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Assistance for Oyster Mushroom Entrepreneurs in Making Fish Feed Formulations for African Night Crawler Worm (ANC) and Trichoderma sp. Fermented Bran

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ABSTRACT
Utilization of baglog waste as a growth medium for ANC worms as a raw material for making formulated fish feed provides opportunities as a side business for oyster mushroom entrepreneurs to increase income. The purpose of this service is to provide assistance to target partners, in this case oyster mushroom entrepreneurs, in utilizing ANC worm flour as a substitute for fish meal and then formulated with Trichoderma sp. fermented bran. The results of the dedication that has been carried out show that there has been an increase in partners' skills in making formulated fish fefazidah@usu.ac.ided and developing the potential of science and technology-based independent entrepreneurs who develop from mushroom businesses. After this dedication, it is hoped that the partners can continue to develop this worm farming business and the application of worm-formulated feed for fish farming which has also been developed by partners so as to create an integrated oyster mushroom-based farming center.
Keyword: ANC worms; baglog waste; fish feed; integrated agriculture Oyster mushroom;

ABSTRAK
Pemanfaatan limbah baglog sebagai media pertumbuhan cacing ANC sebagai bahan baku pembuatan pakan ikan terformulasi memberikan peluang sebagai bisnis sampingan pengusaha jamur tiram untuk menambah penghasilan. Tujuan pengabdian ini yaitu melakukan pendampingan kepada mitra sasaran dalam hal ini pengusaha jamur tiram dalam pemanfaatan tepung cacing ANC sebagai bahan substitusi pengganti tepung ikan dan selanjutnya diformulasikan dengan dedak terfermentasi Trichoderma sp. Hasil pengabdian yang telah dilakukan menunjukkan terjadi peningkatan keterampilan mitra dalam pembuatan pakan ikan terformulasi dan pengembangan potensi wirausahawan mandiri berbasis IPTEK yang berkembang dari usaha jamur. Setelah dilakukan pengabdian ini diharapkan mitra dapat terus mengembangkan usaha budidaya cacing ini serta aplikasi pakan terformulasi cacing untuk budidaya ikan yang juga telah dikembangkan oleh mitra sehingga terwujud sentra pertanian terpadu berbasis jamur tiram.
Keyword: cacing ANC; jamur tiram; limbah baglog; pakan ikan; pertanian terpadu

1. Introduction

One of the integrated agricultural agribusines originates from the oyster mushroom cultivation business developed by one of the entrepreneurs who owns the D'Jamuran trade. In 2021, the owner of this business has 2 mushroom cultivation and 11,000 baglogs consisting of 6,000 baglogs that are still in mushroom production, 2,000 baglogs that have just been inoculated with mushrooms and are not yet in production, and 3,000 baglogs that are already in production waste [1].

The waste generated from the oyster mushroom cultivation business has the potential for the development of worms [2]; [3]; [4]; [5]. In the previous service activity (in 2021) assistance was provided in utilizing baglog waste for the cultivation of African Night Crawler (ANC) worms. Partner assistance in worm cultivation is

carried out because the number of baglogs that are no longer producing are very abundant and the cultivation is expected to increase partner income.

ANC worms with the scientific name *Eudrilus eugeniae* are a group of earthworms that have many benefits. According to [2], ANC worms can also be used for medicines such as typhoid medicine and as an energy drink. Similarly, ANC worms which belong to the group of earthworms (*Lumbricus rubellus*) can also be used as raw materials for making animal feeds such as catfish, shrimp, frogs, poultry, and others [6].

The ANC worms are used as fish feed is caused because the protein content in ANC worms is quite high, reaching 60-70% [7] and can be increased by giving cow dung and sugarcane blotting [8]. The potential of worms as a source of protein in fish feed is carried out in order to form an integrated agricultural agribusiness business for this D'Jamuran business owner partner. In 2021, a fish pond has also been built and tilapia cultivation has been carried out in the pond. The worms that have been successfully cultivated through baglog waste have been applied to fish in the form of fresh worms. To continue the previous service program, ini 2022 fish feed formulated from ANC worms will be made in the form of fish pellets as an alternative protein source. In addition to fish feed from the ANC worms, probiotics are also added [9] and fermented bran using isolates of Trichoderma sp. the research results of [10] to improve fish health and the application of Bacillus cereus [11] which is later expected to be used as water engineering in aquaculture ponds as an ammonia decomposer in fish ponds. All of these activities are expected to support the growth and health of farmed fish and can also be a product of the development of science and technology-based entrepreneurship implemented by partners.

The activity of this entrepreneurship development program is expected to be able to realize the creation of science and technology-based independent entrepreneurs in the form of fish feed formulated with ANC worms which are enriched with Trichoderma sp. fermented bran. In addition, it is also hoped that the guidance carried out through community service activities in this entrepreneurship scheme can increase partner income.

2. Methods

This service is carried out in a business developed by a service partner named D'jamuran which is located at Elang Sakti Street, Simpang Baru Village, Tampan District, Pekanbaru. The materials used in this study consisted of several ingredients for making fish feed including ANC worm meal, *Trichoderma* sp. fermented bran, fish oil, soy flour, wheat flour, vitamins and minerals. The tools used are cameras, paper labels, plastic, basins, trays and fish pellet printing machines. Some of the technical steps for implementing community service activities that have been carried out are as follows:

1. Socialization and Coordination. At this stage the service team will disseminate science and technology which will be applied to partners and then continue with discussion and coordination regarding the next implementation steps;

2. Implementation of science and technology in the form of demonstrating the processing of ANC worms for fish feed;

3. Counseling and demonstration of product packaging techniques in the form of ANC worms and fish feed based on ANC worms.

Some indicators of the achievement of community service activities include:

- Realization of entrepreneurship with the application of science and technology;
- Increasing the income of partners outside of the oyster mushroom cultivation business;
- Increasing partner side business results through the utilization of baglog waste.

3. Results and Discussion

3.1. ANC worm cultivation

ANC worm cultivation is carried out by utilizing baglog waste which is no longer able to produce mushrooms. Worm cultivation begins with building a worm farming house. Through this community service activity, an ANC worm farming house was built with a size of 5x8 meters using a light steel building covered with plastic-coated paranet and covered with a tin roof covered with thatched roofs. Inside the cultivation house, worm racks are built measuring 1.2 x 7 meters with 3 store shelves with 3 rows of shelves. The worm rack can accommodate as many as 800-1,500 kg of worms at a time of harvest/3 months.

The ANC worm culture media uses unproductive baglog waste which is crushed until fine and sieved using a sieving net and then spread into the worm rack. The spreading of ANC worm seeds was carried out after all the cultivation media became moist. The seeds used for stocking were juvenile seeds, which were 20-30 days as much as 30 kg of seeds. During cultivation, the worms are given food in the form of leftover pieces of mushrooms and damaged mushrooms resulting from the mushroom harvest. Feeding is done every day where it takes 6-10 kg of mushrooms for 30 kg of worm food. The condition of the mushroom cultivation media must be in humid conditions so that it must be sprayed onto the worm cultivation media. Then sorting is done by selecting adult worms (aged 20-60 days) or adults on a rack containing new media to separate the worms that have grown and developed from the previous worms. The worm harvesting process is carried out after the worms are 80-90 days old after sowing, in which sowing 30 kg of worm seeds will produce a harvest of 90-150 kg of worms in 3 months of cultivation. The selling price of worms is IDR 40,000-60,000/kg. So, the side income that partners will generate from worm cultivation is around IDR 5,000,000 - IDR 9,000,000 in 3 months. ANC worm cultivation owned by partners through the entrepreneurship program can be seen in Figure 1.

Figure 1. Cultivation of ANC worms by utilizing baglog mushroom waste as a medium for the development of ANC worm.

3.2. Production of fish feed based on ANC worms and Trichoderma sp.

The success of fish farming is highly dependent on the provided feed. Fish feed is one of the production costs that must be incurred in fish farming. The better the feed given, the faster the development of the fish. The ANC worms produced from this service activity can also be an excellent fish feed to assist in providing nutrition to fish. This is because worms can be processed into fish pellets if they are in the worm flour form. The protein content of worm meal is known to be higher than fish meal. In the manufacture of fish pellets always use fish meal, but because the price of fish meal is increasing, worm meal can be an alternative in making fish feed. According to [2], the high content of essential amino acids in worm flour will make fish growth faster and feeding with worm meal extract will make fish grow much faster. The process of harvesting worms and cleaning worms from their growth media and making worm meal for fish feed can be seen in Figure 2.

Furthermore, the worm flour is used in the feed formulation which is also added with fermented bran fungus Trichoderma sp. Bran can be a source of fish fiber in fish meal formulations. The use of bran in feed for carnivorous fish can reach 15% while for omnivorous or herbivorous fish it can reach 35% [12]. In addition to bran, corn flour and tofu dregs can also be added. Utilization of bran as a

source of nutrition for fish feed formulations contains several important components in supporting fish growth. However, the increase in the nutrients needed in the feed formulation can be done by fermenting the bran using fungi. This is because the bran contains an anti-nutritional compound called phytic acid which has the potential to interfere with mineral absorption.

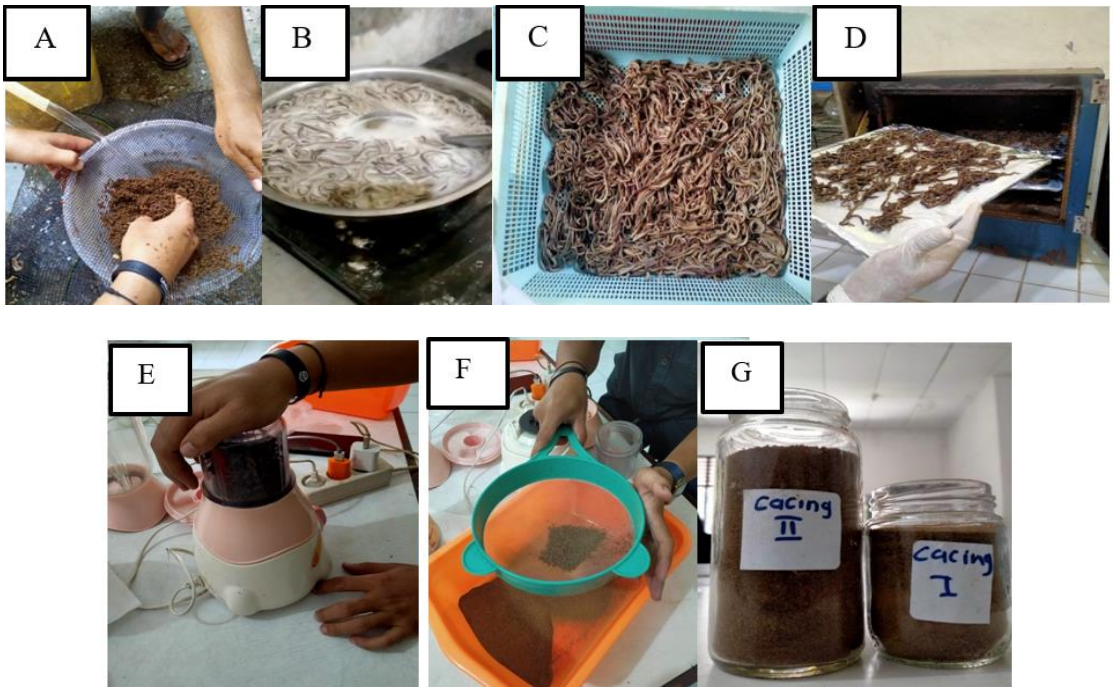

Figure 2. The process of harvesting until the flouring of cultivated ANC worms (A. Washing, B. Boiling, C. Filtering, D. Drying, E. Grinding, F. Filtering, G. Packing ANC worm flour)

According to [13], phytic acid can bind minerals such as calcium, magnesium, zinc, and copper. Therefore the use of bran which has been fermented by fungi is capable of producing phytase enzymes which can hydrolyze phytic acid into inositol phosphate, mio inositol phosphate and inorganic phosphate. [14]. Based on the research results of [15], the fermentation process with *Saccharomyces cerevisiae* can increase the nutritional value in bran such as protein by 4.78% and carbohydrates by 95.71%, and crude fiber by 17.43%. Other research related to the use of *Trichoderma* sp. as an effort to increase the nutritional value of fish feed, especially to increase crude protein content and reduce crude fiber content as an alternative feed ingredient in fish feed formulations to support aquaculture productivity. Therefore, in this service, bran fermentation was carried out with Trichoderma sp. which is also expected to be able to decompose the phytic acid in the bran. Then, the feed formulation that will containing bran does not contain anti-nutrients derived from the bran and increases the nutritional value of the bran as a feed ingredient. The form of fermented bran with *Trichoderma* sp. can be seen in Figure 3.

Figure 3. Fermented bran of *Trichoderma* sp.

The formulation of fish feed consists of several compositions of ingredients in the manufacture of feed including ANC worm flour, wheat flour, soybean flour, vitamins and minerals, fish oil, *Trichoderma* sp.

fermented bran, water. The process of making fish feed can be seen in Figure 4.

Figure 4. Materials and equipment for making fish feed and the process for making fish feed (A. Ingredients for fish feed made from worms and bran fermented by *Trichoderma* sp. B. Mixing process, C. Preparation of feed printing with a feed printing tool, D. printed feed).

Figure 4 shows that fish feed containing worm meal and supplemented with Trichoderma sp. has the potential to be used by fish farming businesses carried out by partners. This of course will be a sustainability if the cultivation of worms can continue. Not only having an oyster mushroom cultivation business, partners can also produce a product that can be useful for the continuation of the partner's business. The price range for tilapia feed is Rp. 9,000 – Rp. 300,000.00. If in one time tilapia cultivation comes to enlargement, of course it will cost quite a lot. If there are 1000 fish in one pond, the daily feed requirement is 15 grams x 1000 fish x 3% = 450 grams or 4.5 kg per day. It will be burdensome for farmers if it is not added with the addition of alternative fish feed from the by-product of ANC worm cultivation. Therefore, it is hoped that the worm cultivation business can continue to be developed by partners so that they can increase the income of partners outside of their main business as oyster mushroom producers.

Some of the levels of achievement of this program's targets include:

1. Increasing partners' side business results through the utilization of mushroom baglog waste;

2. The realization of independent entrepreneurship with the application of science and technology;

3. Increase the income of partners outside of the oyster mushroom cultivation business;

4. This service activity provides great opportunities for partners to further develop side business opportunities other than oyster mushroom cultivation. If all activities such as ANC worm farming, vermicompost plus fertilizer, and fish farming are carried out, the income will be much higher than before. In addition, this entrepreneurship service activity can become one of the integrated agricultural centers in Pekanbaru.

4. Conclusions

Based on the results of the service carried out, it can be interpreted that the partner's skills increase in

utilizing African Night Crawlers (ANC) worms in the manufacture of fish feed formulated with rice bran fermented by *Trichoderma* sp. as a by-product of the oyster mushroom business. In addition, there has been an increase and development of the potential of science and technology-based independent entrepreneurs (IPTEK) by partners developing the oyster mushroom business. It is hoped that partners can continue to develop this worm farming business and apply worm feed formulations for fish farming which have also been developed by partners so as to create integrated oyster mushroom-based cultivation centers.

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