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# EFFECTIVENESS OF COMMERCIAL PROBIOTICS ON MAINTENANCE MEDIA AGAINST SURVIVAL AND GROWTH OF RED TILAPIA FINGERLINGS (*Oreochromis niloticus*)

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KeyWords
Ammonia, Survival Rate, Red Tilapia, Probiotics.

## ABSTRACT

The purpose of this study was to obtain an effective concentration of commercial probiotics to achieve the highest optimum survival and growth rate of red tilapia fingerlings. This research was conducted from February to May 2018 at Ciparanje Hatchery, Faculty of Fisheries and Marine Sciences Padjadjaran University, while water quality test was conducted at Aquatic Resource Management Laboratory Faculty of Fishery and Marine Sciences, University Padjadjaran. Method with complete randomized design with 7 treatments and 3 replicates, namely treatment A (probiotic treatment with concentration of 3 ml/$L^{-1}$, 5 ml/$L^{-1}$ and 7 ml/$L^{-1}$), B (probiotic concentration 3 ml/$L^{-1}$, 5 ml/$L^{-1}$ and 7 ml/$L^{-1}$), C (Control without treatment). The results showed that probiotics A with 5 ml/$L^{-1}$ dose has a better environmental conditions for the culture of tilapia. probiotic A with 5 ml/$L^{-1}$ dose resulting 0.030 ml/$L^{-1}$ of ammonia concentration, so that resulting the lowest ammonia concentration at the end of the observation and has the highest survival rate of 72% and the highest growth rate of 5.50%.

## INTRODUCTION

Red Tilapia are one of fisheries commodity that in demand by society and red tilapia becoming one of a freshwater aquaculture that could support Indonesian food security. Some of the superiority of red tilapia compared to black tilapia that has been known before is the rapid growth, attractive color and also the meat is more delicious and tastier. Red Tilapia well known in society because its similarity with red snapper fish that has a high price (Fisheries Departement West Java Province 2006). However, at fingerlings stadia is the vulnerable stadia towards bad environment and disease attack. Therefore, fingerlings maintenance is an important thing in the fish production process to keep the survival rate of Red Tilapia fingerlings.

Red Tilapia has a higher tolerance towards the fluctuation changes of the water quality. Water quality takes an important role in the maintenance of fish, and as an indicator of successness in aquaculture activities (Boyd 1998). Probiotic is a group of living microorganism cells that has a beneficial effect for the host animal that consumes it through balancing intestinal microorganism flora of the digestive track (Irianto 2003). Probiotic is useful for neutralizing water so that fish protected from toxins and disease-causing bacteria. Other than that, water quality such as temperature, pH, Dissolved Oxygen (DO), nitrat, and ammonia.

Probiotic addition on maintenance media is expected to improve the water quality, increase the survival rate of fingerlings so that availability of Red Tilapia fingerlings can be increased. The current use of probiotics is an alternative way to overcome the problems that related to water quality management should be controlled so that the survival and growth rate of red tilapia can be increased.

Inside the waters there are probiotic bacterias including, *Lactococcus* sp., *Carnobacterium* sp., *Staphylococcus* sp., *Lactobacillus* sp., *Bacillus* sp., *Eubacterium* sp., *Bifidobacterium* sp., *Micrococcus* sp., dan *Pseudomonas* sp. bacteria, (Holt 1994), nowadays probiotics with a several types of product for fish maintenance are commercially available. The application of probiotic must be appropriate in both concentration and use. Therefore, need a further research on effectiveness from several commercial probiotic on maintenance media toward survival rate and growth of Red Tilapia.



## METHOD OF RESEARCH

### Research on place and time

This research was held on February-May 2018 in Hatchery of Ciparanje, Faculty of fishery and marine science, Universitas Padjadjaran, Jatinangor.

### Tools

The equipment used in this research are 21 pieces of 40x30x30 $cm^3$ sized aquarium , water pump, hoses, aeratior stone, *heater*, DO meter, pH meter, digital scales, rulers, strainer, measuring cup and plastic containers.

### Materials

The materials used in this research are including:

1. Fingerlings that used in this research i.e. comes from locals farmers in Cianjur, West Java. Red tilapia fish fingerlings that used are on the 3rd nursery stage with a length of 5-6 cm
2. Commercial Probiotics commonly contains bacterias with *Lactobacillus* sp, *Streptomycetes*, and the additional of a mixture of molasses which is a source of nutrients for probiotic bacteria so that can improve the effectiveness of the probiotics.

### Method

The method used in this research is experimental method and done with a Complete Randomized Design (CRD). Treatment that will be tested is the addition of probiotics on media maintenance with different concentrations, the treatment consists :

A : Concentration of probiotics Aquasimba (3 $ml/L^{-1}$, 5 $ml/L^{-1}$ and 7 $ml/L^{-1}$ )

B: concentration of probiotics EM4 (3 $ml/L^{-1}$, 5 $ml/L^{-1}$ and 7 $ml/L^{-1}$)

C : Control (non treatment)

## Research Procedure

This research is conducted through several stage of procedures such as the preparation of the container and followed by:

1. Cleaning up the Aquarium, aeration hose, aeration stone, and then all tools soaked in potassium permanganate (PK) for 24 hours to kill any possible disease causing germ. After that rinsed with clean water.
2. Installing the aeration hose, aeration pumps and aeration stone.
3. Filling up the aquarium with freshwater thereabouts 27 L and then aerated the water around 1 day or more.
4. Measuring the water quality as a preliminary data parameters
5. Adding up the probiotics for the first treatment.

Research stages are followed by:

1. The fingerlings of Red tilapia used in this research was approximately 20 tails in each Aquarium.
2. Acclimatization for the fingerlings $\geq$ 14 days before the treatment starts.
3. The day before the treatments starts the fingerlings has been fasted and then measuring the weight to know the initial weights.
4. Feed provided as much as 5% of the biomass weights with three times a day frequency.
6. Probiotics are given to each treatments once in 10 days, lasts for 30 days.
7. measuring the weight biomass of fish and also measuring the water quality.

## The Observation Parameters:

1. Water quality: temperature, pH, DO, nitrate, ammonia.
2. Survival Rate

The survival rate (SR) is calculated by using the formula of Effendie (1997) , as follows :

$$SR = \frac{\text{Nt}}{\text{No}} X\ 100\ \%$$

Description:
SR = The rsurvival rate of fish (%)
Nt = The number of fish that live there are initial observations (tail)
No = The number of fish that live there the end of observation (tail).



3. Growth Rate

Growth rate according to Subandiyono and Hastuti (2014) relative growth rate (RGR) of fish were calculated by using the formula:

$$RGR = \frac{Wt - Wo}{\text{Wo x t}} X\ 100\ \%$$

Description:
RGR = relative growth Rate (% per day)
Wt1 = Weight of the fish at the end of treatments (g)
Wto = Weight of fish at the beginning of treatments (g)
t = time (days) of treatments

## Data Analysis

Research data were analyzed based on the treatment given to the growth and survival of the red tilapia fingerlings is analyzed using Analysis of Variance (ANOVA). If there is a difference between the treatment extended by using multiple distance Duncan test with 95% credibility level (Gasperz 1991). Water quality data (temperature, pH, DO, nitrate and ammonia), analyzed in a descriptive and presented in the form of tables and graphs.

## RESULTS AND DISCUSSION

### Water Quality

#### 1. Temperature

The results of the temperature measurement on any media maintenance during observations of 29 ± 1$^{o}$C water temperature during the study are at normal rate for Red tilapia fish farming. Based on (BSNI 6141:2009) fingerlings production of tilapia (*Oreochromis niloticus*) stage of spreading fingerlings the common temperature is 25$^{0}$-30$^{0}$C, while according to the Government Regulation (PP No. 82 Year 2001) temperature criteria parameters based on stage III i.e. deviation 3 meaning, from a State of temperature deviation naturally. The temperature range in accordance are relatively stable at any Aquarium Research book one of which can be caused by the presence of a temperature regulator tools *heater.*

#### 2. Dissolve Oxygen

Dissolved oxygen needed by any water living organisms in order to breathe. The concentration of Oxygen is an important factor as a regulator of metabolism to grow and also for breeding. The content of dissolved oxygen (DO) at the time of research ranging in between 7.0-7.9 mg/L$^{-1}$, these results accordant to the quality standart of dissolved oxygen for the maintenance of optimal fish tilapia i.e. > 3 mg/L$^{-1}$ (PP No. 82 Year 2001), metabolism process, growth, and the decomposition of organic material (Boyd 2012).

Table 1. The Concentration of Dissolved Oxygen (DO)

| Treatment | The DO Concentration (mg/L$^{-1}$) |
|---|---|
| A1 | 7,3 |
| A2 | 7,8 |
| A3 | 7,9 |
| B1 | 7,5 |
| B2 | 7,6 |
| B3 | 7,7 |
| C1 | 7,5 |

Based on (BSNI 6141:2009) fish fingerlings production of tilapia (Oreochromis niloticus) in spreading stage i.e. oxygen concentration > 5 mg/L-$^{1}$ , so in all aquarium during this research remains to have an optimum range of dissolved oxygen and even more can be said that have a good oxygen content. That the content of dissolved oxygen in tilapia fish farming should be higher than 3.0 mg/L-$^{1.}$

#### 3. The Level Of Acidity

The level of acidity (pH) during this research are on the range 6.7-7.9, the value is in the range of normal according to the Government Regulation No. 82 in 2001 grades III i.e. pH range of 6-9.Based on (BSNI 6141:2009) fish fingerlings production of tilapia (Oreochromis niloticus) i.e. in spreading stage concentration pH must be in the range of 6.5 to 8.5. so it's indicates the value of a normal pH concentration for fingerlings breeding Red tilapia fish.

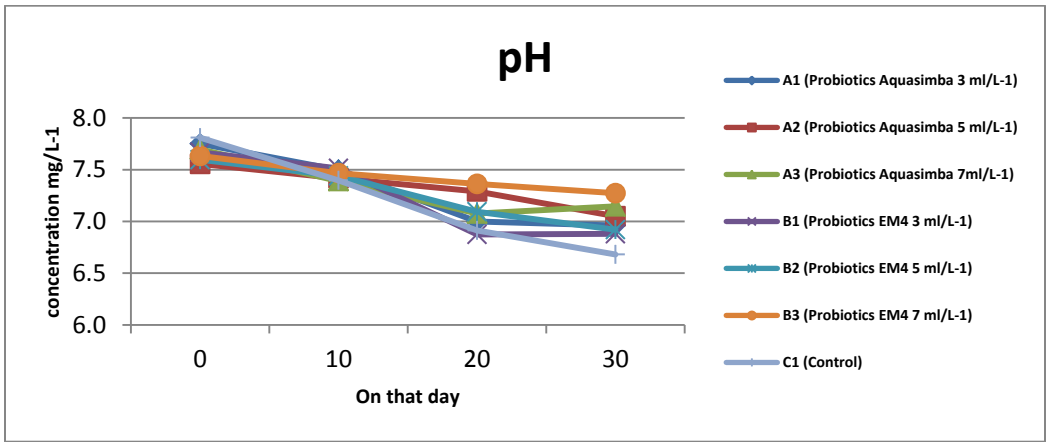


Figure 1. The concentration of pH

On (Figure 1) showed the concentration of pH is decreased on each treatments in between day 20 and 30 . The occurrence of the decreasing in pH at each treatments are suspected due to the release of carbon dioxide by tilapia fish. The value are decreasing along with the weight of the fish, because of the increasing of the weight, fish will need an excess oxygen absorption so that increase the value of acidity in media maintenance of the fish. According to Mackereth (1989) the presence of carbon dioxide in water cultivation will hydrolyzed into carbonic acid which is acidic and causing the pH decrease.

## 4. Ammonia

Based on the results of water quality analysis that has been done for 30 days , the content of ammonia in each treatment has a concentration differences on control and with the addition of probiotics shows the range of 0.002-0.050 mg/$L^{-1}$. The highest value of the ammonia concentrations already exceed according to the Government Regulation Number 82 of 2001 in the ammount 0.02 mg/L >-1, it is stated that the quality of water for the Red tilapia fish farming is not secure. Changes in the concentrations of ammonia can be seen in Figure 2.

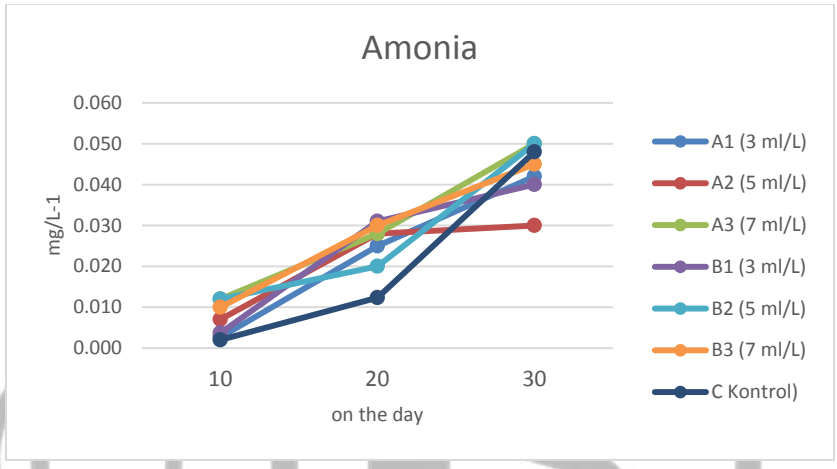


Figure 2. The Concentration Of Ammonia

The concentration of ammonia from all treatment nearly the same on day 0 i.e. 0.001 mg/$L^{-1}$, this is because the addition has not been done on the fish maintenance medium. The concentration of ammonia in the 20th and the 30th has been increased in every treatment. This is in accordance with statement of Zahidah (2015) ammonia increasing caused by the accumulation of the excess of the feed and the excess of the metabolism on feed.

The average value on the lowest concentrations of ammonia in this research is 0.030 mg/$L^{-1}$ on the concentration of the probiotics addition of the A2 (5 ml/$L^{-1}$), this is in conjunction with the increasing of the low nitrates concentration, It is on the A2 treatment, indicating the occurrency of oxidation process of ammonia into nitrate and nitrate present the most optimal treatment A2. In accordance with the statement of Djokosetiayanto dkk. (2006), i.e. the more ammonia is oxidized the more nitrate were produced.

The average value of the highest ammonia in this research is 0.050 mg/$L^{-1}$ in A3 with a 7 ml/$L^{-1}$ of probiotic concentration treatment. The addition of a high concentration in media maintenance can lead to the increasing in the number of bacteria and competition process will occur the food by the bacteria, so that the process of decomposition of the excess of the metabolism and excretion of the fish in feces and urine on the process of nitrification less optimal by bacteria, thus resulting in increased concentrate.

## 5. Nitrate ($NO_3$)

Nitrate nitrogen compound is soluble in water and is stable (Effendie 2017). Based on the research results obtained by the concentration of nitrates until day 30 with the addition of probiotics with different concentration ranges between 0,326$^{-1}$,968 mg/$L^{-1}$. The condition is still within the limits of tolerance for the growth of tilapiafish. Observations the concentration of nitrates meets the range of still viable, because it is still under the maximum limit of the raw water quality i.e. < 20 mg/$L^{-1}$ (PP No. 82 Year 2001).

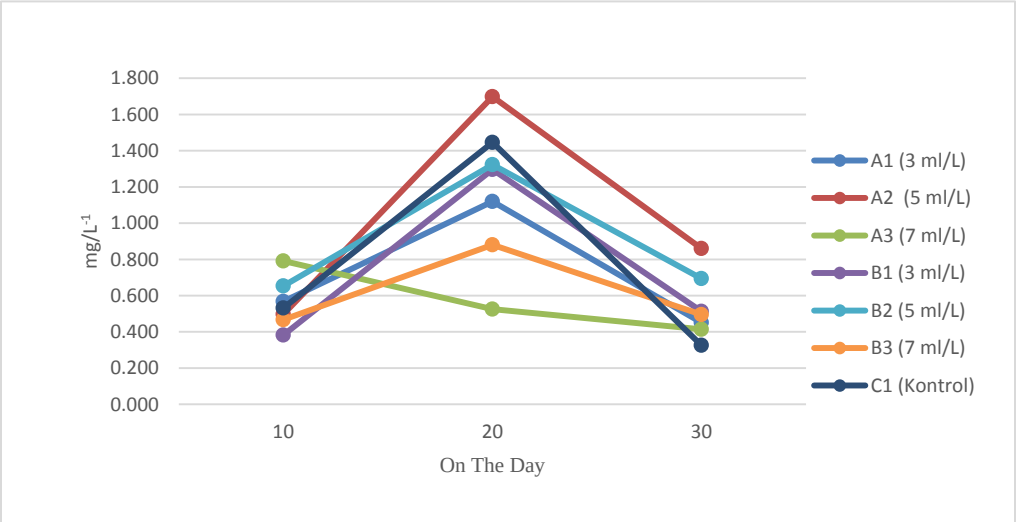


Figure 3. The Concentration of Nitrates

Nitrate concentrations tend to fluctuate every observation. Nitrate concentrations have elevated the most high on the 20th day of the refractory treatment A2, and on the 30th day of the concentration of nitrates tend to decreased and showed the highest value at the end of the observation contained in the treatment of the A2. This indicates the nitrification bacteria with optimal concentrations of probiotics on adding 5 ml/$L^{-1}$ (A2), as a result of nitrates obtained greater than all the treatment. In line with the lowest concentrations of ammonia is obtained at the end of the observation on the treatment of the A2.Djokosetiayanto et al. (2006) States that the oxidation of ammonia by bacteria will produce the most optimal nitrates are the most numerous

## 6. Survival Rate

The results showed that the survival rate of Red tilapia fish for 30 days observation showed different results on each treatment. The results showed that administering probiotics treatment Aquasimba with concentrations of 5 ml/$L^{-1}$ (A2) have the highest survival rate compared to other treatments i.e. 72%. The treatment given with probiotics EM4 with concentrations of 3 ml/$L^{-1}$ (A1) have the second-highest survival rate of 70%. The lowest result in probiotic Aquasimba with concentrations of 7 ml/$L^{-1}$ (A3), i.e. 23%. Survival rates of the control treatment was not given the addition of probiotics namely amounted to 47%.

Table 2. The Survival Rate Of Red Tilapia Fish

| Treatment | Survival (%) | The notation |
|---|---|---|
| A1 | 66 ± 17,56 | a |
| A2 | 72 ± 30,14 | b |
| A3 | 23 ± 18,93 | a |
| B1 | 70 ± 17,32 | b |
| B2 | 38 ± 49,07 | a |
| B3 | 33 ± 33,29 | a |
| C | 47 ± 41,63 | a |

According to (BSNI 6141:2009) fish fingerlings production of tilapia (*Oreochromis niloticus*) in spreading stage level II which produces the survival rate of 70%, then It can be said the research is producing good survival rate at A2 treatment compared with the other treatments. According to Hermawan (2013), the survival rate is influenced by external factors and also the internal factors from the fish itself and factors from the outside it is influenced by the quality of the feed and the water quality.

The results of the analysis of the multiform prints with 95% confidence levels indicates that treatment with the addition of the probiotics in media maintenance against the survival of Red tilapia fish fingerlings produces different results on each treatment (Table 1.) seen from the results in table 1 that in the different treatment of real addition of probiotic with Aquasimba with a concentration of 5 ml/$L^{-1}$ (A2) and the probiotic EM4 with concentration of 1 ml/$L^{-1}$ (B1) and without the addition of probiotic (C) shows that there is a real difference. The higher the concentration of probiotics causing the higher mortality rate

## The Pace of Growth

The results of this research provide a different relative growth rate on any moderate, ranging from 5.50% to 2.89%..

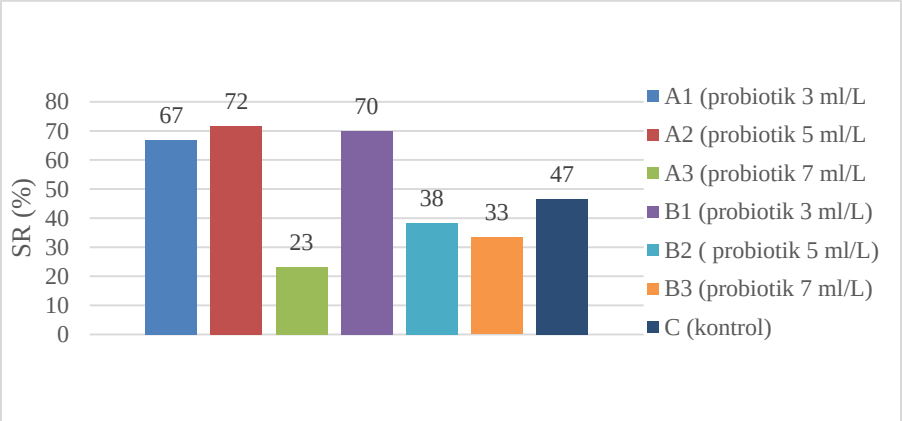


Figure 4. Growth rate (RGR)

The highest growth rate on the Red tilapia fish fingerlings is in A2 treatment (Probiotic Aquasimba 5 ml/$L^{-1}$) of 5.50%. Results in treatment of B1 (Probiotics EM4 3 ml/$L^{-1}$) amounting to 4.68% the growth rate value has not have much different from A2. Treatment C (control) that is not given an extra probiotic generate growth rate of 2.89% and the treatment gives the lowest results in the study. It is work well and causing the effect on the significantly growth because the bacteria contained in the probiotic of Red tilapia fish.

Research results during the 30 days of maintenance against the fingerlings of Red tilapia fish with the addition of probiotics with different concentrations. The results of the analysis of the range of growth of Red tilapia fish relative weights indicate that treatment C (control), A2 treatment (Probiotic Aquasimba 5 ml/$L^{-1}$), C (control) treatment differ markedly against other treatments. B2 treatment (Probiotic EM4 5 ml/$L^{-1}$) no different treatment with B3 (Probiotics EM4 7 ml/$L^{-1}$). Based on the results of data analysis that the best treatment is treatment given probiotics A2 Aquasimba as much as 5 ml/$L^{-1}$).



## CONCLUSION

Based on the results of the research can be drawn the following conclusions:
Administering probiotics Aquasimba with doses of 5 ml/$L^{-1}$ gives a better environmental conditions for tilapia fish farming to produce low ammonia concentration at the end of the observation contained in probiotic Aquasimba with a dose of 5 ml/$L^{-1}$ of 0.030 ml/$L^{-1}$. The highest survival rate i.e. 72% and the highest relative growth rate of 5.50%.

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