



Development and Improvement of Catfish Cultivation Productivity in Balongmojo Village, Mojokerto

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ABSTRACT

Balongmojo Village is an entrepreneurial village in Mojokerto that has great potential in the livestock sector, especially catfish cultivation. The community service carried out aims to increase the productivity and sustainability of fisheries businesses in the village through the application of simple and environmentally friendly technology. Community service activities carried out include: (1) development of alternative feed based on agricultural waste (tofu dregs) for catfish; (2) making probiotics to improve catfish health; (3) managing catfish pond waste into liquid fertilizer; and (4) implementing an IoT-based automatic feeding system. The results of the study showed that the application of this technology was able to improve the quality of pond water and the growth of catfish. In addition, the use of organic waste also contributes to increasing soil fertility and reducing environmental pollution. Overall, this community service program has had a positive impact on improving the welfare of the Balongmojo Village community through increasing income, improving the environment, and developing community capacity in adopting modern technology.

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INTRODUCTION

Balongmojo Village, situated in the tranquil Mojokerto district of East Java province, stands out as the most secluded settlement in the Puri District. It shares borders with the neighboring Sooko District, creating a geographical enclave that fosters a distinct community spirit (Widagdo, RS. *et al.*, 2024). The village's economy is primarily driven by agriculture, small-scale industries, and traditional crafts, reflecting the resilience of its residents in adapting to their surroundings (Ardianik, A. *et al.*, 2023). In recent years, Balongmojo has experienced significant growth in catfish farming. This rapidly expanding industry, led by local residents with the support of village officials and the Head of Balongmojo Village, has resulted in the establishment of numerous well-managed catfish farms.

The primary factor driving this growth is the increasing demand for animal protein, especially fish, which is expected to rise sharply due to population growth and higher incomes within the community. As global fish stocks from natural waters and oceans decline, catfish farming in Balongmojo Village presents a promising solution to meet the region's growing protein needs. By focusing on improving fisheries activities, particularly catfish farming, the village can play a significant role in addressing global food security challenges.



Figure 1. Location of community service activities

Catfish farming offers a strategic solution for increasing fisheries production. Through intensive cultivation techniques and expanding aquaculture areas, this practice maximizes the use of diverse natural resources (Satoto, I. *et al.*, 2021) To meet the rising demand for fish protein within the community, initiatives such as freshwater fish farming can be adopted. Due to their high nutritional value and affordability, freshwater fish species are a popular choice among consumers, leading to sustained market demand (Fitriani, F., 2019)

The success of freshwater fish farming in meeting community production needs depends largely on selecting fish varieties that match consumer preferences. Although various freshwater species can be farmed, not all are equally popular among the local community. Understanding these preferences is essential for ensuring that the cultivated fish align with market demand and enhance the community's well-being. To address the previously mentioned challenges, the community service team is committed to providing education and support to improve catfish farming through appropriate technological interventions. These initiatives include developing an IoT-based automatic feeding system, utilizing catfish pond wastewater as a natural plant fertilizer, and offering more organic alternatives for catfish feed.

METHODS

The community service team has selected Balongmojo Village, Mojokerto, as the site for this program due to the village's strong potential in catfish farming. The program is designed to empower local catfish farmers through comprehensive training, mentoring, and infrastructure development. The goal is to enhance productivity, improve the quality and competitiveness of catfish products, and ultimately increase the income and well-being of the farming community.

Utilization of Noni Fruit to Prevent or Treat Diseases in Catfish

Catfish farming has become a significant economic activity in many regions. However, the industry faces numerous challenges, including disease outbreaks that can lead to significant losses. To mitigate these risks, various methods have been explored to suppress or avoid disease attacks. One promising approach involves the utilization of natural products, such as noni fruit.



Figure 2. Noni Fruit as a Fish Pellet Mixture to Reduce the Risk of Disease in Catfish

Noni fruit has gained attention for its health-promoting properties, such as anti-inflammatory and antimicrobial effects, making it a promising supplement for improving fish health in aquaculture. One simple way to incorporate noni into catfish feed is by grinding the fruit into a paste or powder (Husna, H. et al., 2024). This processed noni can then be blended with regular catfish pellets to create a fortified feed. Through this enriched diet, catfish can absorb the beneficial compounds found in noni fruit, potentially enhancing their overall health.

Utilization of Tofu Dregs as Alternative Basic Ingredients for Catfish Feed

Tofu dregs, a byproduct of tofu production, have significant potential as an alternative ingredient for catfish feed. Rich in protein, fiber, calcium, and other essential minerals, tofu dregs can contribute to the growth and development of catfish (Henda, E., 2020). Incorporating tofu dregs into catfish feed offers several benefits, including reduced production costs, improved nutrient absorption, and a lower environmental footprint. However, it is important to address the presence of anti-nutritional factors and the risk of contamination in tofu dregs. Proper processing and combining with other feed ingredients are essential to ensure the quality and safety of the feed. Overall, the use of tofu dregs presents a sustainable solution for the aquaculture industry (Sunu, P., 2020).



Figure 3. Fermented tofu dregs as organic feed for catfish



Utilization of Catfish Pond Wastewater as Liquid Organic Fertilizer

Catfish pond wastewater, often considered hazardous, actually holds great potential as a liquid organic fertilizer. It contains essential nutrients like nitrogen, phosphorus, and potassium, which are crucial for healthy plant growth. The waste treatment process involves several stages, including sedimentation to remove solids, filtration to capture particles, and disinfection using chlorine or UV light to eliminate harmful bacteria. Catfish pond wastewater can be applied to plants in various ways, such as direct watering and fertigation. Utilizing this wastewater as liquid organic fertilizer not only reduces environmental pollution but also offers economic advantages for farmers by lowering the cost of chemical fertilizers. Additionally, organic fertilizers help improve soil structure, enhance water retention, and promote the growth of beneficial microorganisms in the soil. The application of treated wastewater contributes to sustainable agricultural practices by recycling valuable nutrients. This approach not only supports crop productivity but also fosters a healthier ecosystem (Mulyani, C. et al., 2022)

Catfish Feeding System with an IoT-based Smart Solution

This community service introduces the concept of designing a system that integrates IoT technology for catfish feeding. It evaluates current farming practices in optimizing feed management to maintain the quality and health of catfish. By using IoT-based technology, feeding can be adjusted to the appropriate dosage, improving efficiency and enhancing the health of the fish. The system utilizes IoT to connect various electronic devices, sensors, and communication networks, enabling the automatic control and monitoring of the feeding process.

RESULT AND ANALYSIS

This section discusses the results obtained from the community service conducted in Balongmojo Village, Mojokerto, concerning the development and enhancement of catfish cultivation productivity. The research aims to evaluate the effectiveness of the strategies implemented to increase productivity and their impact on the economic welfare of the local community. Through the analysis of data collected from surveys, observations, and training sessions, the results will be compared to the initial conditions prior to the intervention. This discussion will also cover the factors contributing to the success of catfish farming, the challenges faced by farmers, and recommendations for further development. Community service activities in Balongmojo Village will introduce innovative approaches in catfish cultivation starting in August 2024. The focus is on developing and enhancing sustainable productivity by utilizing noni fruit to prevent or treat diseases in catfish farms, using tofu dregs as an alternative ingredient in catfish feed, and employing catfish pond wastewater as a liquid organic fertilizer to mitigate environmental pollution. Additionally, a smart IoT-based catfish feeding system will be established. These initiatives aim to provide new innovations for farmers and the community, ultimately boosting the local economy.

Utilization of Noni Fruit to Prevent or Treat Diseases in Catfish

Practical demonstrations and direct explanations will be provided to catfish farmers on various methods to prevent or minimize disease outbreaks in catfish. One effective approach involves utilizing noni fruit, which can be processed simply by mashing the fruit and then incorporating it into catfish pellets.



Figure 4. Application of noni fruit as a multivitamin for catfish

Incorporating noni fruit into catfish feed can yield various positive effects on both growth and fish health. Noni fruit is rich in nutrients such as vitamins, minerals, and antioxidants, which can enhance catfish growth, resulting in improved weight and length gain. Additionally, noni serves as a natural feed ingredient that boosts feed quality, as its fiber and nutrient content increase palatability, making it more appealing to the fish (Nafiqoh, N. *et al.*, 2020)

The inclusion of noni also contributes to fish health due to its antimicrobial properties, helping to maintain the well-being of catfish by reducing the risk of infections and diseases while enhancing their immunity against various pathogens. Furthermore, feed efficiency may improve with better nutrient absorption, allowing fish to grow faster with less feed. Some studies have indicated that noni can also help reduce fat accumulation in fish, which benefits the quality of catfish meat (Cholifah, D. *et al.*, 2012).

Utilization of Tofu Dregs as Alternative Basic Ingredients for Catfish Feed

The process of creating pellets from tofu dregs and polar as catfish feed ingredients presents an alternative due to the accessibility and affordability of these materials, as well as their market value. This combination not only provides a good source of protein but also helps reduce waste generated by the tofu industry. Additionally, incorporating tofu dregs and polar into fish feed can enhance the sustainability of aquaculture by utilizing affordable local resources.



Figure 5. Making tofu dregs as an alternative basic ingredient for catfish feed



The use of organic catfish pellets made from tofu dregs can reduce the mortality rate of catfish seedlings by 10-20% and promote faster growth. This improvement is attributed to the addition of probiotics in the organic tofu dregs pellets, which contain beneficial microorganisms that enhance the resilience of catfish (Jalil, A. *et al.*, 2022). The immune system of catfish fed with these organic pellets is superior to those fed with commercial feed. Probiotics play a crucial role in increasing the growth rate of catfish and boosting their immunity against disease by altering the composition of intestinal bacteria. The inclusion of probiotics in catfish feed serves as an indirect substitute for antibiotics (Lestari, S., 2024)

Utilization of Catfish Pond Wastewater as Liquid Organic Fertilizer

The introduction and direct demonstration to the community and the PKK mothers will focus on methods to reduce environmental pollution. The resulting liquid organic fertilizer can be utilized for medicinal plants (toga), as catfish pond water is rich in organic materials, including nitrogen, phosphorus, sulfate, potassium, and beneficial pH levels (Gusnawan, R. *et al.*, 2021). These nutrients are highly beneficial for toga plants. By using this liquid organic fertilizer, it is expected that the yield of toga crops will increase, providing economic benefits to the community. Furthermore, this method supports sustainable agriculture principles by utilizing catfish pond waste as a nutrient source for plants (Juliarti, A. *et al.*, 2022).



Figure 6. Socialization of making catfish pond waste as liquid fertilizer

Using catfish pond water as liquid fertilizer is an effective way to utilize waste from catfish farming. This water is rich in essential nutrients such as nitrogen, phosphorus, and potassium, which support vegetative growth, root development, and photosynthesis in plants. To prepare this liquid fertilizer, pond water should be collected after it has aged for at least 2-3 weeks and then filtered to remove large particles and debris. If desired, the water can be fermented with organic materials like bran or sugar to enhance its quality (Prakosa, D.G., 2021).

This liquid fertilizer can be applied by mixing the pond water with clean water in an appropriate ratio, such as 1:5, before being used to irrigate plants. The advantages of using catfish pond water as liquid fertilizer include cost-effectiveness and environmental friendliness, as it reduces the need for chemical fertilizers and minimizes waste from catfish farming. However, it is crucial to ensure that the pond is well-maintained and free from harmful chemical contaminants to avoid posing risks to plant health. By utilizing catfish pond water, farmers can promote sustainability in both crop and fish farming while efficiently managing resources.

Catfish Feeding System with an IoT-based Smart Solution

The IoT-based smart catfish feeding system is designed to automate and monitor the feeding process in aquaculture settings, aiming to ensure that fish receive the right amount of feed at the right time, thereby improving growth rates and reducing feed waste. This system consists of several key components, including an automated feeding mechanism that dispenses feed based on real-time data, as well as sensors that monitor water quality (such as temperature, pH, dissolved oxygen, and ammonia levels), the remaining feed weight, and fish activity behavior (Zaelani, A. *et al.*, 2019). A microcontroller, such as Arduino or Raspberry Pi, processes data from the sensors and controls the feeding mechanism, while connectivity modules (Wi-Fi or cellular) enable data transmission to the cloud (Cristiand, C. *et al.*, 2022).

The cloud platform is used for data storage, analysis, and remote monitoring, which can be accessed via a mobile or web application, providing convenience for farmers to efficiently monitor and manage the system. By continuously collecting data and using smart feeding algorithms, this system can reduce overfeeding, minimize waste, and lower feeding costs, while also helping to detect fish health issues early through monitoring water quality and fish behavior (Rusindiyanto, R. *et al.*, 2024). Although there are challenges, such as high initial costs and the need for technical skills, the integration of this technology has great potential to enhance aquaculture practices by improving productivity and sustainability. In the future, this system could be enhanced by implementing machine learning algorithms to predict fish growth patterns and optimize feeding based on historical data, as well as integrating with other systems to monitor fish health and farm management comprehensively (Novianda, M. *et al.*, 2022).



Figure 7. Automatic feeding system demonstration for catfish farmer

Effective feeding management is one of the main challenges in catfish farming, as improper feed management can lead to waste, reduced fish quality, and even fish mortality. Therefore, the application of the Internet of Things (IoT) in the catfish feeding system is crucial for improving the efficiency and effectiveness of feed management. This system design could include the use of sensors to monitor water quality, such as temperature, pH, and dissolved oxygen, allowing for the adjustment of feed provision based on optimal conditions for the fish. Additionally, an automated feeding system connected to a mobile application can be programmed to deliver feed at specific times and in precise amounts based on data received from the sensors. Monitoring fish behavior is also important, where sensors can detect activity



and feeding patterns, providing insights into the health of the fish. Furthermore, it is essential to explore the farmers' acceptance of new technologies, such as IoT systems, and any barriers they may encounter in implementing such solutions. By understanding the practices and challenges faced by farmers, we can design appropriate and effective solutions that not only enhance the productivity of catfish farming but also support the sustainability of the aquaculture industry.

Discussion

After this community service project, several follow-up activities can be considered to enhance the sustainability and effectiveness of catfish farming. First, conducting additional training and extension services for farmers on improved cultivation techniques, feed management, fish health, and the latest technologies in aquaculture can be beneficial. Secondly, encouraging farmers to diversify their ventures by exploring the cultivation of other fish species or aquaculture products, such as tilapia or carp, and utilizing waste from catfish farming for livestock feed or fertilizer can enhance productivity. Furthermore, developing better marketing networks, including online platforms, will help farmers reach more consumers and achieve better prices for their products. Establishing partnerships with cooperatives can also promote resource sharing, knowledge exchange, and collective marketing efforts among farmers. Additionally, initiating research and development activities will allow for the evaluation of farming outcomes and the exploration of new methods to boost productivity and efficiency.

CONCLUSION

The community service activity conducted in Balongmojo Village, Mojokerto, has successfully enhanced catfish cultivation productivity through various interventions and training sessions. By implementing more efficient cultivation technologies, effective feed management, and appropriate fish health practices, local catfish farmers have significantly increased their harvest yields. Moreover, the program has raised awareness among the community about the importance of environmental management and sustainability in aquaculture. The involvement of community members in every stage of the program has strengthened their sense of ownership and responsibility for the achieved outcomes.

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