

Community-Based Maggot Production for Organic Waste Management in Kelir Village, Banyuwangi

Danang Sudarso Widya Prakoso Joyo Widakdo¹, Nanda Rusti², Dinda Febta Meliyana³, Ayu Lestari⁴, Tanti Rusditasari⁵

Departement of Agriculture, Politeknik Negeri Banyuwangi, Indonesia^{1,2,3,4,5}

Corresponding Author: Danang Sudarso Widya Prakoso Joyo Widakdo (danang.sudarso@poliwangi.ac.id)

ARTICLE INFO

Date of entry:

30 April 2026

Revision Date:

28 June 2026

Date Received:

28 July 2026

Published:

01 August 2026

ABSTRACT

Organic waste management in Kelir Village, Banyuwangi Regency, remains constrained by conventional disposal practices that cause environmental pollution and health problems. This community service program aimed to develop a community-based maggot production unit using Black Soldier Fly (BSF) larvae as a solution for organic waste management. The program employed a participatory approach involving community members in planning, implementation, and management stages. Activities included outreach, technical training, production unit construction, operational assistance, institutional strengthening, and monitoring and evaluation. The program resulted in a significant increase in community knowledge, with the average pre-test score rising from 54 to 87 in the post-test, representing a 61.1% improvement. The production unit successfully processed 100 kg of organic waste daily, achieving a 40% reduction in waste volume. The business generated a profit of IDR 1,100,000 per month from maggot and kasgot sales. This program demonstrates that community-based maggot cultivation effectively addresses organic waste challenges while creating economic opportunities and supporting circular economy development at the village level.

Keywords: Maggot; Community Empowerment; Organic Waste Management; Bioconversion; Circular Economy



Cite this as: Widakdo, D. S. W. P. J., Rusti, N., Meliyana, D. F., Lestari, A., & Rusditasari, T. (2026). Community-Based Maggot Production for Organic Waste Management in Kelir Village, Banyuwangi. *Empowerment Society*, 9(2), 106–113. <https://doi.org/10.30741/eps.v9i2.1983>

INTRODUCTION

Waste management remains a critical environmental challenge in Indonesia. National data indicates that organic waste constitutes approximately 60-62% of total waste generation, with food scraps accounting for 39.26%, followed by wood and twigs at 12.58% (SIPSN KLHK, 2024). In Kelir Village, Kalipuro District, Banyuwangi Regency, household activities, agricultural practices, and small businesses generate substantial organic waste daily. However, current management practices remain limited to disposal, open dumping, or incineration. These practices cause environmental pollution, greenhouse gas emissions, and health problems, while failing to capture the economic value inherent in organic waste. Black Soldier Fly (BSF) maggot cultivation has emerged as an effective technology for organic waste processing through bioconversion. Research demonstrates that BSF larvae can reduce organic waste by 70-80% within a relatively short period (Asri & Wani

2024). The resulting maggots contain 34-59% protein, making them valuable as alternative feed for fish, poultry, and livestock (Hartono et al., 2021). Additionally, the bioconversion process produces kasgot (residue) that serves as organic fertilizer. This technology supports circular economy principles by converting waste into economically valuable products (Widiyanto et al., 2024). Despite its potential, community-level implementation faces obstacles including limited knowledge and skills regarding BSF cultivation, as well as the absence of institutional frameworks for sustainable management (Fitriyah & Nisa, 2021; Wahyono et al., 2013). Kelir Village possesses abundant organic waste from households, markets, and food stalls. The community's involvement in agriculture, livestock, and fisheries sectors creates potential local markets for maggot products. However, a community-based production unit capable of systematically processing organic waste does not currently exist. This situation reflects a gap between waste availability and management capacity, as well as between technological potential and community skills.

The problem statement guiding this program is: How can community-based maggot production be developed as a sustainable solution for organic waste management in Kelir Village? Specifically, this program aimed to: (1) establish a community-operated maggot production unit processing 100 kg of organic waste daily; (2) increase community knowledge and skills in maggot cultivation; (3) reduce organic waste volume; and (4) generate economic benefit through maggot and kasgot production. The program contributes to environmental sustainability through waste reduction, community capacity building through knowledge transfer, and circular economy development through waste-to-value conversion at the village level.

METHODS

This community service program used a participatory community empowerment approach focused on active partner involvement, capacity development, and institutional strengthening. The implementation was carefully structured in a series of steps, from preparation to evaluation (see Figure 1).

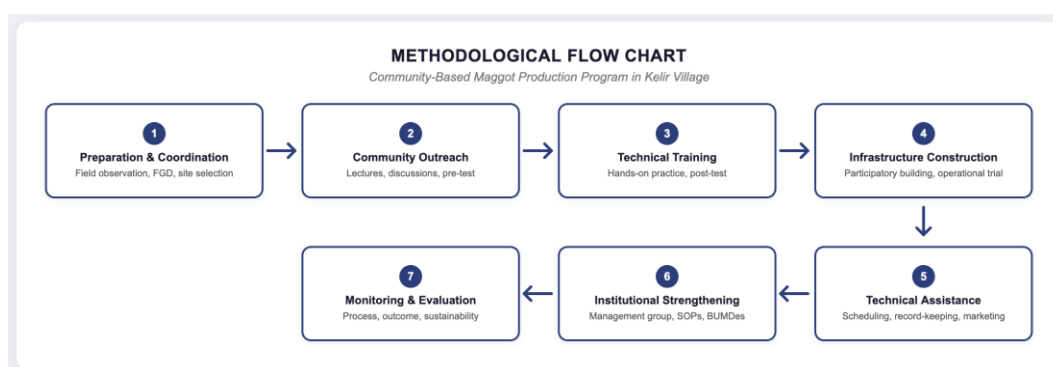


Figure 1. Methodological Flow Chart of the Community-Based Maggot Production Program in Kelir Village

Source: Developed by the authors (2026)

Program Implementation Stages

The program began with preparation and coordination activities. Field observations and focus group discussions (FGDs) were conducted to identify existing waste management conditions, potential organic waste sources, community readiness, and suitable locations for the production unit. Coordination meetings with the Kelir Village government, community leaders, and potential partner groups established a common understanding of program objectives, intended benefits, and the roles and responsibilities of each party. This phase resulted in the formulation of a joint work plan, agreement on activity locations, and community commitment to active participation.

Following preparation, community outreach was conducted to increase public awareness and understanding of organic waste management. The outreach was delivered interactively through lectures, discussions, and question-and-answer sessions. Materials covered environmental and health impacts of improper waste management, waste reduction concepts (reduce, reuse, recycle), BSF maggot technology potential, circular economy concepts, and business opportunities from waste processing. Pre-test assessments were administered during this phase to measure baseline knowledge. Technical training followed, aimed at improving community skills in independent maggot cultivation. The training employed hands-on practice (learning by doing), enabling participants to understand each production stage practically. Training materials included BSF biology and life cycle, egg hatching and larval rearing techniques, feed management from household organic waste, humidity and odor control, harvesting techniques, product processing, and kasgot utilization as organic fertilizer. Post-test assessments were administered to measure knowledge improvement. Technical modules and guides were provided as reference materials for partner groups. Infrastructure construction and installation of community-scale production facilities were carried out participatorily, involving community members to foster ownership and responsibility. Facilities included BSF fly cages, larval rearing containers (bioponds), production racks, organic waste sorting areas, and supporting equipment such as buckets, shovels, tarpaulins, and covers. Initial BSF eggs and larvae were provided as starter cultures. Operational trials were conducted to ensure system functionality for regular organic waste processing.

Intensive technical and managerial assistance was provided to ensure sustainable operation. Assistance included operational scheduling and group task allocation, production flow management and raw material collection, simple recording of production costs and sales results, product processing and storage techniques, and product packaging and quality improvement. Potential local markets among poultry and fish farmers were identified as users of maggot products. Institutional strengthening was conducted to ensure program sustainability beyond the service period. A management group was established with a clear organizational structure and division of tasks. Standard Operating Procedures (SOPs) for production and management were developed. Coordination with village government encouraged program integration with BUMDes (village-owned enterprise) or environmental programs.

Monitoring and Evaluation

Monitoring and evaluation were conducted periodically to assess progress and identify challenges. Evaluations employed multiple methods, including pre-test and post-test assessments for knowledge measurement, structured observation of operational performance, review of production and financial records, and focus group discussions for qualitative feedback. Table 1 presents the program indicators used for evaluation.

Table 1. Program Indicators (Input-Output-Outcome)

Indicator Type	Aspect	Measurement Method	Measurement Time
Input	Community participation	Attendance records, involvement documentation	Throughout program
Input	Facilitator and resource availability	Team presence, training delivery logs	Throughout program
Input	Infrastructure readiness	Facility construction completion checklist	Pre-operation
Output	Knowledge improvement	Pre-test and post-test comparison	Before and after training
Output	Waste processing volume	Daily weighing records	Daily during operation

Output	Maggot and kasgot production	Harvest records, weight measurement	Per production cycle
Outcome	Waste volume reduction	Baseline vs. post-program comparison	Pre and post-program
Outcome	Income generation	Financial records analysis	Per cycle/monthly
Outcome	Institutional sustainability	Operational continuity observation, SOP implementation review	Throughout and post-program

Source: Authors' elaboration (2026)

Evaluations were conducted in three stages: process evaluation, outcome evaluation, and sustainability evaluation. Process evaluations occurred throughout the program by monitoring community participation levels, implementation of outreach and training activities, and readiness of facilities and infrastructure. Outcome evaluations measured increases in partners' knowledge and skills through pre-test and post-test comparisons, as well as operational performance indicators including waste volume processed, production frequency, maggot and kasgot quantities, and existence of production and financial records. Sustainability evaluations assessed institutional capacity, SOP implementation, and potential for continued operation after program completion. Evaluation results were used as a basis for program improvements and plan development.

RESULTS AND DISCUSSION

The program operated from April to early May 2026 in Kelir Village, Kalipuro District, Banyuwangi Regency. Results are presented according to program components, followed by integrated analysis.

Knowledge Improvement

Knowledge assessment using pre-test and post-test questionnaires demonstrated significant improvement following training interventions. The pre-test average score was 54%, increasing to 87% in the post-test. This represents a knowledge improvement of 61.1% (calculated as $(87-54)/54 \times 100\%$). The improvement indicates that technical training effectively transferred essential knowledge regarding BSF biology, cultivation techniques, waste processing, and product utilization

Table 2. Knowledge Improvement Results

Assessment	Average Score	Improvement	Category
Pre-test	54	-	Baseline
Post-test	87	61.1%	Significant
Target Achievement	-	58.3%	Exceeded (target: 50%)

Source: Authors' elaboration based on program evaluation data (2026)

Infrastructure Development

Participatory construction established a community-scale maggot production unit with complete facilities. Figures 2 and 3 document the socialization activities and training sessions.



Figure 2. Socialisation activities for the development of maggot production units in Kelir Village

Source: Authors' documentation (2026)

Figure2. Socialization activities for the development of maggot production units in Kelir Village Production facilities included BSF fly cages for adult breeding, larval rearing containers (bioponds) with capacity for 100 kg daily waste processing, production racks for efficient space utilization, organic waste sorting areas, and supporting equipment (buckets, shovels, tarpaulins, covers). Initial BSF eggs and larvae were provided as starter cultures. Operational trials confirmed system functionality for regular organic waste processing.



Figure 3. Technical training on maggot production and trial of organic waste sorting equipment

Source: Authors' documentation (2026)

Waste Processing Performance

The production unit processed an average of 100 kg of organic waste daily, achieving the program target. Waste reduction through maggot bioconversion reached 40%, slightly below the 50% maximum target but exceeding the minimum 30% target. The waste reduction calculation compared input waste weight (100kg) to residual maggot weight (60kg), yielding a 40% reduction.

Table 3. Organic Waste Processing Performance

Parameter	Target	Achievement	Status
Daily processing capacity	100 kg	100 kg	Achieved
Waste volumereduction	30-50%	40%	Achieved

Processing frequency	Daily	Daily	Consistent
----------------------	-------	-------	------------

Source: Authors' elaboration based on program evaluation data (2026)

Production and Economic Outcomes

Maggot production averaged 150 kg per 14-day cycle, with maggot production of 300kg per cycle. Business analysis (Table 4) demonstrates economic viability with a monthly profit of IDR 1,100,000.

Table 4. Maggot Cultivation Business Analysis

No	Description	Calculation	Value (IDR)
1	Total organic waste processed	100kg × 14 days	1,400 kg
2	Maggot income	150kg × IDR 7,000	1,050,000
3	Kasgot income	300kg × IDR 3,000	900,000
4	Total income	IDR 1,050,000 + IDR 900,000	1,950,000
5	Waste management costs	1,400kg × IDR 1,000/kg	1,400,000
6	Profit per cycle	IDR 1,950,000 – IDR 1,400,000	550,000
7	Profit per month (2 cycles)	IDR 550,000 × 2	1,100,000

Source: Authors' elaboration based on program evaluation data (2026)

Community Participation and Institutional Development

Partner participation occurred throughout all program stages. During preparation, partners contributed to needs identification through FGDs, information provision, and location selection. During implementation, community members actively participated in outreach, training, waste sorting, feed preparation, larval rearing, and harvesting. Voluntary assistance included land, labor, and locally available materials; community members sustained daily operations, including organic waste collection from households, production management, and record-keeping. Institutional strengthening resulted in the formation of a management group with a clear organizational structure and Standard Operating Procedures (SOPs): village government provided institutional support and facilitated coordination. It encouraged program integration with village environmental activities.

Outcome Classification

Table 5. Program Outputs and Outcomes Classification

Category	Description	Achievement
Physical Output	Maggot production unit facility	Fully constructed and operational
	BSF cages, bioponds, racks	Installed and functioning
	Processing equipment	Available and utilized
Knowledge Output	Training module	Developed and distributed
	Knowledge improvement	61.1% increase (54% to 87%)
	Skilled community members	20 trained participants
Economic Outcome	Monthly business profit	IDR 1,100,000
	Market connections	Established with local farmers
Environmental	Waste volume reduction	40% reduction
Outcome	Daily processing capacity	100kg/day achieved
Institutional Outcome	Management group formed	Operational structure established
	SOPs developed	Implemented in daily operations
Impact Potential	Circular economy contribution	Waste to value conversion
	Community income increase	Sustainable income stream

Source: Authors' elaboration based on program evaluation data (2026)

The significant knowledge improvement from 54% to 87% (61.1% increase) demonstrates the effectiveness of participatory training methods in transferring technical skills for maggot cultivation. This finding aligns with studies showing that hands-on training (learning by doing) enhances retention and practical application of knowledge (Fitriyah & Nisa, 2021). The training approach, which incorporated both theoretical understanding and practical skills, addressed the knowledge gap previously identified among community members regarding BSF technology benefits and techniques. The 87% post-test score indicates near-mastery of essential concepts, suggesting that the training duration and methods were appropriate for the target participants. This knowledge improvement is critical for program sustainability, as community members now possess the understanding necessary to manage cultivation operations independently without external supervision. The established production unit successfully processed 100 kg of organic waste daily, achieving the program target and demonstrating technical feasibility at the community level. The 40% waste volume reduction, while slightly below the 50% maximum target, significantly exceeds the 30% minimum target. This reduction rate is consistent with studies reporting that BSF larvae can reduce organic waste by 70-80% under optimal conditions (Asri & Wani, 2024; Hartono et al., 2021). The slightly lower reduction in this program may be attributed to operational factors including waste composition variability, feed management optimization, and the initial learning curve of community operators. As community skills improve through continued operation, further efficiency gains are anticipated. The consistent daily processing of 100 kg demonstrates that the infrastructure and operational systems established are robust enough for sustained community management.

The economic analysis showing IDR1,100,000 monthly profit confirms maggot cultivation's viability as an income-generating activity, supporting circular economy principles (Widiyanto et al., 2024). This profit is particularly significant as it derives from converting waste materials that previously had negative value (disposal costs) into valuable products. The sensitivity of profit to kasgot utilization is noteworthy; the business model relies heavily on kasgot sales for profitability. This finding suggests that programs should emphasize kasgot marketing and utilization strategies, as maximizing kasgot sales significantly improves economic returns. The profit generated provides tangible economic incentives for continued community participation, addressing a common challenge in community-based waste management programs where activities often cease after external support ends (Wahyono et al., 2013). Several factors supported program success. The participatory approach, involving community members in planning, construction, and operations, fostered ownership and commitment; the village government's institutional support, including coordination, facilitation, and integration with BUMDes, provided legitimacy and sustainability pathways. The availability of abundant organic waste from households, markets, and food stalls ensured consistent raw material supply. The presence of local markets among poultry and fish farmers created immediate product demand.

However, several challenges were also identified. Variability in waste composition, particularly during rainy seasons when green waste increases, affected bioconversion efficiency. Limited community members' time availability for daily operations, as most have primary occupations in agriculture or small businesses, created scheduling constraints. Initial aversion to handling maggots and organic waste required persistent socialization efforts. These challenges highlight the importance of flexible operational scheduling, ongoing mentorship, and adaptive management approaches in community-based waste management programs. The program's contribution to circular economy development is evident through the conversion of waste materials into valuable products (maggots and kasgot) that re-enter production systems as animal feed and fertilizer. This reduces reliance on synthetic inputs in agriculture and aquaculture while addressing waste management challenges. The institutional framework established, including the management group and SOPs, provides the organizational foundation for continued circular economy activities beyond the program period.

CONCLUSION

The Community-Based Maggot Production program successfully addressed organic waste management challenges in Kelir Village. The program resulted in the establishment of a community-operated production unit processing 100 kg of organic waste daily, achieving a 40% waste volume reduction. Community knowledge increased significantly from 54 pre-test to 87 post-test, representing a 61.1% improvement. The production unit generated monthly profit of IDR 1,100,000, demonstrating economic viability and providing income for the management group. Institutional strengthening through management group formation and SOP development ensures program sustainability. The program contributes to circular economy development by converting waste into valuable products while building community capacity in sustainable waste management. Future program development should focus on optimizing kasgot utilization to maximize economic returns, expanding market networks, and integrating with village government programs for long-term sustainability.

ACKNOWLEDGEMENT

The authors would like to thank the Kelir Village, Kalipuro District, Banyuwangi Regency, for their participation in the socialization and training on maggot cultivation for processing organic waste, which contributed to the success of this activity. The authors also express their gratitude to the P3M of the Banyuwangi State Polytechnic for their financial support in carrying out this community service activity

REFERENCES

- Asri, F. M., & Wani, C. E. (2024). Organic Waste Processing Innovation Using the Black Soldier Fly (BSF) Method for Local Food Independence. *BA: Journal of Community Service*, 2(1), 8–12. <https://doi.org/10.58477/ba.v2i1.213>
- Fitriyah, S., & Nisa, R. (2021). Organic Waste Processing Using Black Soldier Fly (BSF) with Plasma Pattern Method. *Afiasi: Journal of Public Health*, 7(3), 356–363.
- Hartono, R., Anggrainy, A. D., & Bagastyo, A. Y. (2021). The Effect of Waste Composition and Feeding Rate on the Bioconversion Process of Organic Waste by Black Soldier Fly (BSF) Larvae. *Journal of Chemical and Environmental Engineering*, 5(2), 181–193.
- Jatnika, G. R. (2025). Comparison of the Effectiveness of Bioconversion of Market and Restaurant Waste Using Maggots (Black Soldier Fly Larvae). *Journal of Information, Science and Technology*, 8(1), 10–18.
- Muyasaroh, S. (2025). Review of household-scale organic waste processing methods in Indonesia. *Jurnal Jernih*, 3(2), 120–136.
- SIPSN KLHK. (2024). *National Waste Management Achievements*. National Waste Management Information System of the Ministry of Environment and Forestry.
- Wahyono, S., Sahwan, F. L., & Suryanto, F. (2013). Community-Based Waste Management in Rawasari, Cempaka Putih Timur Subdistrict, Central Jakarta. *Journal of Environmental Engineering*, 13(1), 75–84.
- Widiyanto, H., Yusmaman, W. M., Rohmah, S. N., & Akbarsyah, M. A. (2024). Maggot-Based Organic Waste Management Model within a Circular Economy Framework in Surakarta City. *Bengawan Solo Journal: Center for Research and Innovation Studies, Surakarta City*, 3(2), 55–71. <https://doi.org/10.58684/jbs.v3i2.81>