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Community Empowerment through Household Organic Waste Management Using Black Soldier Fly (BSF) Maggots in PRA Tegalrejo, Yogyakarta

Ambar Pratiwi [1, *], Nursyiva Irsalinda[2], Ichsan Luqmana Indra P, Eri Eryati , Sutan Nur Camida TA, Churin S Sirly dan Zakhrul Zulfikar
[1] Prodi Biologi FAST Universitas Ahmad Dahlan,[2] Prodi Matematika FAST Universitas Ahmad Dahlan
*Corresponding author: ambar@bio.uad.ac.id

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Abstract
Household organic waste management in densely populated areas such as Tegalrejo, Yogyakarta, poses a significant challenge that impacts both environmental quality and public health. This community service program aimed to enhance the knowledge and skills of local residents—particularly members of the PRA Tegalrejo women's group—in utilizing Black Soldier Fly (BSF) larvae, or maggots, as biological agents for organic waste decomposition. The training was conducted through educational sessions, live demonstrations on maggot utilization, and interactive discussions. The results showed a 14.73% increase in participants' understanding, based on pretest and post-test scores. Participants not only gained knowledge about the decomposition process using maggots, but also recognized the potential of maggot farming as a source of animal feed and local economic opportunity. This program demonstrates that hands-on, eco-friendly education can effectively encourage community participation in waste management while simultaneously strengthening environmental resilience and household socio-economic sustainability.

Corresponding Author:
Ambar Pratiwi
Universitas Ahmad Dahlan

1. INTRODUCTION

The Special Region of Yogyakarta (DIY) ranks sixth as the region with the highest population density in Indonesia. This condition directly impacts the volume of household waste production, which continues to increase annually. One of the main Final Disposal Sites (TPA) in this region, namely the Piyungan TPA, has been experiencing overcapacity since 2012 and has been closed several times due to being unable to accommodate the volume of waste [1]. The closure of the Piyungan TPA in July 2023 prompted the local government to issue a policy of reducing waste at source and encouraging the community to manage waste independently [2] through the concept of Reduce, Reuse, and Recycle (3R).

Efforts undertaken include the establishment of waste banks, but this program focuses more on inorganic waste management. Organic waste processing using stacked bucket technology can convert organic waste into liquid and solid fertilizer to support plant growth [3]. In addition, composting also needs to be promoted as a solution in organic waste processing. On the other hand, the processing of organic waste, which actually contributes a significant proportion of total waste generation, has not been optimally handled. One simple technology that is starting to be introduced is the use of Stacked Buckets, which allows for a household-scale composting process. In addition, the use of Black Soldier Fly (BSF) larvae, also known as maggots, is a more efficient and environmentally friendly alternative in organic waste management.

Tegalrejo District is one of the densely populated areas in Yogyakarta through which the Winongo River flows. Demographic data shows that of the total 4,458 residents of Tegalrejo

Village, 33.34% are not in the workforce, with 14.89% [4] of them being housewives. This group has significant potential for involvement in household waste management efforts because they have the time and capacity to carry out productive activities from home.

The practice of dumping waste into rivers is still prevalent, which can pollute water quality and endanger the ecosystem. The local government has tried environmentally friendly incineration technology, but this has not fully resolved the problem of household waste management, particularly for organic waste. However, existing waste management practices have not been effective in addressing household waste issues. This is particularly true for organic and inorganic household waste, which must be managed independently by residents. Therefore, the FAST Biology Student Activity Unit (PKM) team needs to strengthen its support by providing assistance for independent household waste management.

Previous research has shown that the use of BSF in organic waste processing can reduce waste volume by up to 70% in a short time and produce larvae with high economic value (Lalander et al., 2019). Therefore, strengthening community capacity through training and mentoring related to maggot cultivation is expected to provide a dual-benefit solution: environmental solutions and improved family economic well-being.

Waste can be processed into products with economic value, such as organic fertilizer, ecoenzymes, maggot cultivation media for feed, and so on. For inorganic waste, the Tegalrejo Subdistrict has initiated a Waste Bank as part of the Zero Inorganic Waste movement.

With stacking bucket technology, households can process waste into economically valuable products, optimizing organic waste management. Based on the analysis of the partners' situation and conditions above, the following issues were identified:

a. Lack of opportunities and skills among women in processing waste into a business that can improve the economy
b. High unemployment rate for women
c. Lack of role of village economic institutions

Of the various problems faced by partners, two main problems that are important to be resolved through this program based on the results of discussions with partners are:

a. Lack of skills in waste processing, especially household waste
b. The high number of women who are unemployed means that there is a need to improve the skills of women in particular.

This community service program aims to empower housewives in the Tegalrejo PRA (Regional Agricultural Research Center) in managing organic waste through an ecological and economic approach, namely through the use of BSF maggots. BSF has advantages over conventional composting methods because it can decompose organic waste more quickly, produces highly nutritious larvae that can be used as animal feed, and produces nutrient-rich residue that can be used as plant fertilizer. The use of BSF also supports the principles of a circular economy, where waste can be converted into useful resources in a sustainable manner.

Thus, this community service program was carried out with the aim of improving the knowledge, skills, and empowerment of women in Tegalrejo Village through PRA Tegalrejo Yogyakarta. The solution to the problem offered by the community service team is in the form of training and assistance in processing household waste using the Stacked Bucket method, making organic fertnnnilizer

2. METHOD

This community service activity is carried out using a training method on household waste management. The material outlined in this activity is as follows:

A. Counseling and assistance in sorting household waste

This outreach and mentoring activity on household waste sorting is carried out in several stages. These stages are shown in Table 1 below:

Table 1. Stages of waste sorting outreach and training activities at PRA Tegalrejo, Yogyakarta

B. Maggot propagation and household waste processing using maggots
Maggot propagation and waste processing using maggots in this activity use stacked buckets using used house paint drums. One waste processing unit requires two paint drums. One paint drum lid is completely perforated, while the other lid is left intact. One of the paint drums has small holes made at the bottom for the flow of leachate (water resulting from waste decomposition). In addition, four holes are made on each side of the top, each with a diameter of 0.5 cm, as a place for adult flies to lay their eggs and also as an entry hole for larvae after hatching from the eggs into the paint drum containing organic waste. The two paint drums are stacked, with the perforated drum placed on top. The household organic waste processing container is ready for use, preferably placed outside the house, in a place exposed to sunlight. Every day, household organic waste can be disposed of into the container. Once full, the leachate can be collected to be used as liquid plant fertilizer, while the solid waste can be mixed into planting media. Similarly, maggots (adult larvae) can be harvested and used as feed for poultry or fish.

C. Evaluation
Evaluation of the activity was carried out with a pretest and posttest carried out by the participants to determine the increase in participants' understanding and skills after the organic waste processing training event using maggots.

3. RESULTS AND DISCUSSION

This community service activity was carried out from February to March 2025 at the Baitul Karim Mosque in Tegalrejo, involving 60 members of the Tegalrejo PRA, most of whom were housewives. The activity was facilitated by a team from FAST UAD, consisting of three lecturers, two educational staff, and three biology students. The training materials included household waste sorting, organic fertilizer production, processing used cooking oil into soap, and training on BSF maggot cultivation and utilization.

Figure 1. Counseling on household waste sorting (personal documentation, 2025)

The waste sorting outreach activity was conducted with Ichsan Luqmana Indra P., M.Si as the resource person. The outreach activity aims to provide an understanding to the community about the importance of waste sorting and good waste management. This outreach is expected to increase the understanding and knowledge of participants in sorting household waste. The waste sorting outreach activity (Figure 1) contains material on the differences between organic and inorganic waste that are often produced at home, the impact of organic and inorganic waste disposal, recommendations for household waste sorting, organic waste processing, waste bank management for inorganic waste.

Figure 2. Counseling and Practice of Household Waste Processing Using Maggots (personal documentation, 2025)

An outreach activity on organic waste processing using maggots was conducted with resource person Ichsan Luqmana Indra P., M.Si. (Figure 2). In addition to increasing residents' knowledge about the use of insects in degrading waste, especially organic waste, residents can also use larvae from the BSF as fish feed. There are residents in Tegalrejo Village who have livestock so that by utilizing the maggots, they certainly gain information about additional feed intake to support livestock nutrition obtained from the maggots. There are even members of the Tegalrejo PRA who have cultivated maggots so that there is a strengthening sharing regarding the use of maggots for organic waste processing. So during the presentation on the benefits of maggots, there was a lot of interaction with residents in the form of questions and answers. The result of this activity is that residents have increased information about the role of maggots in reducing organic waste.

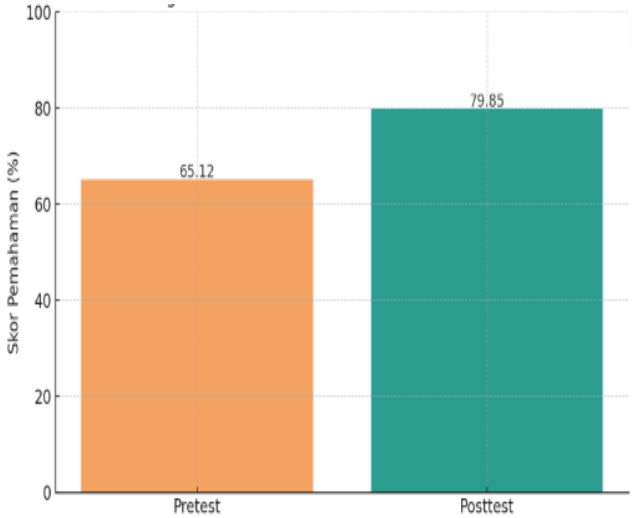

Figure 3. Results of Increasing Participants' Understanding of Organic Waste Management by Utilizing Maggots (personal documentation, 2025)

The training results showed a significant increase in understanding of organic waste management (Figure 3). Based on the pretest and posttest results, there was a 14.73% increase in scores, indicating an increase in participants' capacity to understand the waste degradation process using maggots and its economic potential. This improvement was particularly evident in participants' understanding of how to process waste into fertilizer and the maggot cultivation process. Furthermore, residents also received information on developing maggots as an alternative animal feed, which can later be cultivated as an economic source for residents of Tegalrejo Village.

In this session, participants not only listened to the material but also participated in discussions and shared experiences, including those who had already begun cultivating maggots independently. This demonstrates that the training process was not merely a one-way transfer of knowledge, but also fostered dialogue and networking among participants. Furthermore, community partners provided full support. This support included providing a location for outreach, inviting and gathering residents, and bringing organic waste requested by the team for a live demonstration of maggot utilization in degrading household organic waste. Active participant participation was very high, especially during the maggot utilization session. One immediate impact was the continued plans of several participants to develop maggot cultivation as a small household business.

From an environmental sustainability perspective, BSF utilization has a positive impact because it can decompose various types of household organic waste, such as food scraps, rotting fruit, and vegetables, which are typically difficult to decompose using conventional composting methods. The residue from this process can be used as fertilizer, while the larvae can be used as high-protein animal feed—a potential that is highly suited to the conditions in Tegalrejo Village, which also has a fish and chicken farming community.

However, several challenges were encountered during the program's implementation, including limited initial cultivation facilities and participants' limited experience in sustainably maintaining BSF colonies. Therefore, the implementation team developed a follow-up strategy consisting of intensive mentoring, distribution of maggot starter kits, and the formation of maggot study groups under the coordination of the PRA.

The economic potential of maggots is enormous. The selling price of dried maggots for animal feed can reach IDR 25,000–40,000/kg, opening up new business opportunities for the community. If managed properly, this activity can not only solve waste problems but also strengthen family food security and create a sustainable source of additional income.

4. CONCLUSION

Based on the results of the evaluation of this community service activity, it can be concluded that the Tegalrejo PRA members have understood the process of sorting and processing household waste and have the skills to process household organic waste by utilizing maggots.

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