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The Influence of Different *Curcuma zanthorrhiza* Dosage on The Growth and Survival Rate of Nile Tilapia (*Oreochromis niloticus*)

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Abstract

The research was held in 14th July – 20th August 2018, located at Brackish Water Laboratory, Fisheries Faculty of Pekalongan University. The aim of this research was to find out the impact of curcuma on the growth and survival rate of Nile Tilapia. The treatment that be implemented was extending dosage of curcuma flour (gram) in 1 kg of artificial fish feed, such as followed: treatment A 0 ml (control), B 9g curcuma, C 12g (curcuma and D 15g curcuma. The method used was the Completely Randomized Design Method consisting of 4 treatments and 3 replications. The result indicated that treatment D showed the highest growth. The average of fish body weight at the end of this experiment for treatment A, B, C, and D was 3,31g, 4,77g, 6,8g and 8.04g. The statistical analysis showed that-treatments resulted different effect-on the fish growth. The water qualities during the research period such as temperature was ranged between 27-29^o C, pH was-7,1-7,3 and the salinity was 16-17ppt. Based on this result, all of the water quality parameters supported to the fish growth.

Keywords: Nile Tilapia, Curcuma, Growth

INTRODUCTION

Aquaculture is one of the fastest growing industry, especially in fish-food production. One of the fish species which was widely cultivated today is Nile Tilapia (*Oreochromis niloticus*). In Indonesia, Nile Tilapia has highly economic value and the important commodity in aquaculture business. The reason is that Nile Tilapia showed many beneficial points such as growing faster, could survive in poor water quality, easy on breeding process, and more disease resistant compare to the other fish. Despite of the high contribution of Nile tilapia to economic field, aquaculture facing a problem especially in coastal area which is not easy to find fresh water due to sea water infiltration inside the land. One of the solutions is to culture Saline Nile tilapia, as this species was able to be surviving in saline condition up to 30 ppt.

Most fish farming or aquaculture activities are carried out with intensive systems that can increase the production of the fisheries sector. But it is bringing out the adverse effect to the environment. Recently, aquaculture production giving declining status because of the presence of some problems, particularly in the suboptimal fish

feed. The provision of fish feed that is not in accordance with the amount and quality needed, it causes the slower growth rate, and brings the fish production is not as expected (Djajasewaka *et al.*, 2007)

Based on that problem, then it is necessary to make improvements related to the growth. One of the ways is the maximizing the growth rate of Nile Tilapia; therefore, it is expected to accelerate the time of harvest later. As one way which could be taken for maximizing the growth rate of Nile Tilapia is through the addition of Immunostimulant in artificial fish feed with the right dose.

Immunostimulant is a substance that able to stimulate or enhances the immune system by interacting directly with the cells, that is by activating the body immune system (Gannam and Schrok, 2001). The use of immunostimulants in aquaculture has opened a new vista in fish health protection (Raman, 2017). Nowday, *immunostimulant* gets more attention in aquaculture activities, due to this substance, not only increasing the fish immune response, but also stimulating the growth of fish.

Some of plants could be sources of medicines and *immunostimulant*, such as Ginger, Turmeric, Pepper leaf and Curcuma. One of the phytopharmaca that can be used as antimicrobial and growth stimulant is Curcuma. Curcuma rhizome contains yellow substances (curcumin), fiber, starch, potassium oxalate, essential oils, and flavonoids, these substances function as antimicrobial / antibacterial, prevent blood clotting, anti-inflammation, smooth metabolism and function body organs (Ditjen, 2000). Moreover Tjitrosoepomo (1989) also mention that curcuma contain ingredients such as starch protein 29-30%, curcumin around 1-2%, curcuminoid 0,0742%, P-tuilmetilkarbinol, seskuiterpen d-camper, Atsiri oil 6 until 10%, fat oil, carbohydrate, protein and minerals. There are Kalium (K), Natrium (N), Magnesium (Mg), (Fe), Mangan (Mn), dan Cadmium (Cd). Those materials could enhance the growth and survival rate due to their important function in the cell.

Based on that information, the aim of this research is to find out the effect of curcuma flour on artificial fish feed to the growth and survival rate of Nile Tilapia seed, especially saline Nile Tilapia. The results of this study are expected to provide information about the content of curcuma to increase growth while maintaining of fish survival rate.

MATERIAL AND METHOD

This research was conducted on July 14th until August 20th, 2018. The research setting was conducted at the Brackish water Laboratory, Fisheries Faculty, Pekalongan University. The experimental design used was Completely Randomized Design (CRD) which consisted of 4 treatments and 3 replications with the different Curcuma flour dosages in fish feed as a treatment. The treatment used were as followed

A control (no curcuma flour in fish feed)

B. 9 g / 1 kg of feed

C. 12 g / 1 kg of feed,

D. 15 g / 1 kg of feed.

The treatments were used following dosages of research by Audiana et al (2018). The curcuma used is in the form of flour that is extracted from the originally dried Curcuma and then refined smoothly.

The growth indicator to be tested was the increase in absolute biomass of Nile Tilapia which based on the Effendi formula (1997) as follows:

$$W = W_t - W_0$$

Descriptions:

W = The test of the Nile Tilapia absolute biomass growth (gram)

W_t = Seaweed biomass test at the end of the research (gram)

W_0 = Nile Tilapia biomass test at the beginning of the research (gram)

The survival rate was counted based on formula from Effendi (1997). Survival rate (SR) is the percentage of fish who are alive until the end of experiment.

$$SR = \frac{N_t}{N_0} \times 100 \%$$

Description

N_t = Number of fish at the end of research

N_0 = Number of fish at the end of research

SR = Survival Rate

This research used a density of 1 fish/ liter with a weight of 3 grams per fish. Each aquarium measures 40 x 25 x 25 cm and is filled with 5 liters of water. Furthermore, it will be observed for 30 days of experiment period. Water quality maintain by checking the parameter every days and changing the water until 30 % every 2 days. The feed has been given by 3 times per day with 5 % of biomass.

The parameters of water quality measured during experiment were temperature, pH and salinity. Those tools for checking water quality include thermometers, pH meters, and refractometer. In addition, placement of totally 12 aquariums is carried out randomly and all equipment is first sterilized to prevent contamination.

RESULT AND DISCUSSION

Nile Tilapia Growth Rate

The additional of Nile Tilapia seed biomass was known through the measurement of seed biomass every ten days. The observation data of Nile Tilapia seed biomass could be seen in table 1. It was explained that the highest growth of Nile Tilapia weight was obtained in treatment D (Curcuma 15g) in the amount of 8.04 g, then followed by treatment C (Curcuma 12 g) in the amount of 6,80g, treatment B (Curcuma 9g) in the amount of 4,77g, and the lowest growth was treatment A (without curcuma) in the amount of 3,31g.

The result of variant analysis (F test) related to the growth Nile Tilapia seeds weight could be known that the value of count F was higher than table F 5%. It was $F(\text{count}) 219,3 > F(\text{Table}) 4,066$ which meant the different of the curcuma dosage gave the real influence towards the growth of Nile Tilapia weight. Before the data was analyze used Anova (analysis of variants), homogeneity and normality of data was tested. Furthermore the post hoc LSD test analyses showed that the treatments was significant different between each other with p value < 0.05

The dosage given to Nile Tilapia was closely related to the energy that could be utilized by the fish for its growth. The higher curcuma dosage given would be higher also the energy got from the Curcuma. Based on Table 1 could be seen, there was the tendency that the higher dosage given would be obtain the higher additional weight also.

Curcuma potential as an herbal plant has been proven through several studies. The advantages of using this herbal plant are, in addition to being easy to find, inexpensive, the application is very easy and can also be expanded naturally and does not cause harmful side effects. Curcuma is not only used as an *immunostimulant* which stimulates the body's immunity but also has a positive effect on growth. The increasing dose of curcuma the greater the rate of growth. This can be seen in treatment A to D, there is an increase in the average growth. The highest results achieved in treatment D, which is 15 g per kg of fish feed reaching an average of 8.4 gr. While those without

Curcuma are on treatment A reached only 3.31g. Increased growth of Saline Nile Tilapia is caused by the content of curcumin, flavonoid, essential oil, protein, carbohydrate; fat even essential mineral which plays a role in the body.

Curcumin and essential oil are substances which can improve the digestive process of food, stimulate appetite and then increase growth (Audina *et al*, 2018). This is also supported by the statement of Wijaya kusuma (2003) that curcuma can increase the rate of gastric emptying, thereby increasing hunger. It is further mentioned that essential oil works by influencing the performance of nerve secretion thereby releasing enzymes that play a role in helping digestion in the intestine. Moreover, in curcuma there is also protein, which is useful for repairing damaged cells and energy sources for metabolism. Protein is one of the essential nutrients needed for growth and survival (Halver, 1976). While important mineral content such as potassium, magnesium and iron which have a function to repairing body cells. Calcium is one of mineral which is used to maintain the development of fish bone (Zainuduin, 2010). Furthermore, it is also mentioned that curcuma also has anti-inflammatory substances such as flavonoid which maintains the body's resilience so that fish can grow well. Flavonoid is also known to be antioxidant which can prevent injuries due to free radical and play a role in protecting the body from the dangerous reaction of fat oxidation (Bustanul and Sanusi, 2018). Respectively, antibacterial of curcuma stabilize the intestine condition and enhance a growth in the end.

The lowest growth value is achieved by treatment A 3.31 g due to the absence of curcuma so that fish growth relies solely on the feed provided. The absence of curcuma causes fish to not have a large appetite and absorption of nutrition is not maximal. Then there is an increase growth in treatment B (4.77 g), followed by C 6.8 g and finally D is 8.04 g. Any increase in growth from treatment B and C shows the effect of curcuma which gives a positive response to the digestive process but it is still not optimal so that the value is still low when compared to treatment D.

The resume of discussion explain that curcuma with useful material inside could stimulate of growth and helping the digestive process by increasing of appetite. The lowest additional weight in this treatment, caused there was no the additional curcuma in fish feed; thus, decreasing on fish appetite and resulting in decreased growth of Saline Nile Tilapia. Furthermore Nur dan Fahrnanah (2015) stated that adding Curcuma 5 % to feed was able to increase growth up to 2,68 g.

Table 1. The Average of Fish Growth

Replication	Treatment			
	A	B	C	D
1	3.4	4.58	6.64	7.85
2	3.45	4.6	6.92	7.89
3	3.08	5.12	6.84	8.38
Total	9.93	14.3	20.4	24.12
Average	3.31	4.77	6.8	8.04

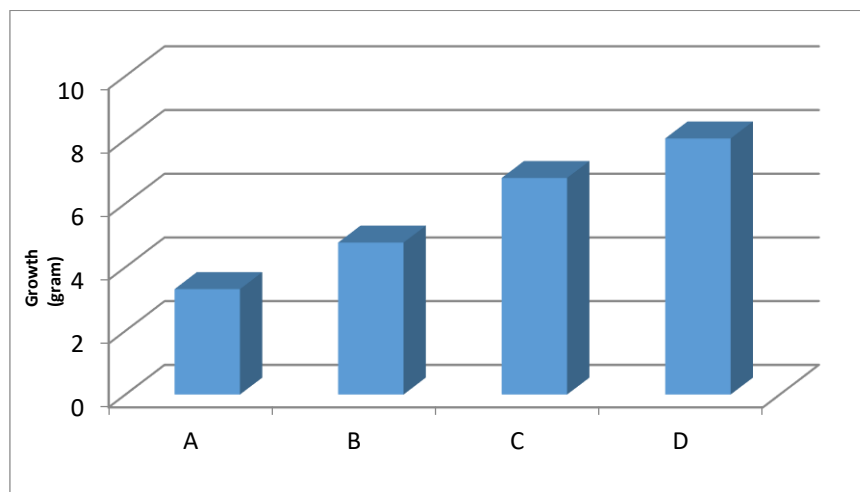


Figure 1. Fish Growth

Survival Rate (SR)

The result of survival rate analyze descriptively. Based on table 2, the result showed that a survival rate of 100% was achieved by all treatments. Regarding to the result that additional of curcuma flour in artificial feed does not affected to mortality of fish. This is due to the presence of antimicrobials that are able to maintain the condition of the fish so they stay healthy and are not infected by pathogens. Taryono *et al* (1987) mentioned that curcuma contains xanthorrhizol and curcumin which are very efficacious. Xanthorrhizol can be effective to inhibit the growth of pathogenic microbes such as *Pseudomonas aeruginosa* and *Bacillus subtilis*. Anti-oxidants such as flavonoid and curcumin that exist in Curcuma play a role to maintain the condition of the fish to stay healthy. Fish in a healthy condition and good water quality will bring a high survival rate.

Regarding to high SR on this research not only caused by the presence of antioxidant but also the water quality during the experiment always in good condition.

Table 2. The survival rate of Fish (%)

	Treatments			
	A	B	C	D
No	5	5	5	5
Nt	5	5	5	5
Total	100 %	100 %	100%	100%

Water Quality

Another factor which has the important role in supporting the test of fish growth during the research was water quality. Water Quality which has function as indicator where aquatic organisms live. In this case water quality be able to meet the requirements in terms of standard; to support the growth and graduation of the organism's life (Effendie, 1979). The parameters which can be measured are temperature, pH, and salinity.

Water quality which is in a good level, shows that curcuma can expand well in water and does not cause pollution to water. A decrease in water quality will result in the emergence of disease and mortality of fish. In addition, inappropriate water quality can also reduce growth rate. Fish survival at the end of the study is 100%, which means, fish can survive during the research process. This is caused by good water quality management and the content of curcumin which helps the body's defense process such as flavonoid which also function as antiseptic so as to maintain the balance of microorganism in water. This affects to the survival rate of fish during experiment periods.

The result of temperature observation in this research showed range between 27 – 29 °C. The temperature during the research included in optimal limit. This thing relates to Kordi (2013) that the optimal temperature for Nile Tilapia growth between 25 – 30°C. Moreover the optimal pH for growth range between 6,5 - 8,5 (Kordi, 2013). During the research, the pH level range between 7,1-7,3, this thing shows that pH level to all the treatments show the optimal value for Nile Tilapia growth The salinity during the research was 16-17 ppt. According to Andrianto (2005) that Nile Tilapia categorized as a fish which can be stand in the range of widely salinity from 0 – 35 ppt.

CONCLUSION

The result during 30 days' research could be concluded as follows:

1. The different of Curcuma dosage influenced towards the additional of Nile Tilapia weight.
2. The average weight gain obtained from D dose of 15 g/ 1 kg of feed (8.04g), then C dose of 10 g /kg of feed (6,8g), treatment B dose of 5 g/ kg of feed (4,77g), and the lowest at the time of control A (3,31g).
3. The water quality during the research was still in optimal range in 27 – 29°C, pH 7,1-7,3 and 16-17 ppt salinity; which meant that the parameters in this research is still feasible for growth of Nile Tilapia

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