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Kasgot Bioconversion of MBG Organic Waste to Increase Healthy Vegetable Production at BSU Bintang Mandiri

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Abstract
Background. Frass (Kasgot) produced from Black Soldier Fly (BSF) larva cultivation is a high-value organic soil amendment, rich in nutrients and beneficial microorganisms.
Aims. This community service initiative was designed to support the BSU Bintang Mandiri waste bank group in Karang Rejo, North Metro, Metro City, Lampung, by utilizing BSF frass in vegetable cultivation.
Methods. The program included training on producing frass from organic waste generated by the Free Nutritious Meal (MBG) program—fermented using the Pumakkal bioactivator—and providing guidance on applying the frass to lettuce, scallions, and eggplants grown in a screen house. The team used varying frass dosages to observe how changes in growing medium composition affected plant growth.

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Result. The results of this community service program indicate that the BSU Bintang Mandiri group was highly enthusiastic about the training, responded positively during the mentoring process, and was willing to apply the frass to their growing media.
Conclusion. Their understanding of frass as a soil amendment and organic fertilizer improved.

Keywords: Waste MBG bioconversion; BSF frass; soil amendment; organic vegetable

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INTRODUCTION

The Free Nutritious Food (MBG) program, implemented since 2025, produces large volumes of organic waste from processing kitchens throughout Indonesia. MBG kitchens with a capacity of 1,500 servings/day have the potential to produce 120–300 kg of organic waste, 500 liters of rice washing water (ACB), and 15–45 liters of used cooking oil per day (Ghgs & Top, 2011);(Arisings, 2016). 2024). In Metro City, Lampung, this waste stream has not been managed optimally and could become an environmental burden, as well as causing a loss of economic opportunities worth millions of rupiah per month.

The Bintang Mandiri Unit Waste Bank (BSU) Group in Karang Rejo Village, North Metro District, is one of the domestic waste management groups that operates conventionally by collecting and selling inorganic waste. This group faces a capacity gap: it is only able to manage 50–100 kg of mixed waste per day with a thin margin of ±10–15%, while the potential for MBG organic waste, which is 3–6 times larger than this capacity, has not been tapped (Papargyropoulou et al., 2014). Diversification of organic waste-based products is a strategic imperative for the sustainability of the group's business. One of the most promising bioconversion technologies of organic waste is the cultivation of Black Soldier Fly (BSF) larvae, Hermetia illucens L. BSF is able to convert organic waste into high-protein larval biomass (protein content of 40–45%) and produce residues in the form of frass or known as kasgot — short for "former maggot media" (Lalander et al., 2015);(Surendra et al., 2020). Kasgot is a combination of larval feces, exudate, partially decomposed feed media residues, and chitin from larval exudate. This composition makes it a soil amendment with a wide spectrum of benefits, different from conventional organic fertilizers.

The main problem partners face is not only organic waste management, but also how to convert this waste into production inputs with agronomic value. Therefore, this activity is directed at the integration of three components, namely (1) organic waste management and

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bioconversion, (2) improving the quality of planting media through the application of kasgot, and (3) producing healthy vegetables as a form of nutrient reuse in a circular agriculture system.

The purpose of this activity is to increase the capacity of the BSU Bintang Mandiri group in producing and utilizing kasgot from organic waste, increase understanding of the function of kasgot as an improvement of planting media and organic fertilizers, and support the application of kasgot-based planting media for healthy vegetable cultivation

METHODS

Location and Target Audience

The service activity was carried out in the BSU Bintang Mandiri group, Karang Rejo, North Metro District, Metro City, Lampung Province (coordinates 5°07' LS, 105°18' E). The target group is a waste bank group with the potential to develop organic waste management and community-based vegetable production activities. The activity involved 30 participants, consisting of members of the BSU Bintang Mandiri group and community members around BSU.

Activity Approach

The activity uses a participatory community empowerment approach, namely the community is involved from the stage of problem identification, technology introduction, kasgot production practices, kasgot application in planting media, to evaluation of cultivation results.

The stages of the activity include:

1. Identify the conditions and needs of partners;
2. Submission of material on organic waste management and bioconversion using BSF;
3. The practice of producing casgot from organic waste;
4. Fermentation of organic matter using Pumakkal bioactivator;
5. Processing and preparation of kasgot for application;
6. Preparation of planting media with several levels of kasgot dosage;
7. Cultivation of lettuce, leeks, and eggplant;
8. Assistance in plant maintenance in screen houses;
9. Evaluation of plant growth, increased understanding and acceptance of technology by partners.

Kasgot Production

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The organic materials used come from MBG program waste. The materials are processed through bioconversion using BSF larvae. Pumakkal bioactivators are used in the fermentation process of organic matter in accordance with the procedures applied in this activity (Sutanto et al., 2016). The production stages include preparing organic matter, fermentation, providing materials as BSF larval substrates, larval maintenance, separating the cast residue, drying or stabilizing it, and preparing the cast as a material to improve the planting medium.

Kasgot Application on Planting Media

Kasgot was applied to the planting medium at several doses to show the effect of changes in medium composition on plant growth. The doses used in the activity are: 5 tons/ha, 10 tons/ha, and 15 tons/ha.

Program Achievement Evaluation

The evaluation assessed partners' capacity and the cultivation results achieved during the mentoring.

RESULTS AND DISCUSSION

Initial Conditions and Partner Problems

The BSU Bintang Mandiri group has strong potential to develop a community-based waste management system. Previous activities show that the group responded positively to the introduction of kasgot technology and is willing to apply it to planting media. This shows that social capital is important for technological sustainability. The problems found do not stop at waste collection; they also relate to how organic waste can be converted into value-added products. In the context of urban agriculture, reusing organic waste to produce kasgot can link waste management and food production. The model aligns with circular economy principles because materials previously seen as waste are returned to the production system as agricultural inputs. The latest literature places frass as one of the potential products of circular agriculture systems because it can return carbon and nutrients to the soil while reducing dependence on external inputs

Bioconversion of Organic Waste into Kasgot

BSF bioconversion technology provides added value to organic waste through biological processes. In this activity, organic waste from the MBG program serves as the base material for producing frass. Black Soldier Fly has a life cycle of eggs, larvae, pupa, and adult

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flies. Adult flies lay eggs in organic waste, and larvae, or maggots, hatch. These maggots will feed on organic waste and grow quickly (Figure 1). After becoming full larvae, they will turn into pupae (pupa) and become adult flies.



Figure 1. Life of the Magot and organic waste

This approach provides two benefits simultaneously: reducing the burden of organic waste and producing materials that can be reused in plant cultivation. Kasgot is not an organic material with uniform characteristics. Kasgot composition is strongly influenced by larval feed materials, bioconversion processes, and stabilization stages. Research (Salomon et al., 2025) shows that the source of BSF raw materials affects nitrogen availability and soil microbiological responses. Therefore, using MBG organic waste as a raw material requires consistent process management to keep waste quality relatively uniform. Research on food waste recycling using BSF also shows that the addition of complementary materials such as straw can reduce the salinity of the frass (Antoniadis et al., 2023), while the advanced composting process can produce kasgot with more suitable characteristics as organic fertilizers (Wantulla et al., 2024). This shows the importance of the stabilization stage before using kasgot in planting media.





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Figure 2. Characteristics of Kasgot according to the type of waste

Kasgot as a Planting Media Imitator

One of the main contributions of this activity is to introduce a paradigm shift: kasgot is not only fertilizer but also a plant media improver. Applying organic matter can increase organic carbon content and provide a substrate for microorganisms. The application of kasgot increases the content of organic matter and nitrogen absorption of plants and results in an increase in plant biomass (Lalander et al., 2015). This effect shows that organic matter from insect bioconversion can improve the plant growth environment while increasing nutrient supply.

Three mechanisms explain how media quality improves. First, kasgot adds organic matter that serves as a carbon source. Second, kasgot provides nutrients that can mineralize gradually. Third, the organic components of kasgot can affect microbial activity in the media. Research (Gebremikael et al., 2022) suggests that applying BSF kasgot increases microbial biomass and soil enzyme activity. Thus, improvements in media quality depend not only on the amount of nutrients added, but also on changes in the biological processes that regulate nutrient transformation and availability.

From the perspective of soil fertility, kasgot has a nitrogen (N) content of 2.2–4.8%, phosphorus (P_2O_5) 2.1–3.6%, potassium (K_2O) 1.4–2.8%, and organic matter 40–65%(Gärttling & Schulz, 2022); (Lomonaco et al., 2024). The content of chitin in kasgot has been shown to play a dual role: as a substrate for chitin-decomposing bacteria that indirectly suppress soil-borne pathogens such as Fusarium spp. and plant parasitic nematodes(Boudabbous et al., 2023). Some studies report noticeable increases in soil microbial diversity and biomass after kasgot application (Lalander et al., 2015), which is positively correlated with nutrient availability and crop productivity (Santos et al., 2026).

Plant Response to Kasgot Application

Applying kasgot to mustard greens, lettuce, pakcoy, leeks, and eggplant shows that the technology can be applied to several groups of vegetables with different growth characteristics. In this activity, several doses of kasgot were used to show that there are further changes in the composition of the planting medium that can affect plant growth.

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Figure 3. Kasgot application for the cultivation of various vegetables in a screenhouse

Conceptually, the plant's response to kasgot follows a dose-dependent pattern. Low doses have the potential to not provide enough nutrients to produce a maximum response, while appropriate doses can improve nutrient availability and media conditions. Conversely, overapplication can increase salinity or ammonium concentrations, so plant growth may decrease.

The application of Kasgot to leafy vegetable cultivation media can increase growth at a certain level, but increasing the dosage may decrease yields due to suboptimal salinity and oxygen conditions of the medium (Gebremikael et al., 2022). Therefore, applying kasgot in community cultivation should follow the principle of the *right source, right rate, right time, and right place,* not just increasing the amount of organic matter. The approach used in the activity at BSU Bintang Mandiri was to introduce several doses of kasgot to partners. The multi-dose approach is more educational than giving only one dose because the public can understand that the effectiveness of organic fertilizer depends on ingredient quality, dosage, and media conditions.

The application of Kasgot in vegetable cultivation is also expected to help the public understand that producing healthy vegetables in this activity is not simply production without synthetic fertilizers, but part of a production system that uses local resources efficiently, reduces waste, and improves planting-media quality. Using kasgot can reduce dependence on external inputs if nutrient needs can be partially met through bioconverted organic materials. The results of this community service emphasize that maggot-based bioconversion of organic waste, followed by the application of kasgot as an organic input, has the potential to improve soil health and plant growth and support a more circular food production system.

Capacity Building and Technology Adoption by Partners

The success of community service activities depends not only on plant response but also on changes in community capacity. The results show strong enthusiasm from the BSU

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Bintang Mandiri group during training and mentoring. Partners show a positive response and willingness to apply kasgot to planting media. Understanding of kasgot's function as an improvement to organic media and fertilizers has also increased.

These findings are important outputs because agricultural technology will not have a long-term impact if it stops at demonstrations. Technology adoption depends on the community's ability to repeat the process independently, the availability of raw materials, ease of use, costs, and perceived benefits. Based on the activities that have been carried out, the empowerment model of BSU Bintang Mandiri can be developed into a system:

MBG → BSF organic waste → kasgot → growing media → vegetables → consumption/sales → group sustainability

The model has added value because one activity produces several outputs. Organic waste is not only reduced in volume, but converted into production inputs. Kasgot is then used to produce vegetable commodities that can be used for household needs or developed into economic products

Key supporting factors for this model include partner enthusiasm, the availability of organic materials, the construction of screen house facilities, and the suitability of BSF technology for waste bank activities. Activities also have development opportunities because kasgot can be produced from local raw materials and reused in cultivation activities.

Obstacles to consider include variations in organic-matter quality, consistency in the bioconversion process, husk maturity, and the accuracy of the application dose. Variations in raw material sources can produce husgot with different chemical characteristics, so quality standards need to be considered. Husgot characteristics differ by insect species and raw material source. Therefore, the next activity should include analysis of husgot quality, including minimum pH, EC, moisture content, C-organic, N-total, P, K, and C/N ratio.

The advanced stage can also focus on creating operational standards for producing BSU Bintang Mandiri kasgot, formulating planting media based on kasgot dosage, packaging kasgot, and developing vegetables as the group's flagship product.

CONCLUSION

The service activities at BSU Bintang Mandiri show that organic waste bioconversion technology using BSF can be integrated with kasgot as an ingredient to improve planting media and support vegetable production. This approach not only increases public understanding of

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kasgot production but also introduces the concept of using kasgot appropriately in planting media.

Using multiple doses of kasgot provides an important learning approach for partners because kasgot's effectiveness depends not only on the presence of organic matter, but also on the quality and dosage of application. Integrating organic waste management, kasgot production, improved planting media, and vegetable cultivation has the potential to develop into a community-based circular agriculture model.

To sustain the program, it should standardize plant quality, determine the optimal dose by plant type, measure changes in the planting medium, and evaluate productivity and economic feasibility. Thus, BSU Bintang Mandiri not only functions as a waste manager, but can develop into a production unit of organic agriculture and vegetable inputs based on local resources.

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