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THE GROWTH AND SURVIVAL RATE OF CATFISH (*Clarias gariepinus*) REARED INTENSIVELY USE BIO-FLOC TECHNOLOGY

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ABSTRACT

The study purposed to investigate the growth and survival rate of catfish (Clarias gariepinus) reared intensively use bio-floc technology. The research used an experimental method, consists of two treatments. Treatment A was catfish reared uses Noni fruit (Morinda citrifolia) fermentation on culture media every seven days with a dose of 10 ml/liter. The treatment also uses papaya leaves as additional feed. Treatment B was catfish reared apply bio-floc technology use probiotics. Probiotic consists of Lactobacillus spp. and Thiobacillus spp. The addition of 5 grams of Lactobacillus spp. and 500 ml molasses in rearing media were carried out every seven days. The feed used in the experiment was fermented by Thiobacillus spp. and molasses at a dose of 150 ml/kg of feed. Two plastic tanks with a volume of 5000 L were used in the experiments. Amount 3000 catfish with the average initial body weight of 6 grams reared in each plastic tank. Catfish were fed twice daily with a feeding rate of 7%. Feed nutrition content was protein minimum 28%, fat maximum 4%, and fiber maximum 5%. Catfish were reared for 64 days. The research data consist of fish growth, feed conversion ratio, and survival rate of fish. Data were analyzed quantitatively descriptively. The results showed that survival rate of catfish in treatment B higher than treatment A, but growth of catfish in treatment B lower than treatment A. Feed conversion ratio in treatment A lower than treatment B. The specific growth rate, feed conversion ratio, and survival rate of catfish in treatment A were 5.19%, 69.83%, and 0.78, respectively. At the same time, the specific growth rate, feed conversion ratio, and survival rate of catfish in treatment B were 3.89%, 90.80%, and 0.95, respectively. The results were indicated that bio-floc technology could improve the survival rate of catfish but no increased growth of catfish.

***Keywords**: bio-floc technology, Clarias gariepinus, growth, survival rate*

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1.INTRODUCTION

Intensive catfish cultivation often experiences various problems. Catfish cultivation requires sufficient feed to support fish growth. However, not all feed was eaten used to grow fish, but 25% were converted into carcass and 62% as dissolved material, and 13% as-deposited particles. Organic matter in fish farming causes a decrease in water quality and fish immune system. Wastewater from catfish cultivation contains high N2 and NH3 (ammonia) resulting from protein and amino acid reformation. Craig et al. (2017) argue that the high content of ammonia in water was very toxic and could cause fish death.

Intensive catfish cultivation requires high quality of feed according to the nutritional needs of fish. Nutritional requirements for catfish were protein (minimum 28%), fat (maximum 8%), carbohydrates (maximum 12%) (Suwarsito & Mustafidah, 2015). In addition, the suitable water quality for fish cultivation also needs to be considered. Water quality that suitable for catfish cultivation were temperature 28 – 30 0C, pH 6.5 - 8.5, dissolved oxygen > 4 ppm, dissolved CO_2 < 12 ppm, NH_3 < 0.5 ppm, and NO_2 < 0.06 ppm (Suwarsito & Mustafidah, 2018). If the nutritional requirements and water quality for catfish farming sufficient, catfish's growth and survival rate become optimal.

The main problem of intensive fish farming was a degradation of water quality. The degradation of water quality causes a decrease in fish appetite, so the growth of fish decrease.

In addition, a reduction of water quality also causes the reduction of the immune system of fish that affects fish easily susceptible to disease to decrease fish survival.

Based on the description of the problem, it was necessary to develop an appropriate catfish cultivation model to obtain optimal growth and survival of catfish. One of the technologies for developing intensive fish farming was bio-floc fish cultivation technology. Bio-floc technology enables fish culture with high densities and saves the use of land and water. Bio-floc technology more effective compared to traditional cultivation and able to increase pond productivity and reduce production costs.

Bio-floc technology was a technique for growing heterotrophic bacteria in fish farming ponds that aim to utilize nitrogenous waste (ammonia) becomes high protein feed by adding carbon sources to increase the C/N ratio (Avnimelech, 1999), (Ekasari, 2009), (Crab et al., 2012). Bio-flocculation technology is one of the technologies currently being developed in aquaculture that aims to improve water quality and efficiency of nutrient utilization (Setiawan et al., 2016). Some studies showed that the application of bio-floc technology could enhance the quality of water, increase biosecurity, increase productivity and reduce feed costs (Avnimelech, 1999), (De Schryver et al., 2008), (Dvimurti, 2013).

The purpose of this study was to investigate the growth and survival rate of catfish (*Clarias gariepinus*) that reared intensively use bio-floc technology.

2. RESEARCH METHOD

The research used experimental method, consists of two treatments, i.e.:

A. *Treatment A*

Treatment A was catfish rearing uses Noni fruit (*Morinda citrifolia*) fermentation on culture media every seven days with a dose of 10 ml/liter and adding papaya leaves as additional feed.

1) *Prepare for noni fruit fermentation*: Noni fruit fermentation was done by mixing 10 liters of water, 1 liter of molasses, 10 kg of noni fruit, and 1 liter of effective microorganisms. Effective microorganisms consist of Lactic Acid bacteria (*Lactobacillus sp*.), Photosynthetic Bacteria (*Rhodopseudomonas* sp.), *Actinomycetes sp*., *Streptomyces sp*., yeast, and cellulose decomposers. Thus, the ingredients were fermented for ten days in an aerobic tank.

2) *Prepare of culture media*:

- The plastic tank with a volume of 5000 L was used in the experiment. The plastic tank was filled with 3000 L of water.
- Add 400 grams of dolomite and 5 kg of salt to the plastic tank.
- Add 100 ml of effective microorganism and 500 ml of molasses into the plastic tank and then aerate it continuously for ten days.
- After more than ten days, the plastic tank was treated with 400 grams of dolomite and 10 ml/liter of noni fermented fruit. The culture media was ready to be used for the experiment.

3) *Rearing of catfish*:

- Amount 3000 catfish with the average initial body weight of 6 grams reared in the plastic tank.
- Catfish were fed twice daily with a feeding rate of 7% at 7 am and 5 pm. Feed nutritions content were protein minimum 28%, fat maximum 4%, and fiber maximum 5%. Catfish were fed no fermented feed. Catfish also were provided by an additional meal of papaya leaves every day at satiation.
- Water replacement was conducted every ten days as much as 10% of water volume. Thus, add 200 grams of dolomite and 10 ml/liter fermented noni fruit to the plastic tank.
- Catfish were reared for 64 days.

B. *Treatment B*

Treatment B was catfish rearing apply bio-floc technology use probiotics. Probiotic consists of *Lactobacillus spp*. and *Thiobacillus spp*. The addition of 5 grams of *Lactobacillus spp*. and 500 ml molasses in rearing media were carried out every seven days. The feed used in the experiment was fermented by *Thiobacillus spp*. and molasses at a dose of 150 ml/kg of feed.

1) *Prepare of culture media*:

- The plastic tank with a volume of 5000 L was used in the experiment. The plastic tank was filled with 3000 L of water.
- Add 400 grams of dolomite and 5 kg of salt to the plastic tank.
- Add 5 grams of Lactobacillus spp. and 500 ml of molasses into the plastic tank and then aerate it continuously for ten days.
- After more than ten days, the plastic tank was treated with 400 grams dolomite and 5-gram Lactobacillus. The culture media was ready to be used for experiments.

2) *Rearing of catfish*:

- Amount 3000 catfish with an average initial body weight of 6 grams reared in the plastic tank.
- Catfish were fed twice daily with a feeding rate of 7% at 7 am and 5 pm. Feed nutrition content was protein minimum 28%, fat maximum 4%, and fiber maximum 5%. Catfish were fed with fermented feed probiotics—Probiotic consisting of *Thiobacillus spp*.
- Water replacement was done every seven days as much as 10% of water volume. Thus, to the plastic tank, add 200 grams dolomite and 5-gram *Lactobacillus spp*.
- Catfish were reared for 64 days.

C. *Research Variable*

The research variable was:

1) *Growth of Catfish*: The growth of catfish consists of absolute growth dan specific growth rate.

- Absolute Growth
  Absolute growth (AG) was counted by the formula of (Weatherley, 1972):
  AG = Wt – Wo
- Specific Growth Rate
  Specific growth rate (SGR) was counted by a formula of (Zonneveld et al., 1991):
  $$SGR = \frac{LnWt - LnWo}{t} x100\%$$
- Water replacement was conducted every ten days as much as 10% of water volume. Thus, add 200 grams of dolomite and 10 ml/liter fermented noni fruit to the plastic tank.
- Catfish were reared for 64 days.

2) *Feed Conversion Ratio (FCR) was counted by formula of* (NRC, 1977) *:*

FCR = F/(Bt – Bo)

3) *Survival Rate (SR) was counted by the formula of* (Effendi, 2002)*:*

$$SR = \frac{Nt}{No} x100\%$$

Data collection was conducted by measuring fish weight at the beginning and end of the experiment. Fish weight measurements were carried out by weighing fish samples in each plastic tank as many as 150 fish. Fish weight data were used to calculate fish growth. Calculation of the number of fish was done at the beginning and end of the experiment. The data were used to calculate the survival rate of fish. The amount of feed given by fish was recorded every day. The data was used to calculate the feed conversion ratio.

Data of fish growth, feed conversion ratio, and survival rate of fish was presented in table form. Furthermore, fish growth, feed conversion ratio, and survival rate of fish were analyzed quantitatively descriptively.

3. RESULTS AND DISCUSSION

Experimental data of growth, survival rate, and feed conversion ratio were presented in Table 1.

Table I. Absolute Growth, Specific Growth Rate, Survival Rate, and Feed Conversion Ratio of *Clarias geriepinus*

Variable	Treatment A	Treatment B
Absolute growth (g)	151.81	99.47
Specific growth rate (%)	5.19	3.89
Survival rate (%)	69.83	90.80
Feed conversion	0.78	0.95

Table 1 showed that catfish growth, both absolute growth and specific growth rate in treatment A were higher than in treatment B. The absolute growth of fish illustrates the weight gain of fish during the experiment, while the specific growth rate describes fish weight gain every day during the investigation. The high growth of catfish in treatment A was thought to be due to papaya leaves as feed additives. Papaya leaves can increase feed digestibility causes food nutrients can be digested properly. The increasing feed digestibility will increase the effectiveness of feed utilization by fish. Feed conversion of treatment A was lower than treatment B. Feed conversion ratio showed the amount of feed consumed by fish converted into fish biomass (carcass or fish skeleton). The decreasing value of feed conversion ratio indicated increasing the amount of feed converted to fish biomass. The results of this study were consistent with the research conducted by Isnawati et al. (2015) that the use of 2% papaya leaf powder could improve the efficiency of feed utilization and relative growth rate of tilapia. But fish growth in treatment B was still higher than the research conducted by Hermawan et al. (2014), which stated that the growth rate of catfish maintained in bio-floc media with a density of 500 fish/m^3 was 3,868 ± 0.014%/day.

Overall, the results of this experiment indicated that catfish rearing with bio-floc technology could improve the effectiveness of feed utilization. This result was under Sudana et al. (2016) that bio-flocculation technology could enhance water quality and enhance the efficiency of nutrient utilization. The application of bio-floc technology in fish farming systems can reduce FCR values and improve feed efficiency. This is inseparable from the contribution of increasing biomass of highly nutritious floc microorganisms formed due to carbohydrates and an increase in the C/N ratio in the rearing medium. Increased floc microorganism biomass was utilized by omnivorous catfish as nutritious natural food, improving fish growth and reducing feed consumption. Wahjuningrum & Setiawati (2009) stated that feed efficiency with the application of bio-floc technology increase because of an increase in bio-floc microbial biomass as a source of nutrition or supplementary food for fish.

However, the survival rate of catfish in treatment A was lower than treatment B even though treatment B was routinely fermented with molasses and noni fruit, not able to reduce fish mortality. The anti-bacterial bioactive substances contained in noni fruit could not minimize fish mortality. In addition, effective microorganisms were used for fermentation also do not function appropriately in oxidizing ammonia. Therefore, the ammonia content in the rearing media increase. The increased ammonia in rearing media has resulted in a low fish survival rate.

The result showed that the survival rate of fish in treatment B was higher than treatment A. The survival rate of catfish in treatment B was 90.80%. The increased survival rate of catfish in treatment B was caused by an increase in the fish's immune system. The use of probiotic fermented feed can increase fish endurance from disease attacks. Whereas in treatment A the feed given to fish is not fermented with probiotics so that the immune system of the fish decreases.

The result of this study was in line with the research conducted by Hermawan et al. (2014) that the survival of catfish reared in bio-floc media with stocking densities between 500 - 1500 fish/m^3 ranged from 91.389 to 91.833%. The high survival rate of fish was due to the role of probiotic bacteria used in rearing media and fish feed. The content of probiotics *Thiobacillus spp*. plays a vital role in sulfur (H_2S) decomposition reactions. H_2S compounds can cause stunted growth, decrease resistance to disease and increase mortality of shrimp and fish. *Thiobacillus denitrificans* function to neutralize H_2S toxins and nitrite by denitrification reaction. Bacillus subtilis describes the remaining feed and feces of NH_3. *Lactobacillus brevis* produces adjuvant polysaccharides, which can trigger the fish's immune system. *Lactobacillus la*ctis helps the digestion process, forms PHA biofilm as bioremediation and biocontrol against pathogens. *Lactobacillus casei* forms colonies of beneficial bacteria on the digestive tract walls, thus blocking disease infections. Lactobacillus acidophilus produces compounds of organic acids that can inhibit the development of germs in the digestive tract.

4. CONCLUSIONS

The results were indicated that the bio-floc technology could improve the survival rate of catfish but no increased growth of catfish.

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