



## Organic Waste Reduction Strategy through Maggot Cultivation and Composting In Kota Pari Village

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#### ABSTRACT

*Kota Pari Village is a developing village or can be categorized as an independent village. Waste is one of the problems experienced by this village. Waste generation in this village mostly comes from household waste which is a type of organic waste and the low level of public knowledge about waste management, especially organic waste, further exacerbates the situation in Kota Pari Village so that the waste problem becomes more complex and needs to be addressed immediately. The purpose of this activity is to carry out waste management through the use of insects (maggot cultivation) and microorganisms (composting) to reduce organic waste generation. This activity was carried out on June 1, 2024 until October 30, 2024. The methods used were identifying problems, conducting socialization, preparing containers and materials and training. The community that participated in this program showed a very good reaction and participated in all series of activities actively. The cultivation of maggot and composting of organic waste that has been carried out can foster community awareness in managing organic waste properly and can be a solution and strategy in reducing organic waste in the village environment.*

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### INTRODUCTION

Kota Pari Village is a developing village and is categorized as a self-help village. This village is located in Pantai Cermin District, Serdang Bedagai Regency, North Sumatra. Kota Pari Village is divided into 11 hamlets with an area of 1000.5 hectares and a population of around 7116 people. The increase in community activities and the large number of people has led to an increasing amount of waste generated (Alifvia et al., 2024:2077). Most of the waste generation in this village comes from household waste which is a type of organic waste. Organic waste is waste derived from biological materials (living things) that can be degraded by microbes

or biodegradable (Kamil et al., 2024:215). This is in line with data collected from the Ministry of Environment and Forestry (MoEF) in 2022, stating that the amount of waste generation in Indonesia is 68.7 million tons per year, which is dominated by organic waste, especially food waste of 41.27% and 38.28% of the waste is sourced from households (Ministry of Environment and Forestry, 2022).

In addition to the generation of organic waste, the low knowledge of the community about waste management, especially organic waste, further complicates the situation in Kota Pari Village so that the waste problem becomes more complex. Organic waste is certainly closely related to all human activities, so to be able to control it, there needs to be awareness from the community about the importance of managing this waste wisely (Putri et al., 2024:104). The success of waste management certainly depends heavily on people's behavior and knowledge of waste management (Saptenno et al., 2022:366). In line with the presentation of Law of the Republic of Indonesia Number 18 of 2008 concerning Waste Management, it states that appropriate waste reduction can be done by limiting waste generation, recycling waste and reusing waste. Therefore, the purpose of this study is to manage waste through the use of insects (maggot cultivation) and microorganisms (composting) to be able to reduce the generation of organic waste in Kota Pari Village.

Maggot cultivation was chosen because it is in accordance with the potential of Pari City Village in the livestock sector. Maggot cultivation is one of the effective ways to reduce organic waste using the help of BSF (black soldier fly) larvae that are able to decompose organic waste very well (Ussolikhah et al., 2023:56). BSF (black soldier fly) larvae can change and reduce the mass of garbage by around 52% - 56% (Izati et al., 2024:34). BSF larvae also contain 30%-45% protein with amino acids that are quite complete so that they can be used as animal feed (Mangisah et al., 2022:37). In addition to livestock, the agricultural sector is one of the main livelihoods of most people, so it is very relevant to composting. Compost is produced through the decomposition process of organic materials such as food scraps, leaves, grass, and agricultural waste through the help of microorganisms (Hastuti et al., 2024:78). Composting is considered very useful to increase agricultural production for the better, improve land quality and can reduce pollution (Firdani et al., 2023:139). Composting is not only a solution to be able to reduce organic waste but is able to produce useful natural fertilizers.

## METHODS

The target of implementing community service activities is the community from Kota Pari Village, including Family Welfare Empowerment (PKK), Integrated Service Post (Posyandu), Farmer Group Association (Gapoktan) and E-Trash Clinic Waste House Management. The activity stages include the preparation of organic waste, starting from the selection and sorting of waste. Then the preparation of maggot cultivation and composting, which involves preparing facilities, infrastructure and acquiring materials and tools. Furthermore, the implementation stage will involve the process of maggot cultivation and composting. The next stage is monitoring and evaluation, which aims to measure the effectiveness and success of the program. This activity was carried out in Kota Pari Village, Pantai Cermin District, Serdang Bedagai Regency, North Sumatra, Indonesia.

## Methods used

The methods used in this activity are as follows:



1. Problem identification. Identifying target community groups, namely Family Welfare Empowerment (PKK), Integrated Service Post (Posyandu), Farmer Group Association (Gapoktan) and E-Trash Clinic Waste House Management in processing organic waste.
2. Socialization is the process of learning norms, values, roles and all other requirements needed to enable effective participation in social life (Sekarningrum, Sugandi & Yunita, 2020). Socialization aims to educate the community about maggot cultivation and composting in organic waste management. This can be done through counseling, training, or socialization involving community work teams. In this stage, the PPK Ormawa team became a resource person in providing an explanation of what maggot and compost are, the benefits of maggot and compost, the process of breeding, caring for, and using maggot and the process of making compost in organic waste management were conveyed in detail.
3. preparation of containers and materials, together with the PPK Ormawa Team and the Community Work Team carried out the construction of maggot cages which aimed to place maggots and flies as maggot cultivation. In addition to making maggot and fly cages, the PPK Ormawa Team together with the Community Work Team also made a container or place for making compost from inorganic waste in the form of used buckets.
4. Training is activities designed to provide learners with the knowledge and skills needed for their current jobs (Cahya et al., 2021). Maggot cultivation training, which aims to provide training to the community and further socialization in the application of maggot cultivation methods directly on the maggot cage land which is attended directly by resource persons from the PPK Ormawa Team and explained in detail how to cultivate maggot from cage maintenance, how maggot breeds and how to cook live maggot into dry maggot by roasting. In addition, composting training was also given. Starting from the selection of organic waste, the materials and tools needed and how the process of making compost and things that must be considered in making compost in detail.

## RESULTS AND DISCUSSION

Cultivation of maggot and compost fertilizer is an activity of the Student Organization Capacity Building Program. This activity was carried out from June 1 to October 30, 2024. The implementation of maggot and compost cultivation activities is divided into 3 stages, namely: introduction to the program, preparation of containers and materials, and training in maggot cultivation and composting. The target group for this activity is Family Welfare Empowerment (PKK), this group was chosen to be the target group because this group has the potential to support the success of the program and to create a sustainability movement that can involve the entire village community in maggot cultivation and composting activities which are integrated with programs that have been designed in PKK activities, such as environmental and health programs. The Integrated Service Post (Posyandu) was also chosen as one of the target groups. The Posyandu women were chosen as the target group because this group is a strategic group to achieve program objectives in improving health, welfare and environmental awareness in the

village community, and Posyandu members have direct access to interact with the community in posyandu programs that are routinely held every week around the village, thus information about this activity can be widely spread among the village community and information about maggot cultivation and composting, as well as its benefits in reducing waste and improving family welfare can be known by the community. The next group to be targeted is the Farmers Group Association (Gapoktan) because this group can be a forum for farmers in the village to collaborate in agriculture, and this group has a direct relationship in the agricultural sector that requires organic fertilizer, based on an interview on June 15, 2024 conducted with the head of the farmer group in Kota Pari village stated that farmers in this area still depend on chemical fertilizers to support their agricultural productivity, so that through this target group it can become an example in making compost and disseminating information in the use of compost as an alternative to organic fertilizer. The E-Trash Clinic Waste House Management was formed into a group tasked with managing and running the operational activities of the digital waste house. The management is tasked with organizing the process of collecting, sorting, managing waste and educating the community about efforts to reduce organic waste in the village environment through maggot cultivation and making organic compost.

### Socialization

The socialization of maggot cultivation and compost fertilizer is an activity that aims to utilize organic waste as a strategy to reduce organic waste in the village environment. This socialization activity was carried out on Sunday, July 13, 2024, which took place at the office to the village in Kota Pari Village, Pantai Cermin District, Serdang Bedagai Regency, North Sumatra, Indonesia. This activity was attended by around 35 participants consisting of village officials, combined farmer groups (gapoktan), mothers of family welfare development (pkk) and mothers of integrated service posts (posyandu) who are housewives and representatives of KKN (Real Work Lecture) students. Most of the participants were not familiar with maggot cultivation and composting as organic waste management solutions. In the socialization activity, starting with PPK Ormawa students explaining the purpose of this activity is to help overcome waste problems and one way is by cultivating maggot and making compost as a strategy to reduce organic waste as well as the products produced as a means of empowering the community to increase economic growth. The socialization activity continued with the process of introducing maggot and compost, the benefits of maggot and compost, the process of breeding, care, and use of maggot and the process of making compost in organic waste management were conveyed in detail, then continued with a question and answer session that took place in two directions between participants and PPK Ormawa students.



**Figure 1.** Socialization of maggot cultivation and compost fertilizer

### Preparation of containers and materials

This section describes the preparation of the required containers and materials used in maggot and compost cultivation. Good preparation is essential for successful cultivation and quality of maggot and compost.

**Table 1.** Preparation stage of maggot cultivation container and compost making

| <b>Preparation for Maggot Cultivation</b> |                                                                  |                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name of products</b>                   | <b>Size of products</b>                                          | <b>Explanation of products</b>                                                                                                                                                                                                                                                                                                                                                 |
| Maggot Sometimes                          | in size<br>Width: 1meter<br>Height: 2 meter<br>Length: 1.5 meter | Where BSF (Black Soldier Fly) mate and produce eggs, which will later be hatched as BSF maggot seedlings. BSF flies can fly above 1.5 meters, so the cage needs to be high enough. BSF egg-producing cages are made of small-density nets to keep the flies from escaping.                                                                                                     |
| Eggies                                    | 25cmx4cm in size.                                                | Small pieces of wood joined together with a small cavity between the pieces of wood that serves as a medium for laying eggs. The cavity will be used as a place for BSF to lay their eggs.                                                                                                                                                                                     |
| Pupal container                           | 25cmx20cm in size.                                               | The pupa container is where the pupae are placed before turning into flies. In the egg-producing BSF cage, to maintain the continuity of the cultivation cycle, the pupae that will become brood flies are placed in the cage.                                                                                                                                                 |
| Hatching biopond                          | 36cmx30cm in size.                                               | The hatching biopond is used for the maggot rearing process from hatching to 7 days old. Hatching bioponds are usually square-shaped with various variations in size depending on the number of eggs you want to hatch                                                                                                                                                         |
| Enlargement biopond                       | 150x100 cm in size.                                              | The enlargement biopond is used for the enlargement process of BSF maggot from 8 days old until the BSF maggot is ready to be harvested. The enlargement biopond is a place for feeding organic waste to BSF maggot.                                                                                                                                                           |
| Migration biopond                         | 150x100 cm in size.                                              | The migration biopond is used for the migration process of BSF maggot to the pre-pupal phase. On one side of the biopond, there is a 45° slope as a path for maggots to the empty space located on the side session of the migration biopond. This slope serves to facilitate adult BSF larvae to migrate to the biopond trench (prepupae container) with a drier environment. |
| Feed storage area                         | 50 L capacity with height: 44 cm, top diameter: 46 cm and bottom | The feed storage area serves as a container for storing maggot feed. To make it easier for BSF maggot to eat organic waste, cultivators usually process the organic waste first before giving it to                                                                                                                                                                            |

|                               |                                                                            |                                                                                                                 |
|-------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
|                               | diameter 35 cm                                                             | BSF maggot by chopping or mashing it using a chopper or machine into a smaller size and texture like porridge.  |
| <b>Composting preparation</b> |                                                                            |                                                                                                                 |
| Bucket with lid               | measuring 25 kg capacity with a height of 38.5 cm and a diameter of 30 cm  | The composter bucket functions as a container in the collection that turns organic waste into compost.          |
| Filtering bucket              | measuring 25 kg capacity with a height of 38.5 cm and a diameter of 30 cm. | The filtering bucket functions as a container for collecting and removing composting liquid (compost leachate). |

**Table 2.** Preparation stage of maggot cultivation and composting materials

| <b>Preparation for Maggot Cultivation</b> |                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Material name</b>                      | <b>Material function</b>                                                                                                                                                                                                                                                                          |
| Rice bran                                 | Rice bran functions as a hatching medium as it provides initial nutrients to aid growth, and maintains moisture to create a conducive environment for BSF larval development.                                                                                                                     |
| Organic waste                             | organic waste serves as the main source of feed in maggot cultivation                                                                                                                                                                                                                             |
| Fermentation waste                        | Fermented waste serves as a feed medium for maggot cultivation because of its high nutritional content and is easier to digest and can be used as a solution to help manage organic waste efficiently by reducing odor pollution and reducing the risk of disease.                                |
| Mangot seedlings                          | Maggot seeds can be eggs or early larvae of BSF (Black Soldier Fly) flies that serve as a start in starting maggot cultivation.                                                                                                                                                                   |
| <b>Composting preparation</b>             |                                                                                                                                                                                                                                                                                                   |
| Green waste                               | Green waste serves as a source of nitrogen in the composting process. Examples of green waste are vegetable scraps, fruit, leaves and fresh grass.                                                                                                                                                |
| Brown waste                               | Brown waste serves as a source of carbon in the composting process, and helps maintain compost moisture. Examples of brown waste are dry leaves or grass, sawdust, wood shavings, rice husks, corn husks and straw                                                                                |
| EM4 (Effective Microorganism s 4)         | EM4 (Effective Microorganisms 4) serves to accelerate the decomposition of organic matter and improve the quality of composting because EM4 (Effective Microorganisms 4) contains a variety of live microorganisms such as lactic acid bacteria, photosynthetic bacteria and fermentation drying. |



### Training on maggot cultivation and composting

The training on maggot cultivation and composting was conducted to educate the community and as a strategy to reduce organic waste in the village environment. Maggot cultivation training was conducted on September 13, 2024. In this activity, PPK Ormawa students act as facilitators who provide material and technical guidance in making compost. This activity was attended by 10 participants, namely the management of digital waste houses in Kota Pari Village, Pantai Cermin District, Serdang Bedagai Regency, North Sumatra. The management of the waste house is a community that is elected and formalized by a decree known by the village head with the aim of managing and running the operational activities of the digital waste house. The management is tasked with organizing the process of collecting, sorting, managing waste and educating the community about efforts to reduce organic waste by cultivating maggots.



**Figure 2.** Training on maggot cultivation

Compost training was conducted on September 3, 2024 which was attended by 6 participants from representatives of Gapoktan (Farmer Group Association) in Kota Pari village, Pantai Cermin sub-district, Serdang Bedagai Regency, North Sumatra with PPK Ormawa students as facilitators who provided material and technical guidance in making compost. This training is designed so that the understanding of the material can be conveyed well and the selection of Gapoktan representatives as participants aims to start introducing composting techniques among farmers first, so that the hope is that these Gapoktan representatives will become agents of change who can apply and disseminate understanding to other communities about composting with organic materials as natural fertilizer and organic waste reduction strategies in the village environment.



**Figure 3.** Composting training

## Discussion

The introduction of maggot cultivation and compost fertilizer to the community was carried out by means of socialization to the community. The socialization was carried out at the Kota Pari Village Hall. The socialization activity aims to provide information on the importance of processing organic waste, which is dominantly sourced from household waste. In addition, it aims to provide training and assistance on the management of organic waste into maggot as waste bioconversion and compost. The implementation of household organic waste processing training is a good example that needs to be maintained and become the main activity in environmental management originating from households to the city level. With a waste management approach at the RT to RW level, it can increase knowledge, understanding and skills in improving health and environmental sustainability (Ningsih and Siswati, 2021).

Socialization is a type of activity that provides an explanation of activities and knowledge about the things discussed during the activity (Herdiana, 2018). The socialization activities carried out went well and the participants who participated in this activity were very enthusiastic and enthusiastic during the demonstration or training on maggot cultivation and composting. A shortcoming in the implementation of the training is the unavailability of a waste chopping machine. Large amounts of waste must be chopped manually using long plywood as a base and a machete as a waste cutting tool. The unavailability of a shredding machine can make the work time less efficient. In addition, the organic matter produced from manual shredding is large and coarse, which can hinder the speed of composting and decomposition of waste by maggots.

A natural renewal used to reduce organic waste with the help of waste-decomposing microorganisms that is easy to do in particular is with maggots. Maggot or the larvae of the Black Soldier Fly (BSF) is not only used as a decomposer of organic waste left over from community consumption, but can be an option for farmers to feed their livestock (Utami et al., 2020). Maggot is a Black Soldier Fly (BSF) larva whose life is often considered a pest by the public. In fact, maggot can be used as an alternative livestock feed because it has high animal protein and is resistant to mold and pests (Bibin et al., 2021).

The maggot socialization and training conducted by the PPK Ormawa Team of UKMI AR RAHMAN MEDAN STATE UNIVERSITY is based on the animal feed problems faced by the community. The results of observations that have been made show that the increasing price of animal feed has caused public unrest. A solution or effort is needed to reduce the high price of animal feed. Through maggot cultivation carried out by the PPK Ormawa Team UKMI AR RAHMAN MEDAN STATE UNIVERSITY can be a solution to overcome the soaring cost of animal feed.

After the socialization of maggot and compost, the PPK Ormawa UKMI AR RAHMAN UNIVERSITY MEDAN NEGERI team facilitated the village community by taking direct action in making maggot and compost media. In this activity, the team has prepared a number of containers that will be used as media making materials. In the implementation session of maggot and compost cultivation, the team involved community participation in a number of stages carried out. The implementation activity of making maggot and compost media lasted for 2 hours. At the end of the meeting, the team provided conclusions regarding post-activities.

Maggots were chosen for cultivation because they can easily multiply and survive. The medium in the maggot growth process is organic waste which has a positive impact on the environment. Maggot as a decomposer of organic waste and an environmental stabilizer in terms of utilizing organic waste, can also be used as a place to benefit from the decomposition of waste



by maggot when it is harvested and traded for alternative animal feed (Salman et al., 2020). The biomass produced by maggot can still be used as a support in agricultural activities as an organic fertilizer called Kasgot (spent maggot). The study by Jeon et al. (2021) states that Black Soldier Fly (BSF) maggot can decompose organic waste effectively, reduce organic waste by 56% and produce useful by-products such as liquid fertilizer and protein sources for animal feed. Within the scope of sustainable environment, maggot can be optimized as organic fertilizer. Compost from spent maggot can be part of circular economy and zero waste measures (Fauzi et al., 2022).

The utilization of maggot cultivation as one of the solutions in reducing the amount of organic waste can also be done by composting. Maggot cultivation and composting have similarities in the waste chopping process. According to Mukhtar et al., (2024) stated that using a waste shredder can increase the volume of compost produced as well as a decrease in production time, homogeneous shredded results and can meet the standards for agricultural use. In the activities carried out by the Team using bio activator EM 4. In addition to EM 4, the use of tree branches and dry leaves is also given in composting.

With the cultivation of maggot and composting of organic waste that has been carried out, it can raise public awareness in managing organic waste properly. In addition, it can be a solution in reducing the high price of feed and fertilizer. In addition, the socialization and training that has been carried out can increase the understanding and knowledge of the community in handling organic waste. The lack of public knowledge about processing waste into something useful needs continuous socialization (Suprpto, 2017).

## CONCLUSION

This activity was carried out with the aim of waste management through the use of insects (maggot cultivation) and microorganisms (composting) to reduce organic waste generation in Kota Pari Village. The implementation of this program begins with the introduction of the program, preparation of containers and materials, and training in maggot cultivation and composting has been carried out well. The community that participated in this program showed a very good reaction and participated in all series of activities actively. With the cultivation of maggot and composting of organic waste that has been carried out, it can foster community awareness in managing organic waste properly so that it can be a solution as a strategy to reduce organic waste in the village.

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