

Growth Performance of Catfish (*Clarias Gariepinus* Burchell, 1822) Cultured in High Density on the Biofloc System

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Abstract. Start your The fish farmers and researchers have made efforts to increase catfish production through high levels of dispersal and application of biofloc systems. This system, in addition to increase production, can also predict when the harvest is done, control the quality of water causing death so that the Survival Rate (SR) is high. The purpose of this study is to determine the growth performance and predict the harvest weight and catfish survival rate (SR) that are cultured with different high density on the biofloc system. The research method used is experimental with test fish in the form of catfish seeds weighing of 8 ± 0.2 gram/fish with each density as treatment: P1. Density of 1,100 fish/m³; P2. Density of 1,200 fish/m³ and P3. Density of 1,300 fish/m³. Pond: The pond used is made of 3m in diameter of tarpaulin, equipped with a 6mm diameter of iron frame. Total volume of water in each pond is 3 m³. Catfish seeds have been adapted and put into the pond at random with the length of cultivation period is 4 weeks. Growth performance analysis uses the SPSS regression statistic series 20. The research results showed that the growth performance for 4 weeks showed that P1 generates the regression equation $Y1 = 6.46 + 7.81 X$ with $r^2 = 0.971$ means that if the harvest is done at week 12th then the weight of catfish has reached 100 grams; P2 generates the regression equation $Y2 = 6.53 + 6.0 X$ den $r^2 = 0.969$ means if the harvest is done at week 12th then the weight of new catfish has reached 78.53 grams and P3 generates the regression equation $Y3 = 6.71 + 5.94 X$ with $r^2 = 0.976$ means if harvest is done on week 12th then the weight of new catfish has reached 77.99 grams. Survival rate at P1 = 97.73%; P2 = 95.91% and P3 = 94.55% while the oxygenated water quality is more than 3.5 ppm; pH ranged from 6.7-7 and ammonia content at week 3 is P1 = 0.04 mg/l; P2 = 0.13 mg/l and P3 = 0.27 mg/l.

Keyword: Catfish Growth Performance ,density, biofloc

1. Introduction

As the population increases, there will be an increase in the number of food needs, for example the prediction of the population in Central Java by 2015 is as much as 16,750,900 people and in 2017 will increase to 16,988,100 people [1]. Fish as one of the foods that contain high protein can be a nutritious food supplier needed by the population, therefore fish production also needs to be improved. The production of catfish *Clarias gariepinus* (Burchell 1822) in Central Java is also continuously improved, the production of catfish in Central Java in 2012 reached 62,686 tons and in 2013 reached 75,236 tons, increased by 20.02% [2].

Many people cultivate catfish is caused by several things, including: biological reasons those are fast in growing, easy to cultivate, easy to consume artificial food, tend to resist disease; Social reasons



i.e. good market prices and physical reasons that are resistant to environmental changes [3]. Cultivation of catfish with biofloc system in closed recirculation container is one techniques that can be done to increase catfish production, in accordance with opinion [4] which states that biofloc system allows cultivation of catfish with high density so that its production is increasing. Biofloc is a collection of various organisms including bacteria, fungi, protozoa or algae gathered in a floc. Cultivation of catfish with high density to produce more waste so that the need for stirring that allows waste can be suspended so that it can be decomposed aerobically into inorganic compounds by heterotrophic bacteria. The remaining organic material derived from feed or dirt will cause a decrease in water quality. Biofloc technology can add organic carbohydrates through an increase in C/N ratio and stimulate the growth of heterotrophic bacteria. Probiotics also serve as immunostimulants to decrease FCR, inhibit pathogenic bacteria and improve water quality [5].

The purpose of this study is to determine the growth performance and predict the harvest of catfish weight and survival rate (SR) that are cultured with different high density on the biofloc system.

2. Research materials and methods

2.1. Test Fish

Catfish seeds weighed of 8 ± 0.2 gram/fish or 8 ± 0.2 g/fish with each density as treatment: P1. Density of 1,100 e/m³ or 3,300 fish/pond; P2. Density of 1200 fish/m³ or 3,600 fish/pond and P3. Density of 1300 fish/m³ or 3,900 fish/pond.

2.2. Pond

The pond used is made of 3 m in diameter of tarpaulin, equipped with a 6mm in diameter of iron frame. Total volume of water in each pond is 3000 L. Catfish seeds have been adapted and put into the pond at random. Pond Preparation: Before the fish is stocked, water is inserted with height as high as 43 cm so that the volume is ± 3 m³, added by 600 gram/pond of salt or 200 gram/m³ and molasses of 300 cc/pond or 100 cc/m³. Pond water is replaced periodically if the water quality variable is above the allowed threshold. Pool Recirculation: For pond water recirculation use 3 water pumps on each pond, with each power of 33 watt.

2.3. Food Preparation

Fish food is in form of commercial floating pellets with protein content of 31-33%; 3-5% of fat; 4-6% of fiber and ash content of 10-13%, water content of 11-13%. Every 1 kg of food to be supplied is added by 5cc of EM 4 (effective micro organism 4) dissolved in 150cc of water. Every 1cc of EM 4 contains a minimum *Lactobacillus casei* 2.0×10^6 cells/ml and *Sacharomyces cerevisiae* 3.5×10^5 cells/ml.

2.4. Experiment Design

The catfish seeds have been adapted and put into the pond randomly, according to the treatment of P1. Density of 1,100 e/m³ or 3,300 fish/pond; P2. Density of 1200 fish/m³ or 3,600 fish/pond and P3. Density of 1300 fish/m³ or 3,900 fish/pond. The collected data were analyzed regressionally with SPSS series 20.

2.5. Measuring of Fish Growth

Weight growth are measured every 7 (seven) days after fish is cultivated, the cultivation period is 21 days; as for the size of fish growth by using the calculation formula used [6]:

$$2.5.1. \text{ Individual Weight Growth/Absolute Weight (g/fish)} \quad (1)$$

$$2.5.2. \text{ Measuring of survival rate (SR)} : \frac{\text{Total fish end of research}}{\text{Initial total fish}} \times 100\% \quad (2)$$

3. Result and discussion

3.1. Result.

3.1.1. Growth Performance

The observation result of the increasing of catfish weight cultured in biofloc system with different high density indicates that starting at the first week of observation, all treatments responded to an increase in absolute weight growth, indicating that the food given and the quality of water management had a positive impact on the pet fish, but the magnitude of response at treatment is diverse; in P1 showed an increase in absolute weight of 11.10333 ± 0.57 gr; In treatment P2 showed an absolute weight increase of 12 ± 0.4 gr and treatment P3 showed an increase of 10.70 ± 0.55 gr. In week IV, the best growth is still dominated by P1 that reaches 37,91667 g in weight, and growth of P2 reaches 32,41667 in weight higher than P3 that is 30.26 g. The weight growth data can be seen in Figure 1.

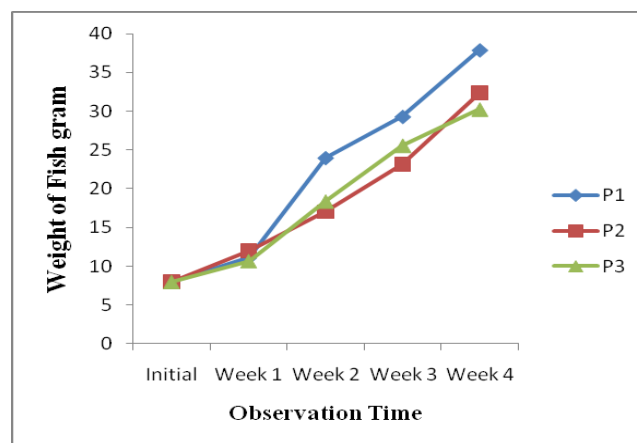


Figure. 1 The growth rate of catfish weights that are cultured with different high density

The growth performance analysis based on regression test showed that P1, P2, and P3 was $Y_{P1} = 6.46 + 7.81 X$ ($R^2 = 0.971$); $Y_{P2} = 6.53 + 6.0 X$ ($R^2 = 0.969$); And $Y_{P3} = 6.71 + 5.94 X$ ($R^2 = 0.976$), from the line equation then if catfish is cultured for 12 weeks or 3 months with treatment P1, it will be harvested with weight of 100 grams/fish, whereas if it is cultured with P2 will be harvested with weight of 78.53 grams/ fish and P3 will be harvested 77.9 grams/fish (especially for P2 and P3 weighing of 100 grams per fish takes 16 weeks or 4 months).

3.1.2. Survival Rate (SR)

After the pond is well prepared, the fish that has been adapted then put in the cultivation pond, then the cultivation stage is started. Initial cultivation of healthy fish condition, after being cultured on the first week, there are some fish that died in P1 as much as 2 (two) fish, in P2 and P3 as many as 5 (five) fish. On the 2nd week there were 3 (three) dead fish in P2, on P2 and P3 each of 10 (ten) and 15 (fifteen) fish. On week 3 the death increased more in P1 by 19 (Nineteen) fish, in P2 and P3 by 30 (thirty) and 40 (forty) fish. When entering the 4th week, water is replaced by 75%. The results showed there was a significant decrease in death rate, at week 4 the death decreased to P1 as much as 5 (five) fish, in P2 and P3 were 6 (six) fish.

After the fish cultured for 4 weeks, it has experienced a very real growth (Figure.1), although it also experienced death. While the total death on P1 as much as 25 (twenty five) fishes or its survival rate (SR) reached 97.73%, on P2 and P3 the number of deaths of 45

(forty five) fishes and 60 (sixty) fishes or survival rate (SR) reached 95.91% and 94.55% or as seen in Figure.2.

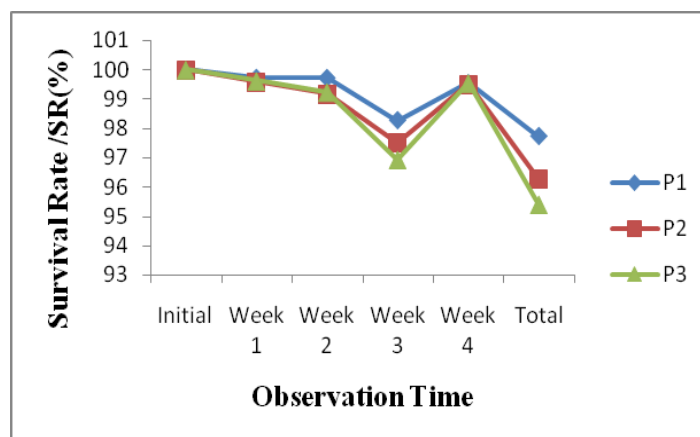


Figure. 2 Survival rate (SR) of catfish that are cultured with different high density

3.1.2. Water Quality

Water quality management in the cultivation of fish with high density with biofloc system becomes a very important factor, especially the factors that greatly affect the growth performance and survival rate (SR) those are the presence of dissolved oxygen (DO) and ammonia.

The results showed DO levels ranged from 3.1-4.2 mg/L from all treatments that have been applied and showed the fish can grow well (Figure 3).

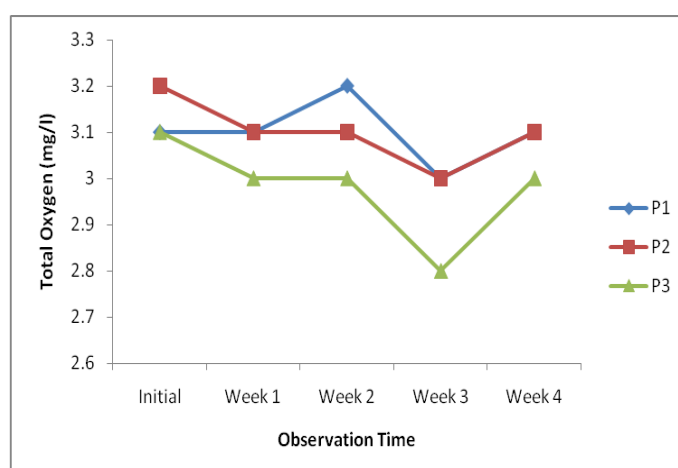


Figure 3. dynamics of oxygen in the water cultivation of catfish with different high density

While ammonia in all treatments showed an increase especially in the 3rd week, the ammonia content in P1 showed 0.13 mg / L, whereas in P2 showed 0.27 mg / L and in P3 showed 0.3 mg / L (Figure 4). The death increased by the increasing of ammonia content especially in 3rd week and the death decreased after water replacement, as well as ammonium content.

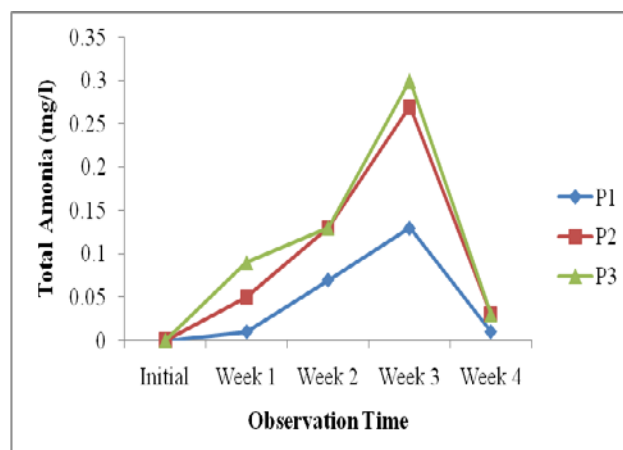


Figure 4. Dynamics of ammonia in the water cultivation of catfish with different high density

3.2. Discussion

3.2.1. Growth Performance of Catfish

Result of observation indicated that, starting from the 1st week until the 4th week, there has been growth of absolute catfish weight which is cultured by using biofloc system with high density. All catfish grew well in accordance with opinion [4] that catfish can be cultured with very high density. In Fig. 1 can be seen that the more increasing of density, the more decreasing of fish growth. It is very clearly seen at week 4, the results of this treatment according to the opinion [7] which states that the more dense the cultivated fish, the more decrease in growth. The decrease in growth from low density to high density is assumed to be due to competition of narrower space or movement, oxygen competition and the increasing of ammonia accumulation.

Regression analysis showed that the growth performance was still increasing linearly, of the growth performance can be predicted that the weight of 100 gr per individual on P1 can be achieved at 12th week, so P1 would be harvested at the 12th week or 3rd month, while P2 and P3 would be harvested at the 16th week or 4th month. Production of catfish with biofloc is very productive, predicted in 1 m³ of water, can be harvested ± 100 kg fish or one pond can harvest 300 kg of fish. The catfish production with biofloc technique in high density is much more efficient than bamboo karamba as the opinion [8] states that when the catfish are kept in bamboo karamba, the production only reaches 75 fish/m³.

3.2.2. Survival Rate (SR)

After fish have been maintained for 4 weeks it has experienced very significant growth (Fig.1), it is suspected that water quality, feed, and cultivation management have supported the growth of fish, even though the environmental dynamics has influenced the survival rate (SR) of the fish cultured.

Base on fig. 2 the results showed that SR performance in the three treatments was very high, above 90%, compared to the resulted of the study [9] showed that the catfish culture of high density is 5 fish/liter with the initial weight of 0.82 ± 0.23 grams cultured in the cultivation tank for 21 days reached SR 56.66 ± 33.30 . Based on the results of the study [10] *Clarias gariepinus* catfish weighing 46 gr, density 1 fish/10L water and maintained for 90 days then the survival rate (SR) ranged between 86.67 - 93.33%.

3.3.3. Water Quality

Water quality is critical in successful catfish farming, water quality observations have shown that DO levels range from 3.1-4.2 mg / L from all treatments that have been applied and these results have shown that fish can grow well (Fig3), this result is in accordance with [11] that in the standard water

quality of catfish seed maintenance DO level of at least 3 mg / l, In accordance with opinion [12] states that in order for fish including catfish to be hduw well if the oxygen level is more than 3 mg / l. .

As the ammonia level during the maintenance of the fish continues to increase with time, by the third week of ammonia has exceeded the threshold has reached 0.13-0.3 mg/l (Fig 4), increase ammonia has caused death in fish [11], therefore do the replacement of water to decrease the ammonia, and seen fish start healthy again, water quality maintenance has ensured fish can grow well.

4. Conclusion and sugesstions

4.1. Conclusion

Based on the results and discussion then the cultured catfish in high density with biofloc system can be concluded as follows

4.1.1. Growth performance for 4 weeks of cultivation P1 generates the regression equation $Y1 = 6.46 + 7.81 X$ with $r^2 = 0.971$ means that if the harvest is done at week 12th then the weight of catfish has reached 100 grams; P2 generates the regression equation of $Y2 = 6.53 + 6.0 X$ with $r^2 = 0.969$ means if the harvest is done at week 12th then the weight of catfish has new reached 78.53 grams and P3 generates the regression equation $Y3 = 6.71 + 5.94 X$ with $r^2 = 0.976$ means if the harvest is done on week 12th then the weight of catfish has new reached 77.99 grams.

4.1.2. The calculation of survival rate (SR) is very high, in P1 = 97.73%; P2 = 95.91% and P3 94.55%.

4.1.3. Water quality can be maintained in conditions which support the growth of catfish

4.2. Suggestion

Based on the results and discussion, the catfish that are cultured in high density with biofloc system suggests that to increase the production of catfish can be used biofloc system with a density of 1100 fish/m³.

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