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Maggot Counseling Program Padukuhan Pereng Dawe Kalurahan Balecatur

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ABSTRACT

The increase in population has an impact on increasing food needs and also increasing waste/garbage. This condition must be accompanied by an increase in food production and ways to manage waste so that it does not become a burden on the environment. Fulfilling food needs can be done by increasing sources of animal protein. The increase in the need for animal protein has also resulted in an increase in the need for feed. The need for poultry and fish feed is still dominated by industrially processed feed such as powder and pellets. Cultivating black soldier flies (Maggot) is a solution to solving feed problems while reducing waste, because maggot food is in the form of leftover food, fruit, and vegetables. Maggot contains high protein and can be an alternative to substitute feed other than puree or pellets and the selling price of maggot is very competitive compared to industrial feed. Then from this phenomenon, we held maggot counseling with the target of Pereng Dawe residents. The activity method is carried out in the form of socializing the importance of entrepreneurship by developing products that have economic value so as to increase their income. The results of this activity are expected to be able to add insight to residents regarding various business opportunities, one of which is maggot cultivation.

1. INTRODUCTION

Based on data from The Economics Intelligence Unit, Indonesia is the second-largest producer of food waste (food loss and waste) in the world, and it is one type of waste that has the potential to be a source of methane gas [1]. When we throw food and garden waste into the rubbish bin, the rubbish is taken and buried in rubbish dumps [2]. As the trash at the bottom decomposes, methane gas is formed. Methane gas can damage the Earth's ozone layer because it is a greenhouse gas that can cause climate change. One method for processing organic waste, such as food waste, is bioconversion [3]. Bioconversion is used as an alternative activity for recycling organic waste today[4]. To speed up the decomposition process in bioconversion, you can use activators such as BSF (Black Soldier Fly) [5] [6]. The products produced include maggots and compost. These products

can have high economic value because they can be used as animal feed, plant fertilizer, and for other purposes [7] [8].

The increase in population has an impact on increasing food needs as well as waste and garbage [9] [10]. One way to meet the need for food is by increasing the production of protein, both vegetable and animal protein. The increasing demand for protein has led to competition within society and the industry to meet this demand. One approach to addressing protein needs is through poultry and fisheries cultivation. The growing demand for animal protein has also resulted in an increased need for poultry and fish feed [11]. Currently, the production of this feed is predominantly controlled by the industry and is in the hands of only a few companies. Relying solely on industrial feed, whether in puree or pellet form, poses significant risks for livestock breeders [12]. This tendency can lead to leaders in this sector easily manipulating supply and prices [13]. It's common to hear and read about farmers experiencing losses because the selling price of their livestock cannot cover production costs. This situation calls for alternative solutions to ensure that farmers are not solely dependent on industrially processed feed. One solution to address this problem is to discover or develop substitute feeds [14].

Black soldier flies, commonly known as maggots, can serve as an alternative or additional feed to industrially processed feed [15]. Maggots are organisms that originate from the eggs of black soldier flies and are considered scavengers as they consume organic materials for growth [16] [17]. Maggots exhibit the capacity to manage large-scale organic waste, with an absorption rate 56% higher than other insects [18]. [19] have enumerated several advantages of black soldier fly maggots. These maggots have a chewy texture and possess the ability to produce natural enzymes that enhance fish's feed digestibility [20]. Black soldier fly maggots can serve as a protein source, offering an alternative for fish feed [21]. According to [22], black soldier fly maggots can be used for converting various waste materials, including agricultural and industrial waste, livestock waste, and feces [23]. Research conducted by [24] demonstrates that maggots can be bred on tofu dregs [25]. Maggot cultivation is straightforward and employs simple methods. You don't need significant capital or a large area of land to start a maggot cultivation business; it can be done on a small scale. Research findings by [26] indicate that maggots have significant potential as an alternative food source for catfish. Combining 50% pellets with 50% maggots can result in a 22.74% reduction in feed procurement costs. Furthermore, other research suggests that maggots can produce organic compost on a large scale, addressing the issue of arid land for agriculture [27]).

Maggot cultivation serves as a source of animal feed. Maggots or the larvae of the black soldier fly (Hermetia illucens), represent an alternative animal feed option that fulfills the requirements as a high-protein source. These maggots are categorized as hardy and can thrive in relatively extreme environments, even in substrates or waste that contain high levels of salt, alcohol, acids, and ammonia. They can endure in warm surroundings, and in cases where the ambient air turns very cold or food becomes scarce, the maggots don't perish but instead become dormant or inactive, awaiting warmer weather or the availability of food. They can also survive in aquatic or alcoholic settings. The life cycle of the black soldier fly involves mating shortly after hatching from the cocoon, typically occurring within 3 days. After these 3 days, the male fly passes away, followed by the female, which dies after laying eggs and poses no harm to others. A single pair of flies can generate between 500 and 900 larvae. In just 13 days, various types of waste can be utilized as their food source. By the time they reach an age of 10 to 20 days, they can be incorporated into livestock and poultry feed with a protein content of approximately 47%.

Opportunities for maggot cultivation can be pursued through entrepreneurial efforts, fostering entrepreneurial activities, and promoting community empowerment. Karang Taruna youth and the Women Farmers group have been proactive in initiating entrepreneurial activities, including the production of various items like fried onions, cassava chips, and packaged banana chips, among

others. Both the production and marketing of these goods involve participation from lecturers and students. The economic potential of these production and sales activities is substantial, especially given that similar products are currently dominated by manufacturers who have set relatively high prices. The availability of similar products resulting from student entrepreneurship offers competitive choices for the community.

Furthermore, during this Real Work Lecture initiative, we have made an effort to improve education related to maggot cultivation, an area that hasn't received adequate attention. Maggot cultivation is relatively unfamiliar to both students and village residents. This KKN (Real Work Lecture) activity is being carried out in collaboration with the Karang Taruna youth and the women's farmer group (KWT).

2. METHODS

The execution of this program involves the Environmental Service, students, and local residents. The approach used includes socialization through presentations and question-and-answer sessions, focusing on the significance of entrepreneurship and entrepreneurial management via maggot cultivation as a means to enhance living standards and economic well-being. Following the presentation and Q&A session, practical demonstrations are conducted to teach participants how to cultivate maggots using the necessary tools and equipment.

Subsequently, the program's results will be monitored periodically through ongoing program activities. If the cultivation proves successful, there are plans to explore marketing opportunities and collaborate with breeders, with a specific emphasis on home-based and individual breeders who are most affected by the fluctuating prices of animal feed, which tend to be unfavorable for individual breeders. It is also feasible that we may propose maggot cultivation as the primary entrepreneurial product within our university environment, providing students with the chance to gain hands-on experience in both producing and marketing this maggot-based product.

The program's primary target audience is the residents of Pereng Dawe, with a particular focus on reaching out to a vast and dispersed population, including those residing in remote villages. Additionally, this program serves as a platform for maggot breeders to disseminate and exchange their knowledge, skills, and expertise in the areas of entrepreneurship and accounting with the Santri (students). Simultaneously, for the Santri and students, these PKM (Real Work Lecture) activities offer an opportunity to acquire insights and knowledge about topics they may not have a clear understanding of, particularly in the realms of entrepreneurship, accounting, and potentially other information, skills, and knowledge areas.

3. RESULTS AND DISCUSSION

The focus of this Community Service initiative is the cultivation of maggots, which are the organisms originating from Black Soldier Fly (BSF) larvae. These maggots are produced during the second phase of metamorphosis, following the egg phase and preceding the pupa phase, during which they transform into adult BSF. Maggots serve as a cost-effective source of food for poultry, including chickens, ducks, and fish. They are derived from household waste and traditional market waste, which are often challenging to process. Wet waste, such as food scraps, vegetable remnants, and fruit peelings, which collectively amount to thousands of tons daily, can be repurposed as maggot livestock feed, thereby supporting the production of thousands of tons of maggots daily.

The Real Work Lecture extension program on maggot cultivation began by addressing the issue of housing waste and the accumulation of traditional market waste. Without effective management, these wastes can mar the natural beauty and give rise to harmful elements like bacteria, germs, viruses, and foul odors. Furthermore, residential and traditional market waste can pose risks to human health, and this issue is particularly acute in a city like Jakarta and its surroundings, where approximately 1 ton of residential and traditional market waste is generated daily from ten

traditional marketplaces. Maggot cultivation proves to be an invaluable solution to the challenges presented by residential and traditional market waste. This approach not only aids in waste management but also creates new employment opportunities, thereby contributing to the reduction of unemployment among the working-age population. By diminishing unemployment, it becomes possible to support those in need of work, ultimately enhancing their well-being and helping meet household survival needs. The fulfillment of community household needs fosters peace and prosperity, leading to content and thriving small communities.

a. Research Stages

In this research, the primary component utilized is female black soldier flies, which serve as broodstock. These flies are obtained from maggots reared until they undergo pupation and transform into adult flies. The medium prepared for the development of fly eggs, which later hatch into maggots, includes 60 kg of tofu dregs, 30 kg of livestock manure, 10 kg of salted fish, clean water, and dry banana leaves. The required tools and their respective functions are detailed in Table 1.

Table 1. Required Tools And Their Respective Functions

No	Equipment Name	Purpose	Quantity
1	Container with dimensions of 56.5 cm x 24.5 cm	Maggot rearing container	6 pieces
2	Container Lid	Lid for the rearing container	6 pieces
3	Corrugated Metal Sheet	Cover for protection from rain	6 pieces
4	Netting/Caging	Protection against disruptive organisms/animals	10 meters
5	Bucket/Basin	Multipurpose container	3 pieces
6	Wood	Framework for maggot cultivation	12 pieces, 200 cm each
7	Shovel	Tool for transporting media material	1 piece
8	Nails	Used for joining wood pieces	1 kg

b. Establishment of Cultivation Framework

The location for maggot development should be prepared in advance during the initial cultivation stage. The tools and materials, which are in the form of prepared wood, are then shaped and assembled to resemble the structure shown in Figure 1 below.

At the top of the framework, corrugated iron is installed to shield the maggot cultivation medium from the harsh sun and rain, which can damage the medium and lead to unsuccessful maggot cultivation. Subsequently, a mosquito net is placed around the framework. The installation of mosquito nets serves the purpose of preventing black soldier flies from leaving the cultivation area, ensuring they can only deposit their eggs in the prepared medium. Additionally, the mosquito net serves to safeguard the maggots from other animals that could potentially harm the maggot cultivation medium, such as chickens, birds, mice, and more. Within the cultivation area, a tub is positioned and subsequently filled with the maggot growth medium.

Figure 1. The location for maggot development

c. Process of Crafting Maggot Cultivation Medium

The creation of the cultivation medium commences with the thorough mixing of the medium's components (tofu dregs, livestock manure, and salted fish) with an appropriate amount of water. This mixing process should be executed slowly to prevent the medium from becoming excessively wet. Stirring is essential to ensure that the cultivation medium ingredients are adequately combined. After achieving a homogeneous mix of the cultivation medium, the surface is covered with dry banana leaves. In his research, [28] observed that female flies do not directly lay their eggs on food sources or cultivation media, necessitating a separate location. The dry banana leaves placed atop the medium serve as a dedicated site for female flies to lay their eggs while also providing protection to prevent disturbances during the egg-laying process.

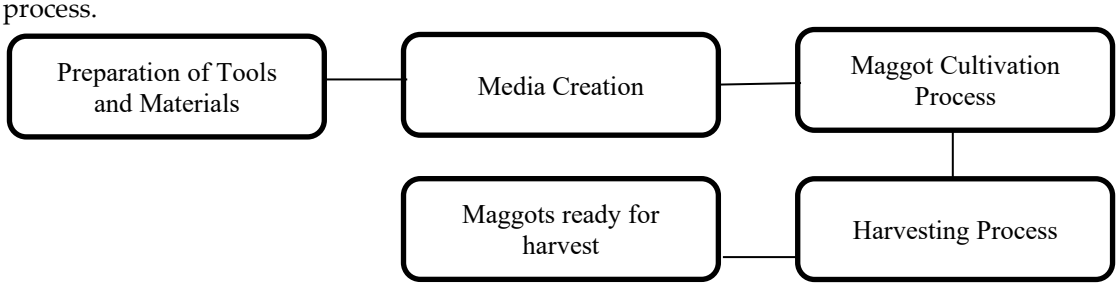

Figure 2. Process of Crafting Maggot Cultivation Medium

The cultivation process commences by placing the maggot cultivation medium into the previously prepared container. The cultivation site should maintain the moisture level of the medium and protect it from rain and direct sunlight. It is anticipated that a location with minimal light, shaded areas, and controlled humidity will have a positive influence on the egg-laying process of the black soldier flies and the subsequent development of the hatched maggots. The broodstock black soldier flies, critical for the process, are introduced into the cultivation medium, which is enclosed with mosquito nets. These broodstock black soldier flies are acquired from individuals who have previously raised black soldier flies. The cultivation process spans a duration of two weeks.

d. Medium Care of Cultivation Medium

A daily inspection of the condition of the cultivation medium is conducted over a 14-day period. The evaluation encompasses aspects such as humidity and water content. If required, additional water or maggot food sources can be introduced. Additionally, regular checks on the mosquito net surrounding the medium are essential to ensure there are no openings that might allow black soldier flies to exit the cultivation area.

e. Maggot Harvesting Stage

The maggot harvesting process commences after a two-week cultivation period. At this point, the maggots must be separated and cleansed from the rest of the growing medium. This involves mixing the growing medium with water, followed by extracting the maggots using a filter. The harvested maggots are then weighed to determine the yield from a single maggot cultivation. Maggots are ready for harvesting at around 10 to 15 days of age, and they can thrive on food sourced from residential wet waste and traditional market wet waste without the need for grinding. To sustain a daily production of approximately 1 ton of maggots, it requires an equivalent amount of wet waste from residential and traditional market sources, totaling about 1 ton of wet waste per day. Maggots are typically sold at a price of approximately Rp. 5,000 per 1 kg, so by producing approximately 100 kg per day, maggot breeders can earn Rp. 500,000 per day (5,000 x 100 = Rp. 500,000). This monthly estimate, if consistent, can provide substantial income. Maggot breeders play a significant role in assisting those seeking employment opportunities. Maggot breeding is a cost-effective and highly productive venture, meeting consumer demand on both local and national levels with ease.

Maggot cultivation can prove to be a profitable endeavor for maggot breeders, particularly if they are also engaged in poultry, fish, or bird breeding. Maggots serve as a direct and cost-effective source of nutrition for poultry, fish, and birds. By incorporating maggots into their diets, breeders can reduce production costs by approximately 10 to 25%, enabling them to offer poultry, fish, and birds at competitive prices within their communities. This approach not only provides access to high-quality protein and essential nutrients but also contributes to community well-being, especially during times of public health challenges like the Covid-19 pandemic. A well-nourished community is better equipped to maintain optimal health, which can aid in the early prevention of Covid-19 transmission. A healthy society is also more capable of generating valuable contributions for both the present and the future. Maggot breeders can offer their harvest for sale at a reasonable price, typically priced at IDR 5,000 per 1 kg, ensuring that these nutritious resources are readily available to the broader community.

f. Maggot Life Cycle

The life cycle of BSF from egg to adult fly lasts around 40-43 days depending on environmental conditions and the food media provided. In their adult years, black flies only live to mate and lay eggs. Quoted from other sources, the laying of eggs by female flies marks the beginning of the life cycle as well as the end of the previous life stage. This type of fly produces groups of around 400 to 800 eggs which are placed near rotting organic material and put them in small, dry and protected cavities to avoid the threat of predators and direct sunlight. In general, the eggs hatch after four days and the newly hatched larvae will immediately look for food in the surrounding area, namely organic waste. BSF only eats in the larval phase (maggot) which lasts around 14 - 16 days, so in this larval phase it will store food reserves (fat and protein) until it is enough to pupate and become a fly, then find a partner, mate (the male fly dies) and lay eggs (female flies) before finally dying. The BSF maggot is a larval phase that lasts around 18 days, in this phase many benefits are obtained, namely as bioconversion which

can speed up the composting/rotting process of organic waste and an alternative food source for fish, duck and chicken farmers and many other benefits.

g. Maggots Can Accelerate Organic Waste Decomposition

Waste poses a significant challenge for Indonesian society, as the daily production of waste, both organic and inorganic, is seemingly limitless. The substantial quantity of organic waste generated presents opportunities for its transformation into organic fertilizers, biogas, or other recycled products. Accelerating the decomposition of organic matter often requires the use of a bioconversion agent, typically involving the assistance of bacteria or fungi. Recently, a bioconversion agent in the form of larvae from black soldier flies, also known as "maggots" (Hermetia illucens), has emerged as an effective solution to address waste issues, particularly those related to organic waste.

In general, these maggots consume a wide range of organic waste, including restaurant waste, market waste, livestock and human waste, animal carcasses, and even soft bones. The end products obtained from this process include solid and liquid organic fertilizers, with the nutritional composition being contingent upon the type of organic waste provided to the maggots. Furthermore, the advantages of this approach extend to odor control, the suppression of pests and diseases (pathogens), and the reduction of greenhouse gas emissions during the waste decomposition process [29]. This aligns with the objectives of the JAMTANI program, which is dedicated to curbing activities that contribute to climate change.

h. Maggots as an Alternative Animal Feed Source

The provision of high-quality feed is a pivotal factor in the successful cultivation of ducks, chickens, fish, and other livestock. Protein plays a vital role in any quality feed formula, as it actively contributes to the formation of body tissue. Traditionally, sources of protein for feed are predominantly derived from both animal and vegetable origins, including soybean meal, fish meal, blood meal, or legumes. Protein, however, is one of the most costly feed ingredients compared to other components. Consequently, the procurement of protein sources places a significant financial burden on feed production costs, resulting in the high market prices of factory-made feed that can be financially burdensome for farmers. In addition to the elevated cost of feed, farmers often encounter concerns regarding the variable quality of protein sources. This quality variability directly impacts the quality of the feed itself, influencing the growth and productivity of livestock or fish, often falling short of expectations and sometimes leading to financial losses. As a means to alleviate production costs while maintaining high nutritional content, there is a growing effort to develop maggots as an alternative natural feed or a reliable source of protein. Previous research has demonstrated that maggots are rich in animal protein, with protein content ranging from 30% to 45%. In their dry form, maggots contain approximately 41-42% crude protein, 14-15% ash, 31-35% ether extract, 0.60-0.63% phosphorus, and 4.8-5.1% calcium [30].

4. CONCLUSION

The implementation of the outreach program activities, led by a group of 144 Real Work Lecturers from Muhammadiyah University of Yogyakarta and conducted in collaboration with the Yogyakarta City Environmental Service, proceeded seamlessly and was well-received by the host site. This time, the program addressed a particularly captivating theme designed to enhance individuals' skill sets, especially for those aspiring to become entrepreneurs. The primary objective of this outreach program was to broaden horizons and inspire motivation, encouraging the

application of knowledge beyond the classroom, encompassing skills and information not typically acquired through formal education. This acquired knowledge can subsequently be put to practical use within the community or at a later date.

The program introduced residents to entrepreneurship, emphasizing the fundamental concept of self-reliance, economic independence, and empowerment. It aimed to equip individuals with the skills and knowledge required to become self-sufficient and contribute positively to their communities. Part of this broader understanding included expertise in Maggot cultivation, a sustainable economic management technique. Notably, the government is presently promoting innovations in fish cultivation, incorporating Maggot, or the Black Soldier Fly (BSF), as an alternative feed source. Maggots, as organic material-consuming insects, offer high-quality protein, rendering them an excellent protein source for fish. Furthermore, maggots contribute to the reduction of organic waste, as they consume household and restaurant waste. The expectation is that community members will capitalize on these newfound skills to create business opportunities and support entrepreneurial endeavors, including organic waste management and fish farming activities.

The outcomes of this initiative will effectively enhance the knowledge and skills of residents interested in livestock cultivation. Additionally, the processed maggots can serve as valuable fertilizer. The results of maggot cultivation, presented by the Environmental Service in an accessible manner, offer multiple benefits that are easily conveyed. Moreover, the counseling, training, and educational activities provide a platform for maggot breeders to exchange their knowledge, skills, and expertise in the realm of entrepreneurship.

Some recommendations to consider include the importance of maintaining ongoing counseling, training, and support to continuously motivate the residents of Pereng Dawe. Furthermore, the introduction of diverse skill sets from various scientific fields can enrich the knowledge of Pereng Dawe residents. Expanding the scope of education to encompass various scientific aspects will further broaden the horizons of the Pereng Dawe village community.

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