and mentoring are needed to help farmers in Malangsuko by teaching them how to make liquid organic fertilizer (*pupuk organic cair*/POC) using vegetable waste that has not been fully utilized.

The appropriate technology implemented for the partners to address the organic waste issue and turn it into POC is the fermentation method. In this process, the decomposition of organic waste in the form of vegetable waste is assisted by local microorganisms (mikro organisme local/MOL). MOL is a group of microorganisms that serve as a starter in the decomposition process into both solid and liquid organic fertilizers. During fermentation, Effective Microorganisms-4 (EM4) is also added as a bioactivator to improve the physical, chemical, and biological properties of the soil, as well as enhance the nutrients required by plants. The bioactivator aids the composting process, accelerating the breakdown of organic waste by decomposing microbes (Solihin et al., 2019; Pradiksa et al., 2022).

The solution to the problem of organic waste in the form of vegetable waste piling up in Malangsuko Village can be addressed by utilizing it to produce Liquid Organic Fertilizer (POC). POC is a liquid organic fertilizer made through a fermentation process using microorganisms and organic waste materials (Prasetyo & Evizal, 2021). The use of POC is relatively easier than solid organic fertilizers because it can be applied through spraying or direct watering onto the soil (Haryuni et al., 2021; Ustiatik et al., 2024). A good POC contains macronutrients, particularly nitrogen (N), phosphorus (P), potassium (K), and organic carbon, as these are essential nutrients that plants need in substantial quantities (Purnamasari et al., 2022). A good physical characteristic of POC is that it has a yellow-brown color, a neutral pH, is odorless, and contains high nutrient content (Solihin et al., 2019). POC has the additional advantage of not harming the soil or plants, even when used frequently (Agustin et al., 2023). Compared to solid organic fertilizers, POC has the benefit of containing binding agents, which allow the fertilizer solution to be absorbed directly by the plants when applied to the soil surface (Basri, 2021).

This community service program aims to provide a solution to the challenges faced by partners, particularly in dealing with vegetable waste and the availability of POC to support vegetable farming in Malangsuko Village. The training and mentoring on POC production targeted at the PKK women of Malangsuko Village could also become a business opportunity, improving the village's welfare and empowering the community to advance (Arifin & Aiyanto, 2018). The training and mentoring are expected to enhance the understanding and skills of the PKK women in producing POC independently (Krisnaningsih & Setiyaningsih, 2018). The production of POC is anticipated to be an innovative breakthrough in agriculture, helping to manage organic waste into a beneficial resource for both the environment and the community (Ermawati et al., 2024).

2. METHODS

Activity Plan

This community service activity is held in Malangsuko Village, Malang Regency, East Java. The partner for this activity is the Malangsuko Village PKK (Family Welfare Empowerment) group, which consists of 100 housewives. The implementation of this community service is designed through training and mentoring on the processing of organic waste into liquid organic fertilizer (POC) using the fermentation method.

Table 1. Implementation timeline

Stage 1. Field Observation	
Activities	- Community service activity location survey - FGD with the Village and the Head of the Malangsuko Village PKK
Objectives	- Determining the date of the community service - Discussion regarding the location to be selected for training
Implementation timeline	First week of April 2024
Stage 2. Tool making and testing	
Activities	- Selection of POC materials - FGD with the team regarding budget
Objectives	- Speed up the process of making test equipment - Ensure test equipment is in accordance with the existing design and budget
Implementation timeline	Second week of May 2024
Stage 3. Sample testing	
Activities	- Sample testing to the Soil, Plant, Fertilizer, Water Laboratory of the Agricultural Research and Development Agency
Objectives	- Ensuring that the POC content is safe to use and beneficial for plants.
Implementation timeline	Fourth week of May 2024
Stage 4. Implementation of training and demonstration	
Activities	- Opening and introduction of tools and materials - Delivery of material on the fermentation process - Demonstration of making POC - Filling out questionnaires in the form of pre-tests and post-tests by participants
Objectives	- Introducing the potential of Malangsuko Village to make POC - Providing insight into the basics of the POC making process - Providing practical knowledge and inviting participants to make POC - Evaluating the usefulness of POC making training
Implementation timeline	Second week of July 2024
Stage 5. Evaluation and mentoring	
Activities	- Monitoring through discussions in WhatsApp groups
Objectives	- Encourage sharing experiences, asking questions, and reporting on the progress of making POC in their respective homes. - Strengthen participants' confidence in their skills in implementing appropriate technology through independent management of vegetable waste.

The facilities and equipment required for the training and mentoring on the implementation of appropriate technology for processing vegetable waste into POC are provided by the team. Some of the tools needed for the training include buckets with lids, wooden stirrers, measuring cups, scales, jerrycans, knives, hoses, and used mineral water bottles. The materials needed for the demonstration during the training are cabbage waste, Chinese cabbage waste, rice husks, EM4 (Effective Microorganisms 4), molasses, and brown sugar.

Subsequently, the content of nitrogen, phosphorus, potassium, calcium, and magnesium in the POC is tested and sent to the Soil, Plant, Fertilizer, and Water Laboratory at the Agricultural Research and Development Agency in Malang.

Program Implementation Method

The community service implementation method is carried out through training and mentoring on the implementation of appropriate technology for processing organic waste, specifically vegetable waste, into liquid organic fertilizer (POC), as well as a survey dissemination method to evaluate the success of the program with the target participants being the PKK (Family Welfare Empowerment) group of Malangsuko Village. This survey is related to the participants' knowledge before and after the community service activity. The indicators in this survey have a scale ranging from 1 to 4, where a score of 4 indicates "very satisfied," a score of 3 indicates "satisfied," a score of 2 indicates "fairly satisfied," and a score of 1 indicates "not satisfied." The implementation schedule for this community service activity is planned from the beginning of activity coordination until the end of the preparation of the final report which is in Table 1.

3. RESULTS AND DISCUSSION

Results

The community service activity is carried out in stages according to the planned method. In the preparation stage, the team prepares all the necessary tools and materials, including cabbage and mustard vegetable waste, rice husks, molasses, and EM4 as a bio activator. A trial is conducted after the preparation and waste processing to ensure the effectiveness of the liquid organic fertilizer (POC) production method.

Figure 1. Trial preparation
Figure 2. Socialization and training

Sampling tests are also carried out after 2 weeks of fermentation by sending the samples to the Soil, Plants, Fertilizers, and Water Laboratory at the Agricultural Research and Development Agency in

Malang. This testing aims to ensure that this appropriate technology product is suitable for development in Malangsuko Village, with contents that are beneficial for plant health.

The next stage is the socialization and training held on July 10, 2024, at the Malangsuko Village Hall. This socialization was attended by the PKK women's group and village officials. The material was presented clearly and in detail through a presentation, accompanied by a live demonstration by the service team. One of the indicators of successful POC production was the distinctive smell, similar to that of fermented rice (tape). Each participant was also provided with a flyer containing a practical guide on how to make POC.

Documentation of the event, including photos, videos, and the flyer, is available in an open file accessible to the public through the following link: (https://drive.google.com/drive/folders/10R07enxS5tIswbBO4Yxer-_iDnvl7IN2?usp=sharing). The steps for producing POC are outlined in the flowchart in Figure 3.

Figure 3. Flowchart of making vegetable waste POC

Figure 4. Questionnaire Completion by PKK Mothers of Malangsuko Village
Figure 5. Community Service Activities

In the evaluation stage, participants filled out pre-test and post-test questionnaires to measure their understanding improvement (Figure 4). The result of this appropriate technology implementation

is that POC (liquid organic fertilizer) made from vegetable waste has been successfully produced and its quality has been tested. Based on the results of nutrient content tests from vegetable waste (cabbage and mustard greens), the POC contains nitrogen, phosphorus, potassium, calcium, and magnesium in the following proportions: 2.50%, 2.20%, 2.50%, 0.50%, and 0.30%, respectively. This product meets the standards required for agricultural use and has a positive impact on improving soil fertility and crop yields.

Testimonies from participants and monitoring through WhatsApp groups also indicate the success of this program. A diagram depicting the pre-test and post-test results shown significant improvement in participants' understanding, which is documented in the form of a bar chart. The training on making liquid organic fertilizer from vegetable waste successfully increased participants' knowledge, awareness, and interest. The majority of participants now understand the benefits of POC, know the process of making it, and are interested in using it at home.

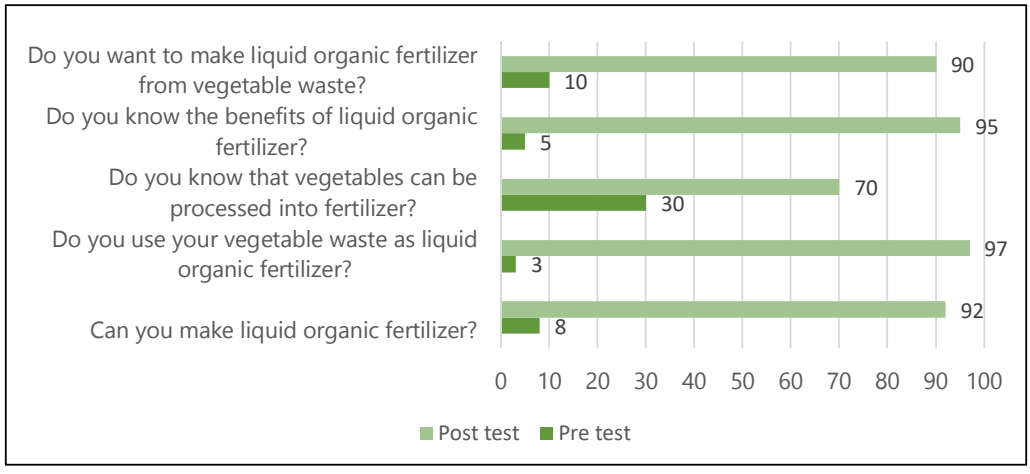

Figure 6. Knowledge in pre and post test

Discussion

The increase in knowledge and skills of the partners in making POC will encourage positive behavioral changes, especially in waste management and organic farming practices. The long-term impact is not only economically beneficial but also strengthens environmental sustainability and community resilience. The sustainability of the program can be achieved through replication of the training and strengthening cooperation networks among stakeholders.

The training on making POC from vegetable waste has brought significant changes to the knowledge and skills of the women's group (PKK) in Malangsuko village, Malang Regency. Before the training, most participants were unaware of the potential of vegetable waste to be processed into fertilizer, and most either discarded it or used it as animal feed. This finding aligns with the research by Agustin et al. (2023), which showed that before the socialization, most people in Jatisari hamlet, Malang Regency, did not utilize vegetable waste. A significant increase in understanding and skills occurred after the training, particularly in processing vegetable waste into POC. This is in line with the research by Paksi et al. (2022), which showed that training can increase the community's interest in applying the technology at home.

With this new knowledge, the women of PKK in Malangsuko village have the potential to produce around two sacks of vegetable waste per day (±50 kg), resulting in a production of 250 liters of POC

per day. This program can meet the local agricultural needs or even be sold as an organic product. This quantity provides an economic and environmentally friendly solution for the people of Malangsuko village.

The use of bioactivators such as EM4 in the fermentation process results in more efficient production. A study by Pradiksa et al. (2022) demonstrated that EM4 accelerates the decomposition of organic materials, shortening the production time and enriching the nutrient content of the POC. For comparison, in a community service program in Jatisari hamlet, Ngajum village, the use of vegetable-based POC proved to increase crop yields, improve soil fertility, and reduce environmental pollution.

To maintain this success, continued training and ongoing socialization are necessary to further enhance the PKK women's skills in making POC. Regular monitoring and mentoring will ensure that they can continue to apply and develop the knowledge they have gained. Innovations like this support the goals of sustainable development, particularly in environmentally friendly agriculture and organic waste management. The benefits are not only felt by the PKK women but also by the farming community in Malangsuko village, who now have access to cheaper, eco-friendly fertilizer alternatives.

4. CONCLUSION AND RECOMMENDATIONS

The goal of this activity is to implement the fermentation method in processing vegetable waste into liquid organic fertilizer (POC). This activity successfully enhanced the knowledge and skills of the partners in producing and utilizing POC, achieving a 92% improvement. The partners successfully produced liquid organic fertilizer with a capacity of 250 liters per day, which is used as fertilizer for plants. The utilization of this POC product is an important step in supporting the sustainability of the program, strengthening the productive management of organic waste, and promoting sustainable agricultural practices in Malangsuko village.

To ensure the sustainability of this community service program, it is recommended that the training on making liquid organic fertilizer (POC) from vegetable waste be conducted regularly and involve more community groups, such as farmer groups. Long-term monitoring and assistance are also necessary to ensure that the community continues to apply the introduced technology and to evaluate its impact on agricultural outcomes. It is also important to diversify the types of organic waste that can be used to make POC, such as fruit waste or kitchen waste, providing the community with more options for waste management. Collaboration with local agricultural and environmental agencies should be strengthened to secure policy support and access to more advanced technologies. This is crucial to expanding the benefits of the program and ensuring the sustainability of innovation within the community.

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REFERENCES

Agustin, I. A., Pawestriningtyas, H. K., Lestari, L. W., Al Aziz, S., Rahmat, F., & Gafur, A. (2023). Penyuluhan pembuatan Pupuk Organik Cair (POC) dari limbah sayur di Dusun Jatisari, Desa Ngajum, Kabupaten Malang. *JRCE (Journal of Research on Community Engagement), 4*(2). https://doi.org/10.18860/jrce.v4i2.20024.

Amilia, W., Rusdianto, A. S., & Choiron, M. (2024). Empowerment of the Tirtobakti II Farmer Group to improve production capacity of frass organic fertilizer. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 9*(2), 338-349. https://doi.org/10.26905/abdimas.v9i2.12423

Arifin, M., & Aiyanto. (2018). Desa penghasil kopi untuk meningkatkan ekonomi masyarakat di Desa Damarwulan Kecamatan Keling Kabupaten Jepara. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang 3*(1). https://doi.org/10.26905/abdimas.v3i1.224.

Bahtiar, K., Fajarfika, R., & Nafi'ah, H. H. (2024). Implementation of hybrid tomatoes as an effort to increase tomato harvest production. *Abdimas Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 9*(3), 483–490. https://doi.org/10.26905/abdimas.v9i3.13650

Basri, H. (2021). Sosialisasi Pembuatan dan aplikasi pupuk organik cair (POC) di Desa Peresak Kecamatan Narmada. *Jurnal Abdidas, 2*(6), 1437–1442. https://doi.org/10.31004/abdidas.v2i6.504.

Ermawati, D., Meicahayanti, I., Winalno, A., Sukamono, Y., Pinasthika, D., Septilani, I., & Baiduri, I. (2024). Assistance for Pokdarwis Zwageri Borneo in providing clean water needs fur rural tourism areas. *Pengabdian Masyarakat Universitas Negeri Malang, 9*(2), 316–328. https://jurnal.unmer.ac.id/index.php/jpkm/article/view/12210/pdf.

Fauzan, S., Nugroho, P., Agustina, S., & Moliani, A. I. (2023). Peningkatan ekonomi desa melalui pemberdayaan masyarakat dalam pengolahan limbah menjadi pupuk organik. *Prima Abdika Jurnal Pengabdian Masyarakat, 3*(4), 483–491. https://doi.org/10.37478/abdika.v3i4.3217

Haryuni, K., Ratih. D., Budiyono, A., Utami, D. S., & Prasetyowati, K. (2021). Pendampingan pembuatan Pupuk Organik Cair plus (POC plus). *Ganesha: Jurnal Pengabdian Masyarakat, 1*(02), 56–61. https://doi.org/10.36728/ganesha.v1i02.1456.

Krisnaningsih, A. T. N., & Setiyaningsih, W. (2018). IbM Kelompok Peternak Sapi Perah di Desa Kemiri Kecamatan Jabung Kabupaten Malang. *Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 3*(1). https://doi.org/10.26905/abdimas.v3i1.2249.

Paksi, A. K., Tiara, A., & Setyorini, F. A. (2022). Pendampingan pembuatan pupuk organik untuk meningkatkan produksi pertanian di Padukuhan Seropan II, Kelurahan Muntuk, Kepanewon Dlingo, Bantul. *E-Dimas: Jurnal Pengabdian Kepada Masyarakat, 13*(4), 699–706. https://doi.org/10.26877/e-dimas.v13i4.11996.

Pradiksa, I., Ari, W., & Widianingsih. (2022). Pengaruh bioaktivator EM4 terhadap proses degradasi Pupuk Organik Cair Cymodocea serrulata. *Journal of Marine Research, 11*(2), 136–144. https://doi.org/10.14710/jmr.v11i2.33771.

Prasetyo, D., & Evizal, R. (2021). Pembuatan dan upaya peningkatan kualitas pupuk organik cair. *JURNAL AGROTROPIKA, 20*(2), 68-80. https://doi.org/10.23960/ja.v20i2.5054

Purnamasari, I., Suci Ristiyana, Yagus Wijayanto, & Tri Wahyu Saputra. (2022). Pengolahan limbah kotoran sapi menjadi pupuk organik untuk perbaikan kualitas lingkungan Desa Seputih Kecamatan Mayang Kabupaten Jember. *Jurnal Pengabdian Magister Pendidikan IPA, 5*(1), 161–168. https://doi.org/10.29303/jpmpi.v5i1.1357.

Rasmito, A. (2019). Pembuatan pupuk organik cair dengan cara fermentasi limbah cair tahu, starter filtrat kulit pisang dan kubis, dan bioaktivator EM4. *Iptek, 23*(1), 55–62. http://dx.doi.org/10.31284/j.iptek.2019.v23i1.496.

Ramdhany, M. R. (2018). Analisis komoditas unggulan sub sektor pertanian terpilih berdasarkan volume produksi di Kabupaten Malang. *Jurnal Ilmiah Mahasiswa FEB, 6*(1). https://jimfeb.ub.ac.id/index.php/jimfeb/article/download/4608/4043

Siregar, F. A. (2023). Penggunaan pupuk organik dalam meningkatkan kualitas tanah dan produktivitas tanaman. https://doi.org/10.31219/osf.io/fyz8v

Solihin, E., Yuniarti, A., Damayani, M., & Rosniawaty, S. (2019). Application of liquid organic fertilizer and N, P, K to the properties of soil chemicals and growth of rice plant. *IOP Conference Series: Earth and Environmental Science, 393*(1), 012026. https://doi.org/10.1088/1755-1315/393/1/012026

Sulistyaningsih. (2020). Pemanfaatan limbah sayur, buah, dan kotoran hewan menjadi pupuk organik cair di Kelompok Tani Rukun Makaryo, Mojogedang, Karanganyar. *Jurnal Surya Masyarakat, 3*(1), 22-32 http://dx.doi.org/10.1088/1755-1315/393/1/012026.

Ustiatik, R., Pertiwi, B. L. S., Ariska, A. P., Wicaksono, K. S., Riza, S., Hadi, S. R. I., Riyanto, A., Arisoesilaningsih, E., & Utami, S. R. (2024). Strengthen farmers' fertilizer self-sufficiency in the tourist area with a reduce-reuse-recycle system. *Abdimas Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 9*(3), 543–554. https://doi.org/10.26905/abdimas.v9i3.13059

Wardhani, R. K. (2021). *Kecamatan Tumpang dalam angka 2021*. CV. Kurnia https://malangkab.bps.go.id/publication/2021/09/24/78976f69160307b1817f3e15/kecamatan-tumpang-dalam-angka-2021.html.