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Community Empowerment in Kota Padang: Circular Economy-Based Organic Waste Management through Black Soldier Fly (BSF) Maggot Cultivation

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ABSTRACT

The issue of organic waste in Padang City is increasing due to the community's high activity level, which predominantly generates food waste. Currently, food waste accounts for 63% of the total waste in Padang City. The Black Soldier Fly (BSF) maggot is an effective agent for processing organic waste, requiring simple technology that is cost-efficient and easy to implement. BSF maggots also produce biomass with a high protein content that can be utilized as animal feed. The methods used in this study include socialization, education, direct field practice, and evaluation. The results demonstrated an increase in community understanding and interest in BSF maggot cultivation as a means to reduce organic waste. Participants also learned about the TOSS (Solid Waste Processing Technology at the Source) method for managing leaf and twig waste. This activity was expected to serve as a waste management model that reduces waste volume and creates opportunities within the circular economy, where organic waste is converted into valuable resources.

Keywords: BSF maggot, circular economy, community-based waste reduction, organic waste management, toss method

INTRODUCTION

Waste management remains a serious challenge in many cities across Indonesia, including Kota Padang. Human activities continuously generate waste, and without proper handling, it can lead to negative impacts on the environment and public health (Sudiro et al., 2018). According to data from the National Waste Management Information System (SIPSN, 2023), Indonesia produces approximately 20.59 million tons of waste annually, with 40.53% consisting of food waste. In Kota Padang, the total waste generated in 2023 reached 236.30 thousand tons per year, or about 647.39 tons per day, with organic waste making up the majority (63%).

Unfortunately, waste management in Indonesia still relies heavily on traditional end-of-pipe approaches, such as transporting and dumping waste at final disposal sites (Darmawan et al., 2020). Around 80.6% of TPAs still use open dumping systems, which have harmful effects on the surrounding air, water, and soil quality (Prajnawita et al., 2020). Moreover, the application of circular economy principles in waste management remains limited, both in policy and in practice at the community level.

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One of the key gaps in organic waste management is the low public awareness of its recycling potential, along with the limited use of environmentally friendly processing technologies. In fact, organic waste holds great potential to be transformed into valuable resources, one of which is through the cultivation of Black Soldier Fly (BSF) larvae, commonly known as maggots. BSF is not a pest and does not carry diseases, making it safe and environmentally friendly (Purnamasari et al., 2023). These larvae are highly efficient in consuming various types of organic waste, including food scraps, vegetables, fruits, and even soft animal bones (Kusumaningsih, 2024).

In addition to reducing waste volume, BSF maggots are rich in nutrients (58–61% protein,1-5% carbohydrate, and 23–24% crude fat) making them a promising alternative for animal feed (Rahayu et al., 2023). This method not only addresses environmental concerns but also creates new economic opportunities for communities, aligning with the circular economy concept that promotes turning waste into valuable resources.

Based on this background, this community engagement initiative aims to empower local residents to manage organic waste independently through BSF maggot cultivation, reduce the amount of waste sent to landfills, and promote the adoption of circular economy practices at the local level. The program is focused on several neighborhoods in Padang City, including Tarantang, Rimbo Kalua, and Linggar Jati, with the hope that it can serve as a sustainable and replicable model for organic waste management.

METHOD

This community engagement program was carried out through several key stages: preparation, implementation, field practice, mentoring, and evaluation. Each stage was systematically designed to ensure active community participation and the achievement of the program's objectives. The program was a collaborative effort involving several stakeholders, including Minagot Sumbar, the Environmental Agency (DLH) of Kota Padang, the representative of Ministry of Public Works and Housing (PUPR), PLN Peduli, PT Semen Padang, and the *Padang Memilah* community group.

The program began with a field survey conducted in three target communities located in the Kelurahan Tarantang, Rimbo Kaluang, and Linggar Jati in Kota Padang. The survey aimed to assess the community's conditions, their awareness of organic waste management, and the social potential that could support the implementation of BSF maggot cultivation. The findings from this survey were used to design the educational materials and determine the most appropriate approach for the activities.

The second stage is socialization and education stages. This stage was conducted in three locations: on August 28, 2024, in Kelurahan Tarantang; September 4, 2024, in Kelurahan Rimbo Kaluang; and October 3, 2024, through a field visit to the Maggot House of Minagot Sumbar at Bukit Belimbing Indah, Kuranji. The activities involved approximately 30–45 participants, including community leaders, environmental volunteers, local residents from each Kelurahan, and representatives from the collaborating partners. Participants were selected purposively based on their active involvement in environmental initiatives and their readiness to become agents in their communities. The educational content covered the concept of the circular economy, the benefits of BSF maggot cultivation, and the economic potential of organic waste management. These sessions were delivered through interactive presentations, group discussions, and educational video screenings.

The third stage is field workshop. The hands-on workshop was conducted at the Maggot House of Minagot Sumbar and continued at each participant's local site. During this stage, participants received technical training on: (a) identifying suitable types of organic

waste for maggot feed, (b) preparing the cultivation medium, (c) handling BSF eggs and larvae, (d) maintaining and harvesting maggots, and (e) processing the harvested maggots into animal feed. The practical training lasted several weeks and was supported by intensive mentoring from the program team and technical partners. Success indicators included participants' ability to manage the cultivation independently, the number of maggot colonies successfully maintained, and the utilization of the harvested maggots by the participants.

The fourth stage is mentoring stage. Following the initial training, extended mentoring was provided over several months to ensure the sustainability of the program. This mentoring involved regular field visits and online communication to monitor progress and provide technical support in addressing any challenges faced by the participants.

The final stage involved evaluating the effectiveness and efficiency of the program. Evaluation methods included in-depth interviews with selected key participants to explore their experiences and the impact of the program, as well as direct observation of the maggot cultivation practices in the field. The results of this evaluation served as a basis for collective reflection among the program team, partners, and community members to inform future program development.



Figure 1. Community empowerment method

RESULTS AND DISCUSSION

The Biology Team from Universitas Andalas, in collaboration with the Environmental Agency (DLH) of Kota Padang, the representative of Ministry of Public Works and Housing (PUPR), PLN Peduli, PT Semen Padang, and the *Padang Memilah* community, carried out a community outreach program aimed at reducing 50% of waste sent to final disposal sites (TPA) in Kota Padang. One of the key strategies introduced was the use of Black Soldier Fly (BSF) maggots for organic waste management. Participants showed great enthusiasm during both the educational sessions and the hands-on training on circular economy-based organic waste processing through BSF maggot cultivation.

Outreach in Kelurahan Tarantang

The first outreach activity was held on August 28, 2024, in Tarantang, a kelurahan recognized for its strong waste-sorting practices. The event was opened by the local head of the kelurahan, followed by remarks from the CSR team of PT Semen Padang. The main presentation was delivered by Dr. Resti Rahayu, who introduced the issue of increasing waste in Kota Padang, various waste treatment methods, and the advantages of using BSF maggots as organic waste processors. She also explained the BSF life cycle and the economic value of maggots as high-protein feed for poultry and fish.

Dr. Rahayu emphasized that BSF maggots are effective bioconversion agents capable of breaking down organic waste such as vegetables, fruits, and food scraps more quickly than natural decomposition. Unlike other fly species, BSF does not act as a disease vector, making it safe for waste management. Her previous research also found that BSF maggot meal contains up to 61% protein, which is highly beneficial for animal growth, especially in aquaculture.



Figure 2. A) Welcome speech by the Head of Kelurahan Tarantang; B) Remarks from the CSR team of PT Semen Padang; C and D) Presentation of the outreach materials in Kelurahan Tarantang

Outreach in Kelurahan Rimbo Kaluang

The second outreach session took place on September 4, 2024, in Rimbo Kaluang. The event began with opening remarks from the local kelurahan head and a representative from DLH Padang. The session introduced the BSF maggot cultivation program, focusing on the insect's life cycle, physical characteristics, cultivation methods, and benefits. Proper introduction was seen as key to increasing community interest in BSF farming.

Participants learned that BSF cultivation helps reduce household organic waste, produces "kasgot" (maggot residue) that can be used as compost, and generates high-protein larvae that serve as an alternative feed for poultry and fish. Following the presentation, a discussion session revealed growing interest among participants, which led to the next phase: hands-on training at the Maggot House.

Hands-On Training at the Maggot House

As a follow-up to the outreach sessions, a practical training was held on October 3, 2024, at the Minagot Sumbar Maggot House in Bukit Belimbing Indah, Kuranji. Participants from Kelurahan Tarantang, Rimbo Kaluang, and Linggar Jati attended the session. The

training demonstrated the full BSF cultivation process, from egg harvesting and placement to larval feeding and harvesting.

Dr. Rahayu explained that 10 grams of BSF eggs can consume 80–120 grams of organic waste over approximately three weeks. Under optimal conditions, maggots can be harvested in as little as 10 days, depending on the type of feed used. According to Wahyuni et al. (2021), several factors influence the success of maggot cultivation, including the quality of the growing medium, environmental conditions, and the nutritional content of the feed. Younger larvae tend to have higher protein content, making early harvesting beneficial. The leftover biomass, known as kasgot, can be used as organic fertilizer, supporting zero-waste and circular economy practices (Fauzi et al., 2022).



Figure 3. A) Welcome speech by the Head of Kelurahan Rimbo Kaluang; B) Remarks from the Environmental Agency of Kota Padang; C) The participants from Kelurahan Rimbo Kaluang



Figure 4. Construction of a maggot house in Kelurahan Rimbo Kaluang



Figure 5. Observation of BSF maggot cultivation practice at Rumah Maggot Minagot Sumbar

Integration of Additional Waste Processing Methods

The session concluded with a presentation by Dr. Fadjar Goembira from the Environmental Engineering Department at Andalas University. He introduced the TOSS method (Solid Waste Processing Technology at the Source) as a complementary approach for managing non-food organic waste such as leaves and branches. TOSS transforms organic waste into high-quality compost or alternative fuel in the form of briquettes. He emphasized that this method empowers communities to manage waste independently, reduce reliance on landfills, and support circular economy practices. He also stressed the importance of active community participation in waste sorting and understanding the environmental and economic benefits of source-based waste processing. This training session was also covered by local media, including Diskominfo and online news outlets such as Fokus Sumbar, helping to extend the program's reach to a broader audience.

Follow-Up and Evaluation

After the outreach and training sessions, the team visited a community group in Rimbo Kaluang that had begun independently building a maggot house for waste processing. This initiative was a direct result of the community-based education and outreach conducted by the Biology Team at Andalas University in collaboration with its partners. The team committed to providing ongoing guidance on circular economy-based waste management through BSF maggot cultivation. Evaluation of the program was conducted both online and offline as part of the follow-up process. In addition, a WhatsApp group was created to facilitate communication and support among participants, which was well received. It is hoped that this initiative will encourage more communities to manage organic waste effectively and gain economic benefits from maggot production through continued collaboration with universities and stakeholders.

CONCLUSION

This program conducted by the Biology Team of Andalas University in collaboration with DLH Kota Padang, the Ministry of PUPR, PLN Peduli, PT Semen Padang, and the *Padang Memilah* community, involved a series of activities including initial surveys,

educational outreach, hands-on training, and follow-up mentoring. The program was implemented in three kelurahan in Kota Padang with the aim of promoting sustainable organic waste management through Black Soldier Fly (BSF) maggot cultivation and the TOSS (Solid Waste Processing at the Source) method. The program successfully increased participants' understanding and interest in managing organic waste using environmentally friendly and economically beneficial methods. Key findings include the community's positive response to BSF maggot cultivation, the emergence of independent initiatives such as the construction of a maggot house, and the integration of circular economy principles into local waste management practices. Practically, these findings demonstrate that BSF maggot cultivation can serve as an effective and scalable solution for reducing organic waste at the household and community levels. The process not only accelerates waste decomposition but also produces high-protein animal feed and organic fertilizer (kasgot), offering both environmental and economic benefits. The TOSS method complements this by enabling the processing of other types of organic waste, such as leaves and branches, into compost or alternative fuel. The implications of this program suggest that with proper education, technical support, and stakeholder collaboration, communities can adopt sustainable waste management practices that reduce reliance on landfills and contribute to local economic development. It is recommended that future programs extend the duration of training, involve more subdistricts, and provide continued support to ensure long-term adoption and impact.

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