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Sustainable Organic Waste Solutions: Maggot Cultivation Training and Community Engagement in Bresela Village

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ABSTRACT

Organic waste management remains a major challenge in rural areas, including Bresela Village, Bali, which is predominantly characterized by household and agricultural activities. The high volume of organic waste that has not been optimally managed highlights the need for an applicative and sustainable community-based waste management approach. This community service program aims to enhance community understanding, skills, and participation in organic waste management through training and mentoring on maggot cultivation. The method employed is a descriptive qualitative approach using observation, interviews, and hands-on practice. The activity was conducted on November 15 in a one-day program consisting of problem observation, field studies through training and demonstration of maggot cultivation, and evaluation of the activity outcomes. The results indicate an improvement in community understanding of organic waste management and a shift in perception toward viewing waste as a valuable resource.

A. INTRODUCTION

The waste management problem in Bali Province has reached a significant level and has become a concern for the government and environmental stakeholders. Based on data from the National Waste Management Information System (SIPSN) and official provincial government reports, waste generation in Bali in 2024 reached approximately 1.2 million tons, equivalent to around ±3,436 tons per day, most of which has not been optimally managed by the existing waste management system. Of this total, organic waste dominates at approximately 65–68%, primarily originating from food waste, household garden waste, and traditional market activities, which are major sources of organic waste in Bali.

The high volume of organic waste generation also reflects real conditions in rural areas such as Bresela Village, where communities produce substantial amounts of organic household waste and agricultural waste daily. Population growth and increasing household activities contribute to the rising volume of organic waste generated each day. In Bresela Village, organic waste management is still dominated by conventional practices such as open dumping and burning, which have the potential to cause environmental pollution, reduce

aesthetic quality, and increase the risk of public health disturbances. This situation indicates the need for innovative waste management approaches focused on source reduction while actively involving the community as the main actor in environmental management (Yulianto et al., 2024)

The utilization of maggots, or Black Soldier Fly larvae, represents an alternative organic waste management method that is considered effective, environmentally friendly, and applicable at the community level. Maggots, or larvae of the Black Soldier Fly (Hermetia illucens), have been recognized as an innovative and effective solution for managing organic waste (Muhammad et al., 2024). BSF maggots are known as highly efficient natural "bio-converters" capable of decomposing organic waste. These larvae possess strong bioconversion capabilities, enabling significant reduction in waste volume within a relatively short time (Andhirta et al., 2025). Maggot cultivation has been proven to reduce organic waste volume by up to 80% within a short period while producing economically valuable products (Alti et al., 2025). The cultivation process does not require complex technology, can be implemented at relatively low cost, and does not produce unpleasant odors when properly managed (Syafaatullah et al., 2024). Therefore, this system is highly suitable to be developed as a community-based organic waste management solution in Bresela Village, which has considerable potential sources of organic waste.

In addition to environmental benefits, maggot cultivation also contributes to improving community economic welfare. Maggots contain high protein levels of approximately 54.34%, making them a potential alternative feed source with economic value for livestock and aquaculture sectors (Sutopo et al., 2022). The demand for affordable, high-quality animal feed continues to increase alongside the growth of fish and poultry farming, creating broad market opportunities for maggot products. Dried maggots can be used as a treatment for diabetes patients, maggot oil can serve as a raw material for cosmetics, and maggot residue (kasgot) can be utilized as fertilizer and biogas feedstock, which has economic value and can reduce farmers' dependence on chemical fertilizers (Sartika et al., 2024). Group-based maggot cultivation development also encourages the establishment of village-based microenterprises that can create employment opportunities, increase household income, and strengthen community economic independence. Thus, organic waste management through maggot cultivation is not only environmentally oriented but also has tangible implications for strengthening local economies and supporting sustainable rural development (Mukhibad et al., 2025).

Studies by(Syaripudin & Kurniawati, 2023; Yuwita & Hasyim, 2022) report that maggot cultivation can become an alternative income source for communities. Although previous studies have extensively discussed the environmental and economic benefits of maggot cultivation in managing organic waste, most existing studies primarily focus on the technical effectiveness of Black Soldier Fly larvae in reducing organic waste volume and producing alternative animal feed products (Muhammad et al., 2024; Primadhita et al., 2024). Several studies also emphasize community empowerment and training activities in waste management programs (Mukhibad et al., 2025; Solekha et al., 2022). However, limited studies specifically explore the integration of community mentoring, participatory environmental education, and sustainable behavioral transformation within rural organic waste management programs, particularly in the context of Balinese villages. In addition, previous studies tend to focus on short-term technical outcomes rather than examining how community engagement and continuous mentoring influence environmental awareness, community participation, and long-term sustainability of organic waste management practices. Therefore, this community service program seeks to address this gap by

implementing a participatory maggot cultivation training and mentoring model in Bresela Village that combines environmental education, practical assistance, and community empowerment approaches to encourage sustainable organic waste management behavior.

The implementation of training and mentoring programs in maggot cultivation is particularly important considering the limited knowledge and skills of the community in managing organic waste productively. Without proper assistance, waste management innovations risk being unsustainable and temporary. Therefore, this community service initiative is designed not only as a knowledge transfer activity but also as a continuous mentoring process that actively involves the community from the planning stage through implementation. The urgency of this program lies in establishing a sustainable, environmentally friendly, community-based organic waste management system capable of providing economic benefits, thereby aligning with the goals of sustainable rural development.

B. METHODS

This community service activity employed a descriptive qualitative method with a direct field observation and participatory devotional approach to obtain an in-depth understanding of the factual conditions of organic waste management in Bresela Village, including the level of community understanding, participation, and responses toward maggot cultivation training and mentoring activities. The descriptive qualitative approach was selected to comprehensively explore environmental conditions, existing waste management practices, and the opportunities and challenges faced by the community in implementing maggot cultivation as a community-based organic waste management solution. In addition, the program applied a participatory devotional approach emphasizing community empowerment, active engagement, and sustainable behavioral change through direct educational assistance, practical mentoring, and collaborative participation between the service team and the Bresela Village community. This approach was designed not only to transfer technical knowledge regarding maggot cultivation but also to strengthen environmental awareness, collective responsibility, and long-term community commitment toward sustainable organic waste management practices.

The target of this community service activity was the community of Bresela Village, particularly household residents, community groups, and representatives of village officials directly related to waste management and environmental activities. This target group was selected because they serve as the main actors in organic waste management at the village level and have the potential to drive the sustainability of the maggot cultivation program. By directly involving the community, it is expected that there will be a sustainable increase in knowledge, skills, and environmental awareness.

The community service activity was conducted on November 15 and lasted for one day, following structured stages of implementation. The first stage was preliminary observation, aimed at identifying the existing conditions of organic waste management in Bresela Village, the types and sources of organic waste generated, and the community's readiness to adopt waste management innovations. This observation was carried out through direct environmental observation and brief discussions with local residents.

The second stage was the field study, which focused on conducting training and mentoring activities on maggot cultivation. At this stage, participants were provided with explanations about the basic concepts of organic waste management using maggots, environmental and economic benefits, and direct demonstrations of maggot cultivation

techniques, including media preparation, organic waste feeding, and maggot maintenance. This activity aimed to enhance the community's practical understanding so they could independently implement maggot cultivation within their respective environments.

The third stage was the evaluation of activity outcomes, conducted to assess the level of community understanding and responses to the training and mentoring implementation. The evaluation was carried out qualitatively through observation of participant engagement, discussions, and direct feedback from the community regarding benefits, challenges, and future development opportunities for maggot cultivation. The evaluation results were used as a basis for assessing the effectiveness of the activity and as input for improving and developing future community service programs.

C. RESULTS AND DISCUSSION

The implementation of maggot cultivation training and mentoring in Bresela Village generated significant environmental, social, educational, and economic impacts for the community. The program increased public awareness of environmentally friendly organic waste management and encouraged residents to shift from conventional waste disposal methods toward sustainable practices through maggot cultivation. The participatory mentoring approach also strengthened community involvement, environmental responsibility, and collaboration between residents and village institutions. In addition, the activity improved community understanding of waste segregation, Black Soldier Fly larvae cultivation techniques, and the economic potential of maggot-derived products such as animal feed and organic fertilizer. The program further changed community perceptions of organic waste from being viewed as a household burden into a productive resource with environmental and economic value, while creating opportunities for sustainable village-based economic empowerment and long-term environmental behavior change.

1.1. Stage 1: Problem Observation

The problem observation stage represents a crucial initial phase in the community service activity, as it aims to obtain an empirical overview of the actual conditions of organic waste management in Bresela Village. Observations were conducted directly within residential areas, focusing on the sources and types of waste generated, household waste management patterns, and community behavior in handling daily waste. In addition to visual observation, data collection was conducted through direct interviews with community members and village officials to explore their level of understanding, habits, and challenges in managing organic waste. The observation results served as the basis for identifying community needs and determining relevant and applicable training and mentoring strategies for maggot cultivation.

The observation findings indicate that most residents of Bresela Village have not yet implemented waste segregation at the source. Organic and inorganic waste are still mixed and managed conventionally without further processing. This condition is reflected in the statement of a resident, I Made Suryana, who noted that waste at home is usually collected together and burned or discarded once it accumulates, as there has been no prior understanding of how to separate it. This reflects that waste management practices are still based on long-standing habits and are not yet supported by adequate knowledge of environmentally friendly waste management.

Figure 1: Maggot Introduction Socialization

Furthermore, interviews revealed that limited knowledge and access to information are dominant factors contributing to the low utilization of organic waste. Ni Luh Sri Wahyuni stated that although the community realizes food waste is abundant, they were previously unaware that it could be reused, leading them to dispose of it directly. This indicates a gap between environmental awareness and technical capacity in managing waste.

Figure 2: Maggot Cultivation Demonstration

From an environmental perspective, field observations showed that the accumulation of organic waste often generates unpleasant odors and reduces residential environmental comfort. This condition was acknowledged by I Wayan Adi Putra, who stated that waste accumulation frequently produces odors, especially during the rainy season, yet the community lacks appropriate solutions to address it. This suggests that although the negative impacts are recognized, access to suitable locally relevant solutions remains limited.

Further observations indicate that the community is open to waste management innovations when accompanied by clear and continuous assistance. I Ketut Sudarma expressed willingness to learn new methods if they are simple and guided appropriately. This suggests that the community has motivation to change but still requires technical guidance and initial support in adopting new waste management practices.

Figure 3: **Maggot Cultivation Mentoring**

Observations of the village institutional aspect, conducted through interviews with the Village Head (Perbekel) of Bresela, I Made Ardika, revealed that waste management has largely relied on individual awareness, with no established sustainable system currently in place. This highlights that organic waste management challenges stem not only from individual behavior but also from the lack of an optimized institutional system at the village level. These findings emphasize the importance of a community-based integrated approach through training and mentoring in maggot cultivation to develop a more structured and sustainable waste management system.

1.2. Stage 2: Field Study

The field study stage constitutes the core phase of the community service activity, focusing on the direct implementation of maggot cultivation training and mentoring for the Bresela Village community. This stage was conducted as a follow-up to the problem observation findings, ensuring that the materials and methods were aligned with the community's actual conditions, needs, and potential. The objective of this stage was to provide practical understanding and technical skills in organic waste management through maggot cultivation while encouraging active community participation in both learning and implementation processes.

The field study began with a socialization session introducing the basic concepts of organic waste management and the principles of bioconversion using maggots. During this session, participants received explanations regarding types of organic waste suitable for utilization, the maggot life cycle, and potential environmental and economic benefits. The results indicated that participants began to understand the relationship between daily waste problems and the maggot cultivation solution introduced. Participant enthusiasm was evident through active engagement in discussions and question-and-answer sessions, particularly regarding the feasibility of applying maggot cultivation at the household level.

The next phase involved participatory demonstrations of maggot cultivation conducted jointly with community members. These demonstrations covered preparation of cultivation media, sorting and processing organic waste, feeding techniques, and maintenance procedures to ensure optimal decomposition. Through hands-on practice, participants gained not only theoretical knowledge but also practical skills that could be directly applied. Observations showed that direct demonstration methods were effective in enhancing participant understanding, as they were able to witness firsthand how maggots decompose organic waste.

During the field study, the community service team also provided intensive mentoring to ensure each cultivation stage was clearly understood. Technical guidance, responses to participant questions, and correction of practical mistakes were provided throughout the process. This approach increased community confidence in independently managing maggot cultivation. Additionally, community members began to show interest in developing small-scale maggot cultivation as part of household waste management efforts.

The field study results indicate that the training and mentoring activities successfully improved community understanding and skills in managing organic waste productively. The community no longer views organic waste merely as waste but as a resource with potential economic value. These findings demonstrate that the field study stage plays a vital role in bridging the gap between knowledge and practice while serving as an initial foundation for sustainable community-based organic waste management in Bresela Village.

1.3. Stage 3: Activity Evaluation

The evaluation stage was conducted to assess the effectiveness of the maggot cultivation training and mentoring activities and to determine the extent to which the community service objectives were achieved. The evaluation took place after completion of all field study activities, using a descriptive qualitative approach through observation of participant involvement, discussions, and direct community feedback. This approach was chosen to obtain a comprehensive understanding of changes in knowledge, attitudes, and perceptions regarding maggot-based organic waste management.

Evaluation results indicate increased community understanding of organic waste management concepts and the role of maggots as bioconversion agents. This is reflected in participants' ability to explain maggot cultivation stages and increased awareness of the importance of waste segregation at the source. Participants also expressed interest in implementing maggot cultivation practices at the household level, either individually or collectively. These findings suggest that training methods combining theoretical explanation and hands-on practice effectively enhance community readiness to adopt waste management innovations.

In terms of participation, the evaluation showed active community involvement throughout all activities. This engagement was evident in the number of questions raised, participation in field practice, and discussions regarding potential village-level development of maggot cultivation. High participation levels indicate strong community interest and motivation to engage in organic waste management. Furthermore, the involvement of village officials during the evaluation stage strengthened institutional support for program sustainability.

Community reflections further illustrate the tangible impact of the activity. **I Made Suryana** noted that the mentoring helped him realize that organic waste management can be implemented simply and is less complicated than previously assumed. **Ni Luh Sri Wahyuni** reflected that the assistance provided new understanding regarding the value of organic waste that had previously been overlooked and that direct demonstrations greatly facilitated practical comprehension.

I Wayan Adi Putra stated that the mentoring increased not only technical knowledge but also awareness of environmental impacts resulting from improper waste management. He reflected that issues such as unpleasant odors and waste accumulation had previously been considered normal but are now understood as preventable through better waste management practices**. I Ketut Sudarma** expressed that interactive mentoring motivated him to actively participate in organic waste management activities and enhanced his understanding of the cultivation process and its benefits. Meanwhile, **I Made Ardika**, the Village Head of Bresela, emphasized that the mentoring provided a concrete illustration of a community-based organic waste management model that could be further developed at the village level.

D. CONCLUSION

The community service activity conducted through training and mentoring in maggot cultivation for community-based organic waste management in Bresela Village successfully achieved its objectives, namely enhancing community understanding and skills in managing organic waste more effectively and sustainably. Through an educational approach combined with hands-on practice, the community gained applicable knowledge regarding organic

waste processing using maggots as a solution suited to local conditions. This demonstrates that the training and mentoring methods applied were effective in addressing organic waste management issues at the village level.

In addition to improving technical capacity, this community service activity also succeeded in encouraging positive changes in community attitudes and participation toward environmental management. The community no longer views organic waste merely as a burden but has begun to recognize it as a resource that can be managed productively. Active community involvement throughout the training and mentoring process reflects the growth of collective awareness regarding the importance of community-based waste management as part of efforts to maintain environmental quality within the village.

Furthermore, this community service activity successfully contributed to community economic empowerment by introducing the potential of maggot cultivation as an alternative business opportunity. The community has started to understand the connection between organic waste management and the creation of economic added value, both as livestock feed and as derivative products. Therefore, this activity not only contributes to reducing organic waste generation but also opens opportunities for developing economic activities based on local potential, which can support the sustainability of waste management programs in Bresela Village.

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F. AUTHOR CONTRIBUTIONS

Activity implementation: Anak Agung Ayu Rika Putri Supartha (ARPS) and Ni Putu Dhanan Kumaradewi M (NDKM) were directly involved in the field implementation of the community engagement activities, including observation, training delivery, mentoring sessions, and interaction with the Bresela Village community.

Article drafting: ARPS prepared the initial draft of the manuscript, including documentation of field activities, description of the program implementation, and compilation of preliminary findings.

Article finalization and translation: NDKM finalized the manuscript, refined the academic writing quality, ensured coherence of the discussion, and translated the article into English for publication purposes.

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