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Humic Acid Aplication in Catfish Farming Using Bucket System in Muncul Fish Farm, Banyuwangi, Indonesia

Darmawan Setia Budi[a)], Hapsari Kenconojati, Mohammad Faizal Ulkhaq, Muhammad Yusuf Taufiqur Rohman, Shovia Finny Anggraeni, Farahnovita Yuliyanti, Ahmad Alie Fikri, Shierly Zaissiliya Clarissa Lifani, Hikam Zainul Qolbi

Study Program of Aquaculture, Department of Health and Life Sciences, School of Health and Life Sciences, Universitas Airlangga, Banyuwangi, Indonesia

[a)]Corresponding author: darmawansetiabudi@fpk.unair.ac.id

Abstract

In Banyuwangi, Indonesia, where the vast potential of natural resources remains largely untapped optimally, the community partnership program (CPP) was introduced to enhance freshwater fish production, with a specific focus on catfish farming in the Muncul fish farm. The region's catfish production, the largest among consumer fish commodities, had been hampered by traditional and semi-intensive methods, limited facilities, disease risks, and uncertain market conditions. To address these challenges, the CPP employed a participatory approach, fostering a close relationship between the community development team and partner groups. Through scientific problem-solving discussions, valuable input from partners, and active participation in decision-making, catfish farmers were empowered. The central innovation of applying humic acid in a bucket fish farming system significantly improved catfish productivity and profitability. As a result, partners gained knowledge and skills in intensive bucket fish farming, substantially increasing their productivity and income. To further expand the benefits of this program, promoting urban farming concepts, especially the bucket fish farming system, should be encouraged to engage more individuals with limited space in small-scale aquaculture for food security and income generation.

Keywords: Community, productivity, fisheries, income, aquaculture

INTRODUCTION

Banyuwangi, Indonesia, is the easternmost regency of the island of Java which has an area of more than 5.7 million km, a coastline of around 175.8 km and a population of more than 1.9 million people and there are at least 10 islands that are part of the Banyuwangi Regency area. With this area and population, Banyuwangi regency is one of the largest regencies on the island of Java. The potential of Banyuwangi district is the condition of a large area with heterogeneous topography, including in the western region which is a highland area with abundant water

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sources. Based on Banyuwangi data, there are at least 35 watersheds that flow throughout the year (BPS, 2008).

The abundant natural potential that is still largely untapped has led the Banyuwangi district government to try to develop and increase freshwater fish production through several programmes, including the 10,000-pond programme. The programme aims to harness the potential of nature and increase the income and nutrition of the community. The development programme is to utilise yard land as fish farming land. Some of the freshwater fish species that are widely developed in Banyuwangi Regency are catfish, carp, tilapia, catfish, snakehead, and eel. Of the several types of fish, catfish is the type of commodity that is currently the most widely cultivated. The production value of catfish in Banyuwangi is 2,655 tonnes and is the largest in Banyuwangi among other types of consumer fish commodities (Newswire, 2016). However, until now the cultivation process still applies a lot of traditional and semi-intensive systems with the application of aquaculture systems and technologies that are not optimal. This has an impact on the environment and increases production costs.

Muncul fish farm is one of the small and medium enterprises (SMEs) which is engaged in ornamental and consumption fish farming. This SME was established on 1 August 2021 and is trying to grow. Muncul fish farm is located in Banjarsari Village, Glagah District, Banyuwangi Regency, Indonesia. Muncul fish farm stands on a small area of land measuring size of 40 × 20 m^2 and has 10 permanent 2 × 1 m^2 ponds, as well as 10 permanent ponds, and has electricity and water source facilities. Muncul fish farm cultivates various types of ornamental fish and also focuses on catfish farming.

Minimal production facilities cause the production capacity of catfish produced is also small. In addition, Muncul fish farm is only managed by 2 people with very minimal management. Some of the obstacles and problems faced by Muncul fish farm in catfish production include: 1) the price of feed continues to rise, 2) minimal facilities, 3) narrow land, 4) erratic weather affects water quality, 5) disease attacks that can reduce production, 6) production capacity that has not been optimized, 7) uncertain market conditions, 8) small margin/profit, 9) mastery of catfish farming technology is still minimal, and 10) quality and quantity of seeds are not guaranteed.

Based on all the existing problems, it is necessary to identify important problems to be resolved through the community partnership programme (CPP) which will be held through mentoring to solve problems and increase partner productivity.

Based on the priority problems and characteristics of the partners, the technology transfer solution offered is "humic acid application in the bucket fish farming system as an effort to increase the efficiency and productivity of catfish farming (*Clarias* sp.)". Where this technology and system is very appropriate to optimise production on narrow land with the concept of urban farming.

Humic acid is an organic compound that can be obtained from humus soil. This compound is widely used in agriculture (Arif et al., 2016). The application of humic acid in the field of fisheries has been carried out on goldfish (*Cyprinus carpio*) to increase immune response and resistance to disease (Abdel-Wahab et al., 2012). Humic acid also increase growth and feed conversion ratio (FCR) (Meinelt et al., 2008).

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One of the efforts that can be made to increase FCR is to increase the absorption of nutrients in the intestine through the addition of humic acid to the feed (Arif et al., 2019). Increased absorption can be measured by knowing the increase in protein retention in fish. The higher the protein retention value, the more feed protein is converted to protein in the meat. A low FCR value will be beneficial for farmers, because the lower the FCR value, the lower the cost of purchasing feed (Sopha et al., 2015). High FCR is due to feed that is not converted into biomass (Dedi et al., 2018). When both parameters have good values, it can be stated that the costs incurred for feed will be reduced. The use of humic acid in feed is expected to improve the feed conversion value and protein retention of catfish, so that the feed used is efficient.

Fish farming activities often require a relatively large area of land, but this is overcome by urban farming. Urban farming is a cultivation process carried out in urban areas by utilising limited land (Wiyanti, 2013). The application of limited land cultivation can be done by using a bucket fish farming system or fish farming in buckets by utilising buckets as cultivation containers so that they can utilise narrow land. Bucket fish farming can be a potential solution for the fishing community by utilising narrow land and can save the use of water and with relatively small capital (Nursandi, 2018).

The solution offered is implemented through the transfer of catfish farming technology according to the characteristics of the partners, assistance in the application of catfish farming technology, and evaluation of efficiency and increased productivity of partners. Where the benefits obtained by partners can be measured through understanding the application of technology and increasing efficiency and productivity.

METHOD

The community development was conducted in Mei-August 2023 at Muncul fish farm that located in Banjarsari Village, Glagah District, Banyuwangi Regency, Indonesia.

The participatory method was used in this community development activity. The participatory rural appraisal (PRA) method is an approach that allows communities to communicate with each other, share and jointly analyse a problem in order to formulate plans and policies for its real implementation. In essence, PRA is a group of approaches or methods that allow communities to share, improve, and analyse their knowledge of conditions and lives and make concrete plans and actions. Some basic principles that must be met in the PRA method include mutual learning and sharing of experiences, involvement of all group members and information, outsiders as facilitators, the concept of triangulation, as well as optimisation of results, practical orientation and program sustainability.

The participatory planning methods that will be carried out include (Figure 1.):

- There is a close relationship between partner groups and the community development team
- Partners and the community development team discuss all the problems faced and can be explained scientifically and provide ideas as valuable input
- Partner members and the community development team play an important role in making decisions that will be used

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- Partners benefit from the results of the implementation of planning carried out jointly with the assistance of the community development team.

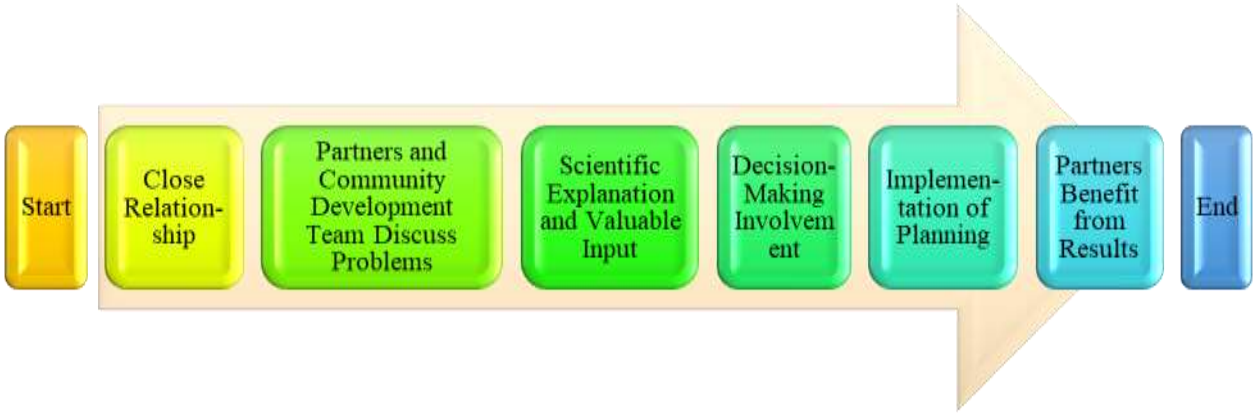

Figure 1. The flow chart of community development participatory planning methods

RESULTS AND DISCUSSION

Aquaculture has the potential to aid in community development by promoting coastal livelihoods and the development of sustainable fisheries (Johnson & Rickard, 2022). To be effective, community-based aquaculture programs must take into account a number of different elements. The perspectives, consultation, involvement, empowerment, and ownership of stakeholders are critical to the sustainability of these programs (Brugere et al., 2023). Aquaculture development must also pay attention to human and social aspects, such as concerns about justice, equity, ethics, and social acceptance (Zanna et al., 2020). Local support for aquaculture facilities can also be influenced by an understanding of the sense of place and social relationships people have to particular areas (Bradford et al., 2020). Governmental and non-governmental groups must implement supportive policies, regulatory frameworks, and support mechanisms in order to accomplish community sustainable fisheries development. The success of aquaculture development depends on the inclusive involvement of small-scale farmers, women, youth, people with disabilities, and indigenous communities.

Activity implementation

Community development activities that have been carried out include: 1) exploration with partners (Muncul Fish Farm), 2) preparation of the cultivation system, 3) implementation of cultivation, 4) marketing of cultivation products. Documentation of activities can be seen in Figure 1.

Standard operational procedure of farming

Equipment such as bucket, aeration stones and hoses, etc were sterilised by soaking in 0.03 ppm in kalium permanganate solution (0.03 ppm) for 3 days. Catfish fry are first quarantined for 2 days in a 52-litre bucket with a medium that is salted with a dose of 4 ppt for 2 days. During the quarantine, the fish were fed with at satiation feed and the media was aerated moderately.

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Fish were raised in the bucket system with varying stocking densities depend on fish size. Fish with a maximum length of 13 cm were stocked at 1000 fish/bucket, 16 cm at 600-800 fish/bucket, 20 cm at 300 fish/bucket, and 20 cm at 120 fish/bucket. Dissolved oxygen in media was kept with aeration and 70% media was changed daily. Humic acid was always applied as a quarter tablespoon after a water change. One tablespoon of zeolite gravel is added to the rearing medium as a substrate for decomposing bacteria that help maintain water quality.

The diet was supplemented with the prepared probiotics at a dose of 1 ml/10 g of feed. The prepared probiotic fermentation mixture was 220 ml EM4, 1 bottle yakult, and 220 ml molasses dissolved in 15 l clean water and fermented for 2 weeks. Feed was given 3% of biomass 3 times a day.

Figure 2. Activity implementation documentation of community development in Muncul fish farm.

Productivity increasing

Increasing the productivity of Muncul fish farm was achieved by increasing the cultivation capacity by intensification through the application of a good bucket culture system with humic acid application. Through this community development programme, we managed to build a more intensive installation for catfish farming. This installation is equipped with an integrated aeration system and water change system, making cultivation more efficient. The benefits obtained by Muncul fish farm as a partner of this community development programme include: 1) knowledge and skills regarding intensive bucket fish farming, 2) increased productivity of fish

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farming, and 3) increase in fish farming business income. Fish farming facilities at Muncul Fish Farm before and after the community development programme can be seen in Figure 3.

An analysis of costs and returns based on data on initial stocking rates and growing periods is shown in Table 1. Based on the business analysis, the potential profit that can be obtained from one bucket of catfish farming for one cycle (± 2-3 month) is around IDR 80,000. In the Muncul fish farm there are 20 buckets so the potential profit of one production cycle can reach up to 1,600,000 IDR.

Figure 3. Fish farming facilities at Muncul fish farm before (left) and after (right) the community development program.

Table 1. Economic analysis of catfish farming (one production cycle) in buckets with humic acid application.

Items	Number	Unit	Price (IDR/Unit)	Total Price (IDR)
Fry	300	fish	500	150,000
Feed	25	kg	15,000	375,000
Water costs	1		10,000	10,000
Electric charge	20	kwh	500	10,000
Humic acid	0.5	kg	30,000	15,000
Medicine and probiotic	1	package	10,000	10,000
Total costs				**570,000**
Total return	25	kg	26,000	**650,000**
Net Profit				**80,000**
ROI (%)				**0.14**
R/C Ratio				**1.14**

CONCLUSION AND SUGGESTION

Conclusion

Community development in the Muncul fish farm has resulted in the acquisition of knowledge and skills in intensive bucket fish farming, increased productivity in fish farming and increased income in fish farming enterprises.

Suggestion

The benefits of this program can be expanded by promoting the concept of urban farming, particularly the bucket fish farming system, as a viable solution for individuals

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with limited space. This approach can empower more people to engage in small-scale aquaculture for food security and income generation.

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