



## Adoption of Maggot (*Hermetia illucens*) Cultivation as an Affordable and Environmentally Friendly Alternative Fish Feed

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### Article History:

Received: May 30<sup>th</sup> 2025

Revised: Sept 15<sup>th</sup> 2025

Accepted: Nov 30<sup>th</sup> 2025

**Keywords:** *Alternative Fish Feed; Maggot Cultivation; Organic Waste.*

**Abstract:** *The waste problem in Dukuhwaluh Village was still a lot of household waste thrown away in any places. This household waste causes unpleasant odors, environmental pollution, various disease outbreaks, aesthetic disturbances, and flooding during the rainy season. Another problem encountered in Dukuhwaluh Village is the provision of feed for catfish farmers, the price of which is increasingly expensive. This causes the development of the catfish farming business to be very slow and even threatened with collapse. This community service activity aims to increase the knowledge and skills of fish farmers in Dukuh Waluh Village in cultivating maggots using media from household organic waste. This community service activity also aims to develop magot as an alternative fish food that is cheap, has high nutritional value and is environmentally friendly. The implementation of this community service uses research-based community empowerment methods. Meanwhile, the approach method used in implementing community service is active and collaborative participation. The results of community service activities can increase the knowledge and skills of the Dukuhwaluh Village fish farmer in maggot cultivation. The fish farmer group has also been able to practice magot cultivation using household organic waste properly and correctly, as well as applying the results of maggot cultivation to feed catfish. Throughout an 80-day cultivation period, catfish fed a combination of commercial feed and maggots demonstrated an average daily weight gain of 1.5 grams and achieved a feed conversion ratio (FCR) of 1.2. The incorporation of maggots as an alternative protein source was able to substitute up to 45% of the commercial feed without compromising growth performance.*



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## Introduction

There are numerous condensed housing areas and shared dwellings surrounding Universitas Muhammadiyah Purwokerto (UMP) in Indonesia. These are primarily concentrated in the Dukuhwaluh and Dampit areas of Dukuhwaluh Village, Kembaran Subdistrict, Banyumas District, Central Java Province. The inhabitants of these residences generate an estimated 2 tons of both organic and inorganic household waste daily, consisting mostly of organic waste. The accumulation of household waste in inappropriate locations remains a significant issue in Dukuhwaluh. Despite the local government providing waste disposal centers, these facilities are located far from residential areas and poorly managed. Consequently, a considerable amount of waste is disposed on vacant land, in household drains, and into irrigation channels. This leads to unpleasant odors, environmental pollution, disease transmissions, aesthetic disturbances, and flooding during the rainy season. These phenomena reflect a general lack of environmental awareness, particularly regarding waste management practices.

One potential solution to address the organic household waste problem in Dukuhwaluh is to use it as a medium for maggot cultivation. Maggots have excellent bioconversion capabilities, meaning they can consume decaying organic matter and transform it into biologically high-value biomass rich in proteins and lipids, which are suitable for animal feed.<sup>1 2</sup> Their ability to decompose organic waste and use it as a breeding medium facilitates easy mass production.<sup>3 4</sup>

Another issue in Dukuhwaluh is the financial hardship experienced by catfish cultivators due to the high cost of fish feed. A group of approximately 20 fish farmers has been operating their catfish cultivation businesses in Dukuhwaluh since 2019. However, the development of their businesses has been very slow and at risk of shutting down. The primary challenge is the rising cost of factory-produced fish feed, which significantly reduces profit margins. Currently, premium-quality factory-made fish feed costs up to 15,000 IDR/kg, while the selling price of catfish is only 20,000 IDR/kg. This situation results in low profitability for the catfish farming business, making it difficult for the farmers to sustain and grow their operations.

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<sup>1</sup> Gardis Andari, Nina Maksimiliana Ginting, and Ramdan Nurdiana, "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak," *Jurnal Ilmiah Peternakan Terpadu* 9, no. 3 (2021): 246–252.

<sup>2</sup> Dewi Yuli Yana et al., "MaGoGreen: Teknologi Bio-Konversi Sampah Organik Sebagai Pakan Ternak Alternatif Memanfaatkan Larva Black Soldier Fly," *ABDIKU: Jurnal Pengabdian Masyarakat Universitas Mulawarman* 1, no. 1 (2022): 6–10.

<sup>3</sup> Amira Amandanisa and Prayoga Suryadarma, "Kajian Nutrisi Dan Budi Daya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RT 02 Desa Purwasari, Kecamatan Dramaga, Kabupaten Bogor," *Jurnal Pusat Inovasi Masyarakat* 2, no. 5 (2020): 796–804.

<sup>4</sup> Seliwati Ginting et al., "Budidaya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cireunghas, Kabupaten Sukabumi," *Jurnal Abdi Nusa* 2, no. 3 (2022): 90–95.

An alternative feed made from maggots offers a potential solution to address the high cost of factory-made fish feed. Maggots (*Hermetia illucens*) are a natural feed option suitable for fish due to their high protein content and ease of mass production. According to <sup>5</sup>, maggots can be cultivated in organic waste media and used as supplementary feed for tilapia fish. Furthermore, ref. <sup>6</sup> identified maggots as a natural nutrient-rich feed source, containing 40-50% protein and 29-32% lipid. A study by <sup>7</sup> demonstrated that using a feed mixture of 50% pellets and 50% maggots could reduce catfish feeding costs by 22.74%. Maggots contain 41.22% protein and have specialized trophocyte organs that store nutrients absorbed from their culture media. <sup>8</sup>. Ref. <sup>9</sup> also reported that maggot porridge could serve as supplementary feed for salmon. Additionally, <sup>10</sup> found that fish feed containing maggots can substitute fishmeal for feeding parrot fish and catfish. Moreover, maggots have been identified as a viable alternative feed for snakehead fish. <sup>11</sup>

Various maggot cultivation initiatives have been successfully implemented across different regions. Ref. <sup>12</sup> conducted training on Black Soldier Fly (BSF) cultivation for use as animal feed in Miri Village, Kismantoro District, Wonogiri. Educational outreach on utilizing organic waste for maggot cultivation as an alternative source of animal feed conducted by <sup>13</sup>. Similarly, <sup>14</sup> developed cultivation media for maggots intended for fish and poultry feed. Meanwhile, <sup>15</sup> carried out a community awareness program on maggot cultivation as an alternative fish feed in RW 05, Cikurutug Village, Cirebon District,

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<sup>5</sup> Rafael Pérez-Pacheco et al., "Growth of the Black Soldier Fly *Hermetia Illucens* (Diptera: Stratiomyidae) on Organic-Waste Residues and Its Application as Supplementary Diet for Nile Tilapia *Oreochromis Niloticus* (Perciformes: Cichlidae)," *Insects* 13, no. 4 (2022): 326.

<sup>6</sup> Guido Bosch et al., "Protein Quality of Insects as Potential Ingredients for Dog and Cat Foods," *Journal of nutritional science* 3 (2014): e29.

<sup>7</sup> Andari, Ginting, and Nurdiana, "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak."

<sup>8</sup> Akhmad Azir, Helmi Harris, and Rangga Bayu Kusuma Haris, "Produksi Dan Kandungan Nutrisi Maggot (*Chrysomya Megacephala*) Menggunakan Komposisi Media Kultur Berbeda," *Jurnal Ilmu-ilmu Perikanan dan Budidaya Perairan* 12, no. 1 (2017).

<sup>9</sup> Feng-Meng Xu et al., "Effects of Zymolytic Black Soldier Fly (*Hermetia Illucens*) Pulp as Dietary Supplementation in Largemouth Bass (*Micropterus Salmoides*)," *Aquaculture Reports* 21 (2021): 100823.

<sup>10</sup> G J Were et al., "Nutritional and Microbial Quality of Extruded Fish Feeds Containing Black Soldier Fly (*Hermetia Illucens* L) Larvae Meal as a Replacement for Fish Meal for Nile Tilapia (*Oreochromis Niloticus*) and African Sharptooth Catfish (*Clarius Gariepinus*)," *Journal of Applied Aquaculture* 34, no. 4 (2022): 1036-1052.

<sup>11</sup> Fitriani Fitriani, Helmi Haris, and Rih Laksmi Utpalasari, "Pemanfaatan Maggot (*Hermetia Illucens*) Sebagai Pakan Alternatif Dengan Kombinasi Pakan Pelet Terhadap Pertumbuhan Dan Sintasan Ikan Gabus (*Channa Striata*)," *Indobiosains* (2023): 13-24.

<sup>12</sup> Sholahuddin Sholahuddin et al., "Potensi Maggot (Black Soldier Fly) Sebagai Pakan Ternak Di Desa Miri Kecamatan Kismantoro Wonogiri," *PRIMA: Journal of Community Empowering and Services* 5, no. 2 (2021): 161-167.

<sup>13</sup> Yana et al., "MaGoGreen: Teknologi Bio-Konversi Sampah Organik Sebagai Pakan Ternak Alternatif Memanfaatkan Larva Black Soldier Fly."

<sup>14</sup> Deden Sudrajat et al., "Media Budidaya Maggot Untuk Pakan Alternatif Ikan Dan Ayam," *Karimah Tauhid* 1, no. 3 (2022): 330-338.

<sup>15</sup> Ginting et al., "Budidaya Maggot (*Hermetia Illucens* L.) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cirebon, Kabupaten Sukabumi."

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Sukabumi Regency.

This community service activity aims to improve the knowledge and skills of fish farmers in Dukuhwaluh in cultivating maggots using organic household waste media. In addition, it seeks to promote the development of maggots as an alternative fish feed that is affordable, nutrient-rich, and environmentally friendly.

## Method

The community service activity was conducted in Dukuhwaluh Village, Kembaran Subdistrict, Banyumas District, from July to October 2024. The primary target group consisted of 20 local catfish farmers, who were selected to serve as initiators and sustainers of maggot cultivation using organic waste as a medium. This initiative aimed to provide an affordable, nutrient-rich, and environmentally friendly alternative to conventional fish feed.

A research-based community empowerment method was employed to carry out the activity, focusing on improving the knowledge and skills of the target group through a technology-shifting strategy. This was achieved via training sessions, hands-on practice, and ongoing mentoring. The applied maggot cultivation technology was developed from research utilizing organic household waste as the cultivation medium. According to <sup>16</sup>, incorporating maggots into fish feed can enhance the growth, feed digestibility, and feeding efficiency of gourami fish. The community service activity emphasized active and collaborative participation. The target group was actively involved in all stages of the project, including coordination, socialization, preparation, and implementation. They also collaborated with the executive team to provide necessary materials, equipment, and venues. Furthermore, collaboration with the local village government was established to gain support for the development of maggot cultivation, with the goal of strengthening the local economy.

The community service activity began with a situation analysis and identification of the target group's problems. Based on the findings, a solution strategy was developed, which included maggot cultivation training. The training aimed to equip fish farmers with the skills to produce affordable, nutrient-rich, and environmentally friendly alternative fish feed. It was delivered using lecture-based methods combined with interactive discussions. Following the training, hands-on practice was conducted, focusing on the production of maggot cultivation media from organic waste and the establishment of a sustainable maggot cultivation development center. Ongoing mentoring was provided throughout the maggot cultivation process until the maggots were successfully cultured

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<sup>16</sup> Suwarsito Suwarsito, Dewi Susylowati, and Aman Suyadi, "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)," *Sainteks* 21, no. 1 (2024): 15–23.

and ready for use in producing catfish feed.

The effectiveness of the training was evaluated using a pre- and post-test method to assess participants' knowledge of the materials delivered by the trainers. Additionally, their practical skills in applying the training content were evaluated through their ability in cultivating maggots successfully. This included all stages of the process: preparing the cultivation media, maintaining the maggots, harvesting them, and utilizing maggots to produce catfish feed in a continuous manner, ensuring a sustainable supply of affordable feed.

## Result

The community service activity was conducted in several stages, including socialization, training, and hands-on practice. The socialization stage aimed to communicate the planned programs to the target group. During this stage, the executive team also explained the requirements that the target group needed to fulfill, such as equipment and materials. Additionally, the venue and schedule for the training and hands-on practice sessions were determined.

The next stage consisted of training sessions. The training started with content delivery by experts, using PowerPoint presentations to facilitate an interactive lecture. The sessions covered how to cultivate maggots and use them to produce catfish feed. This was followed by discussions and a question-and-answer session, where participants explored solutions to the challenges faced by the target group. Key topics included addressing the rising cost of fish feed, which affects the profitability of fish farming. Participants raised questions about whether maggots could serve as a more affordable alternative feed for catfish and whether their use would have any negative effects on the farmed catfish. Some participants also inquired about the benefits of maggots as fish feed and whether maggots could be mass-produced effectively.



Figure 1. Maggot Cultivation Training

During the discussion forum in the training sessions, experts provide detailed answers and explanations to the participants' questions. One potential solution to the high cost of factory-made fish feed is the use of maggots as an alternative. Maggots (*Hermetia illucent*) are a natural feed option with high potential as fish feed due to their high protein content and mass-producibility.<sup>17</sup> According to<sup>18</sup>, maggots can be cultured in organic waste media and used as supplements for tilapia fish. Ref.<sup>19</sup> further highlighted that maggots are a natural feed source containing 40-50% animal protein and 29-32% lipid. Similarly,<sup>20</sup> reported that maggot larvae consist of 42.63% protein, 21.47% carbohydrate, and 21.38% lipid. The high protein content of maggots plays a crucial role in supporting fish body metabolism, tissue formation, and growth rates.<sup>21</sup>

Experts also explained the favorable properties of maggots. Maggots possess excellent bioconversion capabilities, meaning they can consume decaying organic substrates and transform them into biomass with high biological value, rich in protein and lipids, which are essential nutrients for fish feed.<sup>22,23</sup> Their ability to break down organic waste as their breeding medium contributes to their high mass producibility.<sup>24,25</sup> Their high protein content (40-50%),<sup>26</sup> low carbon footprint, ability to break down organic waste such as vegetables, fruits, kitchen scraps, and food waste, and their overall high nutrient value<sup>27</sup> make them an excellent candidate for fish feed. In addition, maggots produce considerable amounts of hydrolytic enzymes, such as amylase, lipase, and protease, which enhance the digestibility of feed nutrients,<sup>28</sup> thereby supporting

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<sup>17</sup> Seliwati Ginting et al., "Budidaya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cireunghas, Kabupaten Sukabumi," *Jurnal Abdi Nusa 2*, no. 3 (2022): 90-95.

<sup>18</sup> Pérez-Pacheco et al., "Growth of the Black Soldier Fly *Hermetia Illucens* (Diptera: Stratiomyidae) on Organic-Waste Residues and Its Application as Supplementary Diet for Nile Tilapia *Oreochromis Niloticus* (Perciformes: Cichlidae)."

<sup>19</sup> Bosch et al., "Protein Quality of Insects as Potential Ingredients for Dog and Cat Foods."

<sup>20</sup> Andari, Ginting, and Nurdiana, "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak."

<sup>21</sup> Suwarsito, Susyowati, and Suyadi, "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)."

<sup>22</sup> Andari, Ginting, and Nurdiana, "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak."

<sup>23</sup> Yana et al., "MaGoGreen: Teknologi Bio-Konversi Sampah Organik Sebagai Pakan Ternak Alternatif Memanfaatkan Larva Black Soldier Fly."

<sup>24</sup> Amandanisa and Suryadarma, "Kajian Nutrisi Dan Budi Daya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RT 02 Desa Purwasari, Kecamatan Dramaga, Kabupaten Bogor."

<sup>25</sup> Ginting et al., "Budidaya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cireunghas, Kabupaten Sukabumi."

<sup>26</sup> Bosch et al., "Protein Quality of Insects as Potential Ingredients for Dog and Cat Foods."

<sup>27</sup> Chiara Ceccotti et al., "New Value from Food and Industrial Wastes-Bioaccumulation of Omega-3 Fatty Acids from an Oleaginous Microbial Biomass Paired with a Brewery by-Product Using Black Soldier Fly (*Hermetia Illucens*) Larvae," *Waste Management* 143 (2022): 95-104.

<sup>28</sup> Wontae Kim et al., "Biochemical Characterization of Digestive Enzymes in the Black Soldier Fly, *Hermetia Illucens* (Diptera: Stratiomyidae)," *Journal of Asia-Pacific Entomology* 14, no. 1 (2011): 11-14.

improved fish growth.<sup>29</sup>

In the subsequent discussion forum, experts addressed the question of whether the use of maggots as fish feed could negatively affect the farmed catfish. They clarified that the non-excessive use of maggots would not have adverse effects on the fish. The proportion of maggots in the fish feed should not exceed 50%. This aligns with the findings of the study by<sup>30</sup>, which demonstrated that fish growth did not differ significantly when fed a mixture of 50% maggots and 50% commercial feed. Ref.<sup>31</sup> further supported this, showing that a 50:50 pellet-to-maggot combination could reduce costs by up to 22.74%. Thus, using maggots in a fish feed mixture can lower the overall cost of fish feed. It is expected that incorporating maggots will reduce fish farmers reliance on increasingly expensive commercially-produced fish feed while utilizing organic waste as a feed source for maggots.<sup>32</sup> Despite the higher protein content of maggots compared to commercial feed, the continued use of commercial feed remains necessary. This is because combining 2 or more protein sources in fish feed results in better fish growth compared to using a single protein source.<sup>33</sup>

Hands-on practice in maggot cultivation followed the training sessions, aiming to reinforce participants' understanding of the training content. The practice began with sorting organic waste suitable for maggots to digest and convert into energy. According to<sup>34</sup>, vegetable waste is highly digestible for maggots to convert into energy. Providing 10.0 mg of vegetable waste per larvae daily showed the highest conversion efficiency. Therefore, organic waste that is easily digested by maggots, such as vegetables, fruits, and food scraps, can be used as cultivation media. Conversely, other organic waste that is less digestible and contains high fiber, such fruit peels, fibrous vegetables, and leaves, is better suited for use as organic fertilizer or compost.

Following the sorting of organic waste, the preparation of maggot cultivation media was carried out. Organic waste was collected into a wooden box measuring 1 m in length, 0.5 m in width, and 0.2 in height. Watery waste was drained beforehand to prevent excessive water content in the media. Next, 100 gram of maggot eggs were introduced into the cultivation media. After approximately 2 weeks of incubation, the eggs hatched. For larval husbandry, organic waste was regularly added to serve as a nutrient source for

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<sup>29</sup> D Suwarsito & SusyLOWATI, "Kinerja Benih Ikan Gurami (*Osphronemus Gouramy*) Yang Diberi Pakan Maggot Dan Cacing Sutera," *Agrokompleks*, 24 (1): 140-149 (2024).

<sup>30</sup> Suwarsito Suwarsito, Dewi SusyLOWATI, and Aman Suyadi, "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)," *Sainteks* 21, no. 1 (2024): 15-23.

<sup>31</sup> Rizal Ula et al., "Analisis Usaha Budidaya Maggot Sebagai Alternatif Pakan Lele Business Analysis of Maggot Cultivation as a Catfish Feed Alternative," *J. Teknol. dan Manaj. Agroindustri* 7 (2018): 39-46.

<sup>32</sup> Amandanisa and Suryadarma, "Kajian Nutrisi Dan Budi Daya Maggot (*Hermetia Illucens* L.) Sebagai Alternatif Pakan Ikan Di RT 02 Desa Purwasari, Kecamatan Dramaga, Kabupaten Bogor."

<sup>33</sup> Suwarsito & SusyLOWATI, "Kinerja Benih Ikan Gurami (*Osphronemus Gouramy*) Yang Diberi Pakan Maggot Dan Cacing Sutera."

<sup>34</sup> Ida Kinasih et al., "Growth Performance of Black Soldier Fly Larvae (*Hermetia Illucens*) Fed on Some Plant Based Organic Wastes," *HAYATI Journal of Biosciences* 25, no. 2 (2018): 79.

the growing maggots. The maggot larvae were for harvest at 14–16 days old when they had stored high reserves of lipids and protein.<sup>35</sup> Harvesting maggot larvae could be done partially, with some larvae allocated as fish feed and others allowed to develop further into pre-pupae (characterized by darkening body color) and pupae (black body color) to serve as broodstock for future cultivation. A maggot house was constructed to accommodate the maggot broodstock, measuring 2 m in length, 1.5 m in height, and 0.5 m in width. The house walls were made from woven-plastic netting, and wooden blocks measuring 30 cm x 5 cm x 1 cm were tied and stacked vertically inside as platforms for maggot eggs. Once the maggot house was ready, pupae were placed inside to mature into adult flies, known as Black Soldier Flies. A nutrient source for the flies was prepared by mixing 1 liter of water with 100 grams of sugar and placing it in a tray within the maggot house. This mixture was replenished as needed to ensure a constant supply. The adult flies mated and laid eggs on the wooden blocks inside the house. The eggs were then harvested by scraping them off the blocks and collecting them in a plastic bowl. These eggs were subsequently reused to sustain continuous maggot cultivation.



*Figure 2. Maggot House*

<sup>35</sup> Sudrajat et al., “Media Budidaya Maggot Untuk Pakan Alternatif Ikan dan Ayam.”



Figure 3. Maggot Larvae (left) and Pre-pupae Maggot (right)

The final stage of the community service activity involved an evaluation to assess the knowledge and skills of the training participants in maggot cultivation. The evaluation results are presented in Table 1.

Table 1. Evaluation Results of the Maggot Cultivation Training

No.	Knowledge	Pre training (%)			Post training (%)		
		Not knowled ge-able	Partly knowled ge-able	Knowled ge-able	Not knowled ge-able	Partly knowled ge-able	Knowled ge-able
1.	Knowledge about maggots	4	4	2	0	5	5
2.	Life stages of maggots from eggs to adults	10	0	0	2	5	3
3.	The benefits of maggots	4	6	0	0	4	6
4.	Nutrient content of maggots	10	0	0	0	5	5
5.	How to cultivate maggots	10	0	0	0	6	4
6.	Equipment and materials for maggot cultivation	10	0	0	0	5	5
7.	How to prepare a medium for maggot cultivation	10	0	0	0	6	4
8.	Maggots can be used as fish feed	4	3	3	0	2	8
9.	How to use maggots as fish feed	10	0	0	0	6	4

10. Advantages and disadvantages of maggots as fish feed	9	1	0	0	9	1
Total	81	14	5	2	53	45

As shown in Table 1, there was a significant improvement in participants' knowledge about maggots. Prior to the training, the majority of participants (81%) were not knowledgeable, while 14% were partly knowledgeable, and only 5% were knowledgeable. After completing the training, the proportion of participants who were partly knowledgeable increased to 53%, and those who became knowledgeable rose to 45%. Meanwhile, only 2% of participants remained not knowledgeable. These results indicate that the training effectively improve participants' understanding of maggots, including their life stages, benefits, and their nutrient content. Furthermore, participants gained knowledge on maggot cultivation, their application as fish feed, and the advantages and disadvantages of using maggots as an alternative feed source.

Following the training sessions, catfish farming activities were continued. The cultivation system utilizes a 4 x 6 m plastic pond filled with well water to a depth of 70 cm. Catfish were reared for a period of 80 days and fed a combination of commercial feed and maggots produced from the maggot cultivation process. Feeding was carried out three times daily—morning, afternoon, and evening—at a rate of 5% of the total fish biomass. The data on the outcomes of the catfish farming activities conducted by the fish farming groups are presented in Table 2.

*Table 2.* Data on the results of catfish cultivation practices

No.	Variable	Value
1.	Initial biomass of catfish	20 kg
2.	Biomass of catfish harvested	463 kg
3.	Biomass gain of catfish	443 kg
4.	Growth rate	1.5 g/day
5.	Number of catfish stocked	4000 fishes
6.	Number of catfish harvested	3680 fishes
7.	Survival Rate of catfish	92%
8.	Commercial feed given	290 kg
9.	Maggot feed given	240 kg
10.	Total feed given	530 kg
11.	Feed Conversion Ratio (FCR)	1,2
12.	Percentage of maggot substitution for commercial feed	45%

In aquaculture, FCR is calculated using the formula (1) <sup>36</sup>.

$$FCR = \frac{\text{Feed\_given}}{\text{Weight\_gain}} \quad (1)$$

The formula used to calculate the fish survival rate is (2) <sup>37</sup>.

$$\text{SurvivalRate}(\%) = \frac{\text{Number of Fish harvested}}{\text{Number of fish stocked}} \times 100 \quad (2)$$

## Discussion

The evaluation of the maggot cultivation hands-on practice demonstrated the success of the fish farmers group in cultivating maggots. The fish farmers in Dukuhwaluh, as the partners in this community service activity, successfully utilized household organic waste for maggot cultivation. The group was able to perform key steps, including sorting organic waste, preparing the maggot cultivation media, maintaining the larvae, and harvesting the maggots. On average, 10 kg of organic waste was processed daily and utilized as a medium for maggot cultivation, yielding approximately 3 kg of maggot larvae ready to be used as catfish feed. This process not only offers a high-nutrient alternative feed but also helps reduce organic waste volume by up to 70%, thereby promoting environmentally friendly and sustainable aquaculture practices. Additionally, they successfully bred maggot larvae into broodstock and Black Soldier Flies, which subsequently produced maggot eggs. These eggs were then used to sustain continuous mass cultivation of maggots, ensuring the long-term viability of the initiative.

Based on the data presented in Table 2, catfish cultivation using maggot larvae as a partial substitute for conventional feed yielded promising results. The fish farming group recorded a biomass increase of 443 kg over the 80-day cultivation period, with an average daily growth rate of 1.5 g/day. This rate exceeds the typical daily growth rate of catfish in conventional systems, which generally ranges from 1.0 to 1.2 g/day, thereby demonstrating the effectiveness of maggot-based alternative feed in enhancing growth performance <sup>38</sup>.

The obtained Feed Conversion Ratio (FCR) value of 1.2 indicates good feed conversion efficiency, meaning that 1.2 kg of feed results in a 1 kg increase in fish body weight. According to <sup>39</sup>, a lower FCR value corresponds to higher feed efficiency. Typically, FCR values for farmed fish and shrimp range from 1.0 to 2.4. Aquatic animals generally exhibit lower FCRs compared to terrestrial animals due to their buoyancy and

<sup>36</sup> Prasanna Joshi, Shri Shivaji Arts, and Sreeramana Aithal, "Introduction to the Fish Nutrition, Feed Formulation, and Feeding Conversion," *Bioscience Discovery* 12, no. 4 (2021): 208–216.

<sup>37</sup> Diana Permatasari, Mohamad Fadjar, and Ating Yuniarti, "Survival Rate and Growth Length of Catfish (*Clarias Gariepinus*) Exposed to Microplastics," *Journal of Aquaculture and Fish Health* 12, no. 1 (2023): 86–93.

<sup>38</sup> Jillian P Fry et al., "Feed Conversion Efficiency in Aquaculture: Do We Measure It Correctly?," *Environmental Research Letters* 13, no. 2 (2018): 024017.

<sup>39</sup> Ibid.

ectothermic nature, which allows them to conserve energy <sup>40</sup>.

A survival rate of 90–95% or higher for catfish is considered very good to excellent, indicating a high level of success in maintaining the fish population throughout the cultivation period. This benchmark was widely accepted in aquaculture studies <sup>41 42 43</sup>. In this study, the survival rate of farmed catfish reached 92%, which falls into the 'very good' category. Several key factors contributed to this high survival rate, including the selection of high-quality fry, the provision of nutritionally balanced feed, and effective management practices. Fry were selected based on specific criteria: they originated from superior broodstock, had uniform sizes, exhibited active movement, possessed complete body parts, showed high feeding response, and were free from injuries or fungal infections. Other important factors influencing survival rate included appropriate stocking density, optimal water quality management (e.g., stable temperature, appropriate pH, and sufficient dissolved oxygen), and maintaining pond hygiene. Additionally, the adequacy of feed supply played a crucial role in reducing cannibalism among catfish, further enhancing survival rates.

Proper feeding practices—including feeding frequency, dosage, timing, and the provision of nutritionally complete and balanced feed—play a crucial role in enhancing both the growth rate and survival rate of cultured catfish <sup>44</sup>. The effectiveness of these practices was evidenced by the observed FCR of 1.2 and a survival rate of 92%, indicating optimal feed utilization by the fish. Adequate nutrition and well-managed feeding regimes were essential components for promoting healthy growth and ensuring high survival rates in aquaculture <sup>45</sup>.

Based on the results of the catfish cultivation practices, the use of maggots as an alternative feed could replace up to 45% of commercial feed, offering significant potential for reducing production costs—particularly considering that feed accounts for 60–70% of the total cultivation expenses <sup>46</sup>. Thus, the use of maggots in catfish cultivation could

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<sup>40</sup> Sandra Langi et al., "Nutritional Requirements and Effect of Culture Conditions on the Performance of the African Catfish (*Clarias Gariepinus*): A Review," *Cogent Food & Agriculture* 10, no. 1 (2024): 2302642.

<sup>41</sup> Rifqah Pratiwi, Kurniawan Wahyu Hidayat, and Sumitro, "Production Performance of Catfish (*Clarias Gariepinus* Burchell, 1822) Cultured with Added Probiotic *Bacillus* Sp. on Biofloc Technology." (2020).

<sup>42</sup> Alni Nuraisyah and Retno Cahya Mukti, "Growth and Survival of Catfish (*Clarias Gariepinus*) with Addition of Papain Enzymes in Feed at Karang Dapo Village, Pagaralam, South Sumatera," *Acta Aquatica: Aquatic Sciences Journal* 9, no. 1 (2022): 42–45.

<sup>43</sup> Suwarsito Suwarsito, "THE GROWTH AND SURVIVAL RATE OF CATFISH (*Clarias Gariepinus*) REARED INTENSIVELY USE BIO-FLOC TECHNOLOGY," *Agritech: Jurnal Fakultas Pertanian Universitas Muhammadiyah Purwokerto* 24, no. 2 (2022): 126–130.

<sup>44</sup> Joshi, Arts, and Aithal, "Introduction to the Fish Nutrition, Feed Formulation, and Feeding Conversion."

<sup>45</sup> Vishnu Kiran Manam, "Fish Feed Nutrition and Its Management in Aquaculture," *International Journal of Fisheries and Aquatic Studies* 11, no. 2 (2023): 58–61.

<sup>46</sup> Salamah Salamah et al., "Pemanfaatan Bahan Baku Limbah Untuk Pembuatan Pakan Ikan Mandiri Di SMK Negeri 6 Lhokseumawe," *Jurnal Solusi Masyarakat Dikara* 3, no. 1 (2023): 1–6.

reduce feed costs by up to 45%. A study by <sup>47</sup> demonstrated that using a feed mixture of 50% pellets and 50% maggots could reduce catfish feeding costs by 22.74%. This result is more favorable than those reported by <sup>48</sup> and <sup>49</sup> who applied a 25% maggot and 75% commercial feed composition for snakehead and gourami, respectively. However, it was still less effective compared to the findings of <sup>50</sup>, who demonstrated that a feed composition consisting of 75% maggots and 25% commercial feed resulted in the best growth performance in pearl catfish.

This community service activity has had a positive impact on the Dukuhwaluh Village community by increasing their awareness of proper household waste management. Many community members have started separating organic waste from inorganic waste. The organic waste is now collected and utilized as a nutrient source for maggot cultivation media, while inorganic waste is gathered and deposited at the community-developed waste bank. This initiative has encouraged voluntary daily participation from the entire community in waste collection, indirectly addressing household waste issues.

Overall, this community service activity has enhanced the knowledge and skills of fish farmers in Dukuhwaluh Village regarding maggot cultivation practices. The smooth implementation of this activity was made possible through the support of various stakeholders. The local village government played a key role by approving the initiative, providing a venue for training, and encouraging the fish farmers to actively participate. The fish farmers themselves contributed by attending the socialization and training sessions and supplying the necessary equipment and materials for the hands-on practice. Most importantly, the persistence and enthusiasm demonstrated by the fish farmers in both the training and practical sessions were instrumental in the success of the activity.

## Conclusion

The community service activity successfully improved the knowledge and skills of the group of fish farmers in Dukuhwaluh regarding maggot cultivation. The group demonstrated the ability to properly utilize the organic household waste for maggot cultivation and the cultivated maggots as a feed source for catfish. Over an 80-day catfish cultivation period with a mixed diet of commercial feed and maggots, the fish

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<sup>47</sup> Andari, Ginting, and Nurdiana, "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak."

<sup>48</sup> A A Wallady, B S Rahardja, and H Kenconoajati, "Dietary Combination of Maggot and Commercial Feed Enhance the Growth Rate and Feed Conversion Ratio of Snakehead Fish (*Channa Striata*)," in *IOP Conference Series: Earth and Environmental Science*, vol. 1036 (IOP Publishing, 2022), 012085.

<sup>49</sup> Suwarsito, Susyelowati, and Suyadi, "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)."

<sup>50</sup> Haris Setiawan et al., "The Effectiveness Combination of Maggot with Commercial Feed on Growth, Structure of Intestine and Skeletal Muscle Mutiara Catfish," *Journal of Aquaculture and Fish Health* 11, no. 1 (2002): 70–80.

demonstrated an average daily weight gain of 1.5 grams and a FCR of 1.2. The use of maggots as an alternative feed source shows potential to replace up to 45% of commercial feed without adversely affecting growth performance. Based on the outcomes of this activity, it was recommended to further develop maggot-derived fish feed into pellet form. This advancement would not only meet the fish farmers' own feed requirements but also enable the commercialization of the pelletized feed, providing an opportunity to increase the income of the fish farmers.

### Acknowledgements

We would like to express our sincere gratitude to *Lembaga Penelitian dan Pengabdian pada Masyarakat* (Institute for Research and Community Services) Universitas Muhammadiyah Purwokerto for their financial support in enabling this community service activity. We would also like to thank the local government of Dukuhwaluh Village for facilitating the smooth implementation of the activity.

### References

- Amandanisa, Amira, and Prayoga Suryadarma. "Kajian Nutrisi Dan Budi Daya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RT 02 Desa Purwasari, Kecamatan Dramaga, Kabupaten Bogor." *Jurnal Pusat Inovasi Masyarakat* 2, no. 5 (2020): 796–804.
- Andari, Gardis, Nina Maksimiliana Ginting, and Ramdan Nurdiana. "Larva Black Soldier Fly (*Hermetia Illucens*) Sebagai Agen Pereduksi Sampah Dan Alternatif Pakan Ternak." *Jurnal Ilmiah Peternakan Terpadu* 9, no. 3 (2021): 246–252.
- Azir, Akhmad, Helmi Harris, and Rangga Bayu Kusuma Haris. "Produksi Dan Kandungan Nutrisi Maggot (*Chrysomya Megacephala*) Menggunakan Komposisi Media Kultur Berbeda." *Jurnal Ilmu-ilmu Perikanan dan Budidaya Perairan* 12, no. 1 (2017).
- Bosch, Guido, Sheng Zhang, Dennis G A B Oonincx, and Wouter H Hendriks. "Protein Quality of Insects as Potential Ingredients for Dog and Cat Foods." *Journal of nutritional science* 3 (2014): e29.
- Ceccotti, Chiara, Daniele Bruno, Gianluca Tettamanti, Paola Branduardi, Stefano Bertacchi, Massimo Labra, Simona Rimoldi, and Genciana Terova. "New Value from Food and Industrial Wastes–Bioaccumulation of Omega-3 Fatty Acids from an Oleaginous Microbial Biomass Paired with a Brewery by-Product Using Black Soldier Fly (*Hermetia Illucens*) Larvae." *Waste Management* 143 (2022): 95–104.
- Fitriani, Fitriani, Helmi Haris, and Rih Laksmi Utpalasari. "Pemanfaatan Maggot (*Hermetia Illucens*) Sebagai Pakan Alternatif Dengan Kombinasi Pakan Pelet Terhadap Pertumbuhan Dan Sintasan Ikan Gabus (*Channa Striata*)." *Indobiosains* (2023): 13–24.
- Fry, Jillian P, Nicholas A Mailloux, David C Love, Michael C Milli, and Ling Cao. "Feed Conversion Efficiency in Aquaculture: Do We Measure It Correctly?" *Environmental*

---

*Research Letters* 13, no. 2 (2018): 024017.

Ginting, Seliwati, Fitriana Lestari, Bagja Rahma Putra, Kahla kahila Wahyudi, Nur Fauza Muhidin, and Nurul Hikmah. "Budidaya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cireunghas, Kabupaten Sukabumi." *Jurnal Abdi Nusa* 2, no. 3 (2022): 90–95.

———. "Budidaya Maggot (*Hermentia Illuciens L.*) Sebagai Alternatif Pakan Ikan Di RW 05 Desa Cikurutug, Kecamatan Cireunghas, Kabupaten Sukabumi." *Jurnal Abdi Nusa* 2, no. 3 (2022): 90–95.

Joshi, Prasanna, Shri Shivaji Arts, and Sreeramana Aithal. "Introduction to the Fish Nutrition, Feed Formulation, and Feeding Conversion." *Bioscience Discovery* 12, no. 4 (2021): 208–216.

Kim, Wontae, Sungwoo Bae, Kwanho Park, Sangbeom Lee, Youngcheol Choi, Sangmi Han, and Youngho Koh. "Biochemical Characterization of Digestive Enzymes in the Black Soldier Fly, *Hermetia Illucens* (Diptera: Stratiomyidae)." *Journal of Asia-Pacific Entomology* 14, no. 1 (2011): 11–14.

Kinasih, Ida, Ramadhani Eka Putra, Agus Dana Permana, Finsa Firlana Gusmara, Muhammad Yusuf Nurhadi, and Ramadini Aini Anitasari. "Growth Performance of Black Soldier Fly Larvae (*Hermetia Illucens*) Fed on Some Plant Based Organic Wastes." *HAYATI Journal of Biosciences* 25, no. 2 (2018): 79.

Langi, Sandra, Sahya Maulu, Oliver J Hasimuna, Veronica Kaleinasho Kapula, and Martin Tjipute. "Nutritional Requirements and Effect of Culture Conditions on the Performance of the African Catfish (*Clarias Gariepinus*): A Review." *Cogent Food & Agriculture* 10, no. 1 (2024): 2302642.

Manam, Vishnu Kiran. "Fish Feed Nutrition and Its Management in Aquaculture." *International Journal of Fisheries and Aquatic Studies* 11, no. 2 (2023): 58–61.

Nuraisyah, Alni, and Retno Cahya Mukti. "Growth and Survival of Catfish (*Clarias Gariepinus*) with Addition of Papain Enzymes in Feed at Karang Dapo Village, Pagaralam, South Sumatera." *Acta Aquatica: Aquatic Sciences Journal* 9, no. 1 (2022): 42–45.

Pérez-Pacheco, Rafael, Demián Hinojosa-Garro, Fernando Ruíz-Ortíz, Juan Carlos Camacho-Chab, Benjamín Otto Ortega-Morales, Nancy Alonso-Hernández, Alicia Fonseca-Muñoz, Nadia Landero-Valenzuela, Henry Jesús Loeza-Concha, and Fidel Diego-Nava. "Growth of the Black Soldier Fly *Hermetia Illucens* (Diptera: Stratiomyidae) on Organic-Waste Residues and Its Application as Supplementary Diet for Nile Tilapia *Oreochromis Niloticus* (Perciformes: Cichlidae)." *Insects* 13, no. 4 (2022): 326.

Permatasari, Diana, Mohamad Fadjar, and Ating Yuniarti. "Survival Rate and Growth Length of Catfish (*Clarias Gariepinus*) Exposed to Microplastics." *Journal of Aquaculture and Fish Health* 12, no. 1 (2023): 86–93.

Pratiwi, Rifqah, Kurniawan Wahyu Hidayat, and Sumitro. "Production Performance of Catfish (*Clarias Gariepinus* Burchell, 1822) Cultured with Added Probiotic *Bacillus* Sp. on Biofloc Technology." (2020).

- Salamah, Salamah, Mahdaliana Mahdaliana, M Hatta, Rachmawati Rusydi, and Mainisa Mainisa. "Pemanfaatan Bahan Baku Limbah Untuk Pembuatan Pakan Ikan Mandiri Di SMK Negeri 6 Lhokseumawe." *Jurnal Solusi Masyarakat Dikara* 3, no. 1 (2023): 1–6.
- Setiawan, Haris, Ichsan Luqmana Indra Putra, Ridwan Alfatah, and Akhmad Nizzar Nasikhudin. "The Effectiveness Combination of Maggot with Commercial Feed on Growth, Structure of Intestine and Skeletal Muscle Mutiara Catfish." *Journal of Aquaculture and Fish Health* 11, no. 1 (2002): 70–80.
- Sholahuddin, Sholahuddin, Ato Sulisty, Retno Wijayanti, Supriyadi Supriyadi, and Subagiya Subagiya. "Potensi Maggot (Black Soldier Fly) Sebagai Pakan Ternak Di Desa Miri Kecamatan Kismantoro Wonogiri." *PRIMA: Journal of Community Empowering and Services* 5, no. 2 (2021): 161–167.
- Sudrajat, Deden, Agus Hardian, Bagus Arif Setiawan, Muhammad Hildan, and Tedi Saputra. "Media Budidaya Maggot Untuk Pakan Alternatif Ikan Dan Ayam." *Karimah Tauhid* 1, no. 3 (2022): 330–338.
- Suwarsito & SusyLOWATI, D. "Kinerja Benih Ikan Gurami (*Osphronemus Gouramy*) Yang Diberi Pakan Maggot Dan Cacing Sutera." *Agrokompleks*, 24 (1): 140 149 (2024).
- Suwarsito, Suwarsito. "The Growth And Survival Rate Of Catfish (*Clarias Gariepinus*) Reared Intensively Use Bio-Floc Technology." *Agritech: Jurnal Fakultas Pertanian Universitas Muhammadiyah Purwokerto* 24, no. 2 (2022): 126–130.
- Suwarsito, Suwarsito, Dewi SusyLOWATI, and Aman Suyadi. "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)." *Sainteks* 21, no. 1 (2024): 15–23.
- . "Pengaruh Substitusi Larva Magot (*Hermetia Illucens*) Terhadap Efisiensi Pakan Dan Pertumbuhan Ikan Gurami (*Osphronemus Gouramy*)." *Sainteks* 21, no. 1 (2024): 15–23.
- Ula, Rizal, A Fauzi, E Resty, and N Sari. "Analisis Usaha Budidaya Maggot Sebagai Alternatif Pakan Lele Business Analysis of Maggot Cultivation as a Catfish Feed Alternative." *J. Teknol. dan Manaj. Agroindustri* 7 (2018): 39–46.
- Wallady, A A, B S Rahardja, and H KenconoJati. "Dietary Combination of Maggot and Commercial Feed Enhance the Growth Rate and Feed Conversion Ratio of Snakehead Fish (*Channa Striata*)." In *IOP Conference Series: Earth and Environmental Science*, 1036:012085. IOP Publishing, 2022.
- Were, G J, F G Irungu, P N Ngoda, H Affognon, S Ekesi, D Nakimbugwe, K K M Fiaboe, and C M Mutungi. "Nutritional and Microbial Quality of Extruded Fish Feeds Containing Black Soldier Fly (*Hermetia Illucens* L) Larvae Meal as a Replacement for Fish Meal for Nile Tilapia (*Oreochromis Niloticus*) and African Sharptooth Catfish (*Clarius Gariepinus*)." *Journal of Applied Aquaculture* 34, no. 4 (2022): 1036–1052.
- Xu, Feng-Meng, Shi-Wei Hou, Guo-Xia Wang, Jia-Yi Gong, Lei Zhou, Yan-Hua Huang, Xian-De Huang, and Li Liu. "Effects of Zymolytic Black Soldier Fly (*Hermetia Illucens*) Pulp as Dietary Supplementation in Largemouth Bass (*Micropterus Salmoides*)." *Aquaculture Reports* 21 (2021): 100823.

Yana, Dewi Yuli, Muslimin Muslimin, Karyati Karyati, Sri Sarminah, and Emi Purwanti. "MaGoGreen: Teknologi Bio-Konversi Sampah Organik Sebagai Pakan Ternak Alternatif Memanfaatkan Larva Black Soldier Fly." *ABDIKU: Jurnal Pengabdian Masyarakat Universitas Mulawarman* 1, no. 1 (2022): 6-10.