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FLUCTUATIONS OF AMMONIA AND NITRATE CONTENT ON NILEM (OSTEOCHILUS SP.) CULTIVATION USING DIFFUSER AERATOR

Indriani Okfri Auralia[1], ISNI NURRUHWATI[1], JUNIANTO[1], HETI HERAWATI[1]

Faaculty of Fisheries and Marine Science, Padjadjaran University
Jl. Raya Bandung Sumedang KM. 21, Jatinangor 45363, Indonesia
Email: h.herawati@unpad.ac.id

ABSTRACT

Nilem in West Java has not been developed, and maintenance is still byproduct so that its production is still low. To produce a high production can be done with the addition of stocking density. Solid dispersion has a significant effect on water quality degradation, requiring better water quality management. Handling that can be done on this cultivation is with the addition of aeration. Aeration added to cultivation container in this research is diffuser aerator. The purpose of this research is to see the consistency of ammonia and nitrate content which is non toxic compound for nilem by comparing from some stocking density. The treatments were A treatment (50 fish/m^3), B (75 fish/m^3), C (100 fish/m^3) and D (125 fish/m^3). This research was conducted in February - March 2018 in Faculty of Fisheries and Marine Sciences Universitas Padjadjaran. Diffuser Aerator has an influence on ammonia and nitrate, all treatments tended to decrease in ammonia levels with treatment A having the lowest ammonia of 0.004 mg/L. While for the greatest nitrate content found in treatment C that is 1.096 mg/L. Stocking of 100 fish is the best number during the study with 86% survival rate with fish population of 86 fish.

Keyword: *diffuser aerator*, nilem, ammonia, nitrate

Introduction

Nilem in West Java has not been developed. According Subagja (2006), maintenance of nilem is still side by side so that its production is still low. That way, nilem need to be developed and seed provision also needs to be improved to produce high production. Such high production can be obtained by the addition of stocking density.

Solid stocking is one of the important factors in cultivation. Solid high seed dispersal uses artificial feed (pellet) as the main feed. The content of pellet protein of nilem is quite high, which is about 39-41%, so that pellet decomposition process will produce an inorganic nitrogen compound of NH_3-N which is one of the toxic compounds. Another effect of waters containing high nitrogen concentration is to decrease water quality . According to Kordi and Tancung (2010), the density of the spreading has a significant effect on the water quality degradation, so in the columns applying high stocking density requires more extra water quality management.

Handling that can be done on this cultivation is with the addition of aeration. Aeration added to the aquaculture tank in this study is aerator diffuser which is a type of aeration that adds air into the water by diffusion of a thin layer of bubbles that can increase the oxygen concentration in water and can increase the productivity of nilem seeds. According to Zahidah et al. (2015) said that aeration efforts may decrease the toxic effects of ammonia. Thus, the purpose of this study is to look at the consistency of the ammonia and nitrate content which is a non-toxic compound for nilem fish by comparing from some stocking densities.

Material and Method

This research was conducted in February - March 2018 which was held in Natural Food Cultivation Laboratory Faculty of Fisheries and Marine Sciences Padjadjaran University. Field activities in the form of observation and maintenance of nilem on fiber fiber media and measurement either directly or laboratory water quality parameters.

The method in this research is experimental method by using descriptive analysis of komperatif. The materials used during this research were 5-7 cm nilem obtained from Sumedang Fish Seed Hall. The feed given to maintenance is the PF-800 pellet (with 39-41% protein). Solid fish stocking in this research are:

A : density of nilem 50 fish/m^3

B : density of nilem 75 fish/m^3

C : density of nilem 100 fish/m^3

D : density of nilem 125 fish/m^3

Calculating the ammonia content of the filtered water sample by means of a 25 ml dipipet inserted into the test tube was then added 1 ml Siegnette solution, 0.5 ml of Nessler solution, then homogenized for ± 10 min, inserted into the cuvette at the electrophotometer apparatus, measured the ammonia content of the sample on the UV-VISiBLE spectrophotometer at a wavelength of 425 nm was then recorded. Calculating the nitrate content of the filtered water sample was 25 ml and inserted into the cup until 2 ml left over the hotplate, then added 1 ml of phenol sulfonic acid and inserted into the waterbath with 89 °C and cooled, after which NH4 was added add NH4OH solution 10% as much as 5 ml which is then diluted to 25 ml and inserted into the cuvette on the spektofotommeter, read, and recorded at 425 nm.

The tank is 80 cm x 80 cm x 40 cm by 12 units. Aerator used type aerator diffuser brand Ying Xin Air Stone type A-10502 with specification 300 mm x 50 mm x 6 mm and casoutput 30L/minute. Provision of feed given 3 times a day at 08.00 pm, 12.00 pm and 16.00 pm. Water quality parameters measured were pH, temperature, and dissolved oxygen measured twice daily at 08.00 am and 16.00 pm.

The survival of Nilem is obtained by following the formula Effendie (1979), which is as follows:

$$SR = Nt/No \times 100\%$$

Information:

SR = Survival rate (%)

Nt = value fish at study end of the research

No = value fish at the beginning of the reseacrh

Result And Discussion

Dissolved Oxygen, pH, and Temperature

The value of water quality range in each treatment obtained during this study can be seen in Table 1.

Table 1. Quality Range of Nilem Fish Seed Water During Research

Parameters	Treatment			
	A (50 fish/m^3)	B (75 fish/m^3)	C (100 fish/m^3)	D (125 fish/m^3)
Dissolved oxygen(mg/L)	6,1 – 7,9	6,0 – 7,5	6,0 – 7,5	6,0 – 7,5
pH	6,0 – 8,5	6,0– 8,5	6,4 -8,5	6,5 – 8,4
Temperature (^oC)	24,2 – 26,7	24,1– 26,5	24,0 – 27,0	24,1 – 26,2

The highest dissolved oxygen content at treatment A 50 fish/m^3 is 6,1-7,9 mg/L, that is because treatment A is the least dense treatment so that oxygen consumed fewer fish and oxygen count in water high, while the treatment of B 75 fish/m^3, C 100 fish/m^3 and D 125 fish/m^3 has a range of dissolved oxygen content which is not different ie 6.0-7.5 mg/L. The value of DO can be said optimal because in accordance with the literature PP No.82 of 2001 which states that the limit of dissolved oxygen concentration for freshwater fish culture is 4.0 mg/L.

The content of the pH of the media at treatments A, B, C and D has a range that is not much different that is between 6.0 - 8.5. In Rizaqi (2016) research, nilem can grow optimally in the pH range 6.0 - 7.0, and based on the standard of water quality of PP No.82 Year 2001, good pH for freshwater fish cultivation is ranging from 6- 9, it shows that the measurable pH in this study is within reasonable limits for cultivation and is a good water quality for optimal growing fish.

Batara et al. (2017) mentions, the higher the pH of water the oxidation reaction in the aeration process faster. Excessively high pH levels can also increase ammonia in water that is toxic. When the pH has a fairly constant value then the dissolved oxygen concentration can also be stable (Kordi and Tancung 2010). One of the things that keep this water pH fluctuation can be prevented by way of frying fish pierce and feed residue that is not consumed in maintenance media and doing 30-75% stepwise water replacement every day.

In this study the temperature range has a fluctuation that does not vary much each treatment, in treatment A has a temperature range of 24.2-26.7^{o} C, treatment B 24.1-26.5^{o} C, treatment C 24.2-26.7^{o} C, when compared with Susanto (2006) saying that the optimal temperature for nilem fish is 18-28^{o} C and according to Kordi and Tancung (2010) states that the temperature suitable for water biota activity is 23-32^{o} C. Then the water temperature during the study is still considered optimal for the survival of the fish, when associated with the dissolved oxygen concentration, the highest temperatures have lower oxygen levels and for the highest dissolved oxygen have the lowest temperatures.

Ammonia and Nitrate

Biologically, in nature there can actually be an ammonia reshuffle to nitrate (NO_3), a harmless form, in the process of nitrification with the help of nitrifying bacteria, especially Nitrosomonas and Nitrobacter. These nitrifying bacteria require a lot of oxygen, a minimum of 80% saturation (saturated) for a normal process, therefore aerated sagates support the nitrification process (Kordi and Tancung 2010).

The results of measurement of ammonia content performed during the study can be seen in Table 2.

Table 2. Ammonia Measurement Results

Treatment	Measurement to (mg/L)				
	1	2	3	4	5
A	0,092	0,010	0,013	0,004	0,004
B	0,089	0,016	0,007	0,016	0,011
C	0,032	0,014	0,005	0,017	0,005
D	0,103	0,002	0,016	0,004	0,004

The results of ammonia measurements in Table 2, early ammonia have a higher value and the longer the study of ammonia content decreases. The highest ammonia content is treatment D that is 0.103 mg/L, in treatment D is the treatment that has the highest stocking density, so that more fish in the cultivation container then the rest of the metabolism in the form of urine or feces that will become more ammonia. The higher the pH of the water will also increase the toxicity of ammonia.

The ammonia content in each treatment varied, in treatment A having an initial ammonia of 0.092 mg/L and last being 0.004 mg/L, treatment B from 0.089 mg/L to 0.11 mg/L, treatment C from 0.032 mg/L to 0.005 mg/L, whereas treatment D from 0.103 mg/L to 0.004 mg/L. All changes in ammonia levels from all treatments mean tend to decrease. Based on PP No.82 of 2001 that is less than 0.02 mg/L for sensitive fish, and when compared with the results of research, the ammonia content in the cultivation of nilem still stable and not dangerous.

Increased ammonia concentration is a threat to aquatic animals, but it would not occur if the dissolved oxygen concentration suffices to remodel the ammonia into nitrites. Can be seen in the following reaction:

$$NH_3^+ + OH^- \leftrightarrow NH_2 + H_2O$$

In the reaction is known, that if the media cultivation of oxygen deficiency then the ammonia will accumulate without any reshuffle, on the contrary if the media is sufficient dissolved oxygen content will be a reaction equilibrium and will occur nitrification process. Silaban et al. (2012) says that ammonia during the maintenance period of fish has increased with increasing maintenance time.

In this study, one of the reasons the ammonia content may decrease is the use of aeration in the form of diffuser aerator. In accordance with Zahidah et al. (2015) who say that aeration efforts may decrease the toxic effects of ammonia. In addition, conducted also penyifonan and water change during the study so that the ammonia levels will decrease and the quality of water is good for the growth of fish nilem. The results of nitrate measurements during the study can be seen in Table 3.

Table 3. Nitrate Measurement Results

Treatment	Measurement to (mg/L)				
	1	2	3	4	5
A	0,669	2,825	1,075	1,892	0,967
B	1,025	2,213	2,210	1,950	1,033
C	1,135	2,088	0,715	2,117	1,096
D	0,864	2,213	0,975	3,238	0,904

Based on the results of the study, the highest nitrate content was 3.238 mg/L (Treatment D), while the lowest nitrate content was 0.669 mg/L (Treatment A). Nitrate is the result of aerobic protein reshuffle, where the levels are influenced by the nitrification process.

Nitrate results obtained when compared with the standard quality of water quality PP No.82 of 2001 for freshwater aquaculture activities, the results are still very far from the specified standard limit of 10 mg/L. According to Patti et al. (2015) the optimum nitrate in the cultivation of nilem is 0,9 - 3,5 mg/L, then nitrate concentration during the research is the optimum level for growth of nilem.

Survival rate

Survival is important in cultivation. Many factors affect the survival rates of nilem such as water quality, feed and stocking density (Rizaqi et al, 2016). Survival Rate along with the existing population on the cultivation of nilem is presented in Figure 1.

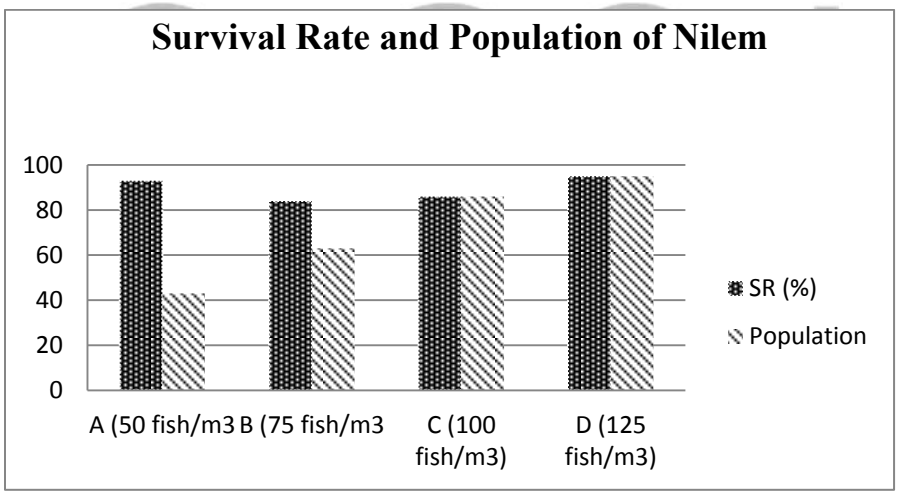

Figure 1. Survival and Population of Nilem

In Fig. 1. The highest SR (%) show is the A 93% treatment and the lowest is the D treatment that is 76%, it is in accordance with Widiastuti (2009), stating that if fish are kept in low density the growth is better when compared to high stocking densities. During the study, the survival of seeds of nilem fish averaged above 50%. Based on the observation, that the dead fish at the time of the research was caused by the beginning of the research of fish still experiencing

the adaptation process with its environment and allegedly related to stress due to the process of sample.

The population that exist in the cultivation tank of nilem seeds in each treatment is very diverse, the treatment of A, B, C, and D has 43 fish, 63, 86, and 95, respectively. aerators that help improve water quality so that the number of fish that can live higher. When compared to survival, C treatment is the best treatment compared to others. At treatment C has fish population (86 fish) higher than other treatment that is 86% from initial number of fish stocked.

Conclusion

1. Using Diffuser Aerator has an influence on ammonia and nitrate in the waters of the cultivation of nilem. All treatments tended to decrease in ammonia levels with treatment A having the lowest ammonia of 0.004 mg/L. While for the greatest nitrate content found in treatment C that is 1.096 mg/L.
2. Stocking of 100 fish is the best number during the study with 86% survival rate with fish population of 86 tails.

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