Original Research Article

EVALUATION OF ADDITION CHROMIUM FEED TO THE EFFICIENCY OF GOURAMY (*Osphronemus goramy*) NURSERY TIME

ABSTRACT

This research aims to determine the efficiency of gouramy nursery time by providing chromium feed. Chromium feed is carried out by adding lemna meals containing chromium to commercial feed with Cr concentration of each treatment at 0 ppm; 1.3 ppm; 1.5 ppm; and 1.7 ppm. Based on preliminary test Lemna sp. *which was cultured in tannery wastewater for five days could accumulate Cr in the tannery wastewater in its tissue in an organic form of 2,319 mg kg-1. This research was conducted using a completely randomized experimental design (CRD) method with four treatments. Treatment A (Control commercial feed without Lemna), B (Commercial feed + Lemna 56.06 g kg^{-1}), C (Commercial feed + Lemna 64.68 g kg^{-1}), D (Commercial feed + Lemna 73.31 g kg^{-1}) and each treatment was repeated four times. The addition of Cr in commercial feed can give significantly different results on increasing the absolute length of gouramy fry, while in survival it does not give a real difference. Giving Lemna* sp. *with Cr 2,319 mg kg^{-1} content as much as 73.31 g kg^{-1} in commercial feed or equivalent to 1.7 ppm Cr produces survival rate, absolute length increase and the best maintenance time efficiency in gouramy fry successively at 87.5 ± 5%; 1.89 ± 0.04 cm and with a maintenance time of 42 days to achieve an increase 2 cm lenght, 1.6 times faster than the control treatment.*

Keywords: Chromium, Giant gouramy, Nursery, Time efficiency

INTRODUCTION

Gouramy is a native fish of Indonesia which has a high economic value.The price is high because the carp has a delicious taste and thick meat also contain a high nutritional value so that the fish became the favorite as fish consumption (Ahmad et al., 2017, Andriani et al., 2018a). Long duration of culture time is one reason why gouramy has relatively higher prices than other consumption fish on the market (Nugroho 2012, Ahmad et al. 2017, Aryani et al. 2017, Andriani et al. 2018a). This causes the demand for gouramy fry is high (Andriani et al. 2018b). However, the procurement of quality fry cannot be separated from the presence of several obstacles and problems in the production process

Gouramy is known for its slow growth (Nugroho 2012, Aryani et al. 2017). One of the problems in the growth of gouramy is about the physiological processes in the process of granting funds that are not efficient in the process of procurement of energy and growth that occurs within a longer time which caused a lower survival rate and an increase in growth (Subandiyono and Hastuti 2016, Andriani et al. 2018a).

The provision of Cr in feed has been known to overcome physiological problems in the utilization of feed carbohydrates in gouramy fish by improving the performance of insulin in carrying glucose from the bloodstream to cells to be immediately converted into energy (Subandiyono and Hastuti 2016). With the increase in glucose entry into cells, the supply of

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energy will occur in a faster time that causes the fulfillment of energy needs to grow and develop can be quickly filled. Therefore it is necessary to conduct research on evaluating the addition of Cr in feed on the time efficiency of gouramy nursery activities.

MATERIALS AND METODHS

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Study area

This research was conducted from February to July 2019. Culture of *Lemna* sp. for tannery wastewater and test feed manufacturing were carried out in the Ciparanje Inland Fisheries Area, Faculty of Fisheries and Marine, Padjadjaran University., While for the maintenance of the test fish it was carried out at the Southern Ocean and Fisheries Service Office in the South Tasikmalaya Region, West Java. Cr testing accumulated by Lemna sp. conducted at the Center for Natural Resources and Environmental Research (PPSDAL) Padjadjaran University.

Biological material

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The animal materials used in this research include: gouramy fry for nursery V how many? with an average length of 6.59 ± 0.12 cm and a weight of 4.24 ± 0.3 g with a stocking density of 10 fish / aquarium, *Lemna* sp. tannery wastewater, bio-slurry and commercial feed. ~~This research was conducted using a completely randomized experimental design (CRD) method with four treatments. Treatment A (Control commercial feed without Lemna), B (Commercial feed + Lemna 56.06 g kg^{-1}), C (Commercial feed + Lemna 64.68 g kg^{-1}), D (Commercial feed + Lemna 73.31 g kg^{-1}) and each treatment was repeated four times.~~

Preparation of Test Feed

Feed preparation begins with culture of Lemna sp. in tannery wastewater for five days and analyzed the Cr content that accumulates in the lemna tissue (Pamungkas et al. 2019). Then the lemna was dried using an oven for two hours at 135^{o}C (Nafea 2016). the dried Lemna mashed into flour and then added to commercial feed by repelleting way.

Preparation of -Container

The container for the maintenance of the test fish during the research was soaked using salt water for 24 hours with a concentration of 500-1000 mg / L^{2} (SNI 2000) and cleaned for later drying before use. After the aquarium is cleaned, it arranged horizontally and given a distance of every four aquariums to distinguish one test from another. Each aquarium was Filled with 30 L water and aeration equipment was installed. Aeration is set not too large because of gouramy are fish that live in warm and calm waters. Each aquarium is labeled with the name of the treatment randomly on each test

Essay conduct ~~Fish Maintenance~~

This research was conducted using a completely randomized experimental design (CRD) method with four treatments. Treatment A (Control commercial feed without Lemna), B (Commercial feed + Lemna 56.06 g kg^{-1}), C (Commercial feed + Lemna 64.68 g kg^{-1}), D (Commercial feed + Lemna 73.31 g kg^{-1}) and each treatment was repeated four times.

Test fish that have been dented for 48 hours before being randomly put into each aquarium are disinfected by first being put into a tub of salt water. Fish density is 30 m^{-2} (SNI 2000) or 10 fish per aquarium. After each aquarium filled with 10 fish, the length and weighing of fish biomass was measured in each aquarium. Maintenance is carried out for 40 days. During the trial period, the test fish were fed twice a day ie in the morning at 08.00 and in the afternoon

at 14.00 according to each treatment 3% of fish biomass. Water replacement was done when the water looks turbid to maintain good water quality by draining 3/4 the volume of water in the aquarium which is then refilled with clean water that has been precipitated. Measurement of fish length and biomass for each treatment and repetition were carried out after 40 days of maintenance.

Sampling and observations were carried out once in every 10 days by observing water quality (temperature, pH and dissolved oxygen), weight and survival rate of fish in each treatment. Sampling for weight and length measurements was carried out by taking five fish as samples except on the 0^{th} day and 40^{th} day measurements were taken on all test fish in the aquarium.

Observation Parameters

Survival rate is the percentage of fish that survive until the end of the experiment, calculated using the formula (Effendie 2002):

$$SR = \frac{Nt}{No} \times 100\%$$

Note :
SR : Survival Rate (%)
Nt : Number of test fish at the end of the study (fish)
No : Number of test at the beginning of the study (fish)

Analysis of the length increase rate, daily length increase, length-weight relationship is performed using the formula (Begenal 1987, Panase and Feed 2015):

Length gain

$$LG = Lt - Lo$$

Average daily gain

$$ADL = \frac{Lt - Lo}{t}$$

Specific growth rate (SGR)?, consomption index (IC)? Condition factor K?

Length / Weight relationship

$W = aL^b$ (Le Cren , 1951)

With :
Lt : Length of test fish at the end of the study (cm)
Lo : Length of test fish at the beginning of the study (cm)
LG : Length Gain (cm)
ADL :Average Daily Length (cm)
W : Weight (g)
L : Length (cm)
a : Intersept
b : Slope

t = period

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RESULTS AND DISSCUSSION

Survival Rate

Survival rate at the end of maintenance varies between treatments. The survival rate ranges from 82.5 to 87.5% ~~with each survival value for each treatment A, B, C and D is 82.5%; 82.5%; 85% and 87.5%~~ (Figure 1). The results of analysis of variance showed that the value of survival in all treatments A, B, C and D were not significantly different ($P<0.05$). ~~from~~ However, the best survival rates was recorded in treatment D with a survival rate of 87.5%. This indicates that the addition of chromium lemna to the feed does not have a negative effect on the survival of gouramy fry.

~~Treatment A and B are the treatment with the lowest survival value, that is 82.5%~~. Even so, the value is relatively high compared to the gouramy survival according to SNI 01-6485.3 - 2000 with the standard survival rate at 80% for gourami fry, even in some research the survival rate is only around 60-80% (Maloho et al. 2016, Mareta et al. 2017, Andriani et al. 2018a, Juliana et al. 2018).

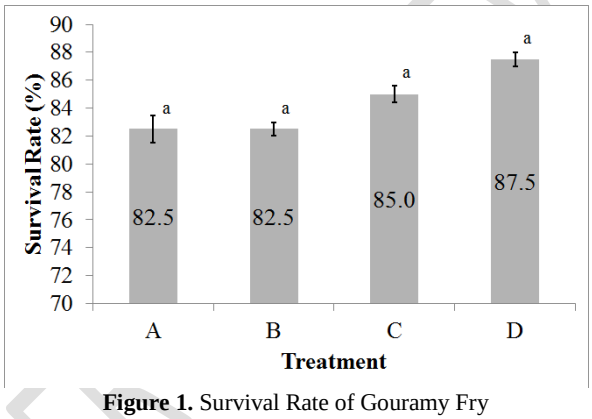

Figure 1. Survival Rate of Gouramy Fry

Although the differences are not significant, the survival rate in each treatment showed a tendency increase the survival rate with increasing dose of Cr added to the feed. The tendency is thought to be caused of the ability of Cr to increase the immunity of gouramy fry (Hastuti et al. 2004). Chromium added to feed can stimulate insulin bioactivity through Glucose Tolerance Factor (GTF) which causes the introduction of blood glucose into cells to be immediately converted into energy can be done more easily and quickly so that glucose entry into cells can occur more efficiently (Subandiyono et al 2004, Hua et al. 2012, Shadreck and Mugadza 2013, Rakhmawati et al. 2017, Vincent 2018). This resulted in the provision of energy for metabolism, maintenance of the body and immunity can be immediately fulfilled. ~~,~~ In other words, feed with Cr content can increase fish immunity which has an impact on increasing survival rate (Hastuti et al. 2004).

Furthermore Hastuti and et al. (2004) explain that the administration of Cr does not always result in an increase in the survival rate in fish. In the administration of Cr as much as 1.5 ppm produces better survival value compared to feed without adding Cr, whereas in the administration of Cr as much as 3 ppm and 4 ppm shows a tendency to decrease Cr function as a

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trigger for insulin bioactivity which is indicated by a decrease in the survival value. This indicates that the addition of Cr in the feed has a certain range in its use. The addition of Cr below the required level of fish will not affect the bioactivity of insulin which can increase the efficiency of energy supply in the fish's body, while giving Cr in high concentrations can cause physiological problems in the form of tissue damage and decreased fish health (Ahmed et al. 2012). In addition to improving insulin performance, feed with the addition of Cr can increase the percentage of hematocrit, decrease cortisol concentration during stress, increase total leukocytes and total immunoglobulin as well as the number of erythrocyte cells which causes an increase in immunity and the body's response to stress (Hastuti et al. 2004).

Efficiency of Growth Length and Maintenance Time

Different levels of Cr on feeding shows a different growth of lengths each treatment. Figure 2~~.~~ shows the increase in gouramy fry length during 40 days of maintenance. The average length of fish seedlings at the beginning of rearing was 6.59 ± 0.12 cm with a fish length range of 6.4 - 6.8 cm and at the end of rearing the average fish length was 8.20 ± 0.32 cm with a range 7.4 - 8.8 cm.

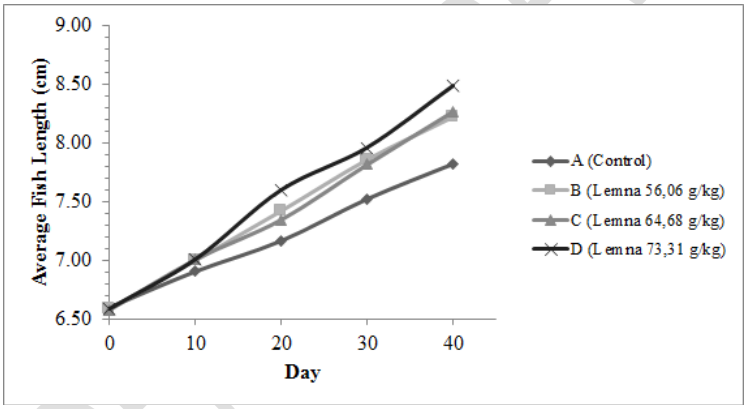

Figure 2. Growth of Gouramy Fry Length on 40 days of Maintenance

~~The average absolute length increase for each treatment A, B, C and D were 1.22 ± 0.03 cm, 1.64 ± 0.09 cm, 1.69 ± 0.05 cm and 1, respectively. 89 ± 0.04 cm.~~ A treatment with feed without addition of Cr resulted in the lowest absolute length increase (P<0.05) (Figure 3) compared to feed with addition of Cr. ~~The results of analysis of variance and Duncan's multiple range tests showed that the administration of chromium lemna to commercial feed gave a marked difference in the absolute length increase of fish (Figure 3)~~. Feed with addition of Cr showed better (P<0.05) results compared to feed without addition, with the best results found in treatment D.

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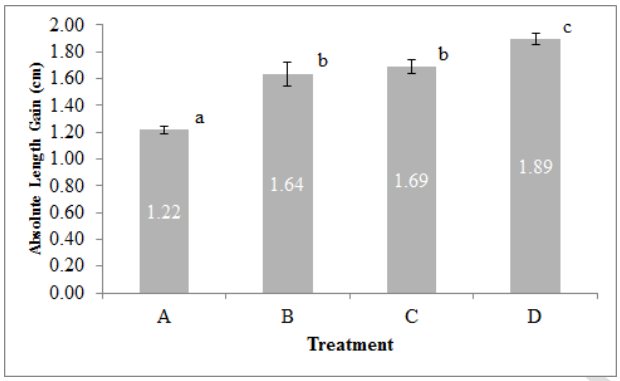

Figure 3. Absolute length gain of Gouramy Fry after 40 days of maintenance

This difference in absolute length increase is thought to be caused by the Cr contained in the lemna added to the feed which can help insulin performance through GTF by assisting active glucose transport which results in an increase in insulin bioactivity in the introduction of blood glucose into cells to be converted into energy (Groff and Gropper 2000, Subandiyono et al. 2004, Subandiyono and Hastuti 2016, Vincent 2018). According to Subandiyono et al. (2004), Giri et al. (2014) and Rakhmawati et al. (2017), eEnergy generated from glucose can quickly reduce protein catabolism as an energy source thereby increasing protein deposition in the body which has an impact on increasing the length and weight of fish fry (Subandiyono et al. 2004, Giri et al. 2014, Rakhmawati et al. 2017). Comparison of the absolute length increase between treatments can be seen in Figure 4.

The average increase in daily length for treatment A is 0.030 ± 0.001 cm, this result is the lowest result between treatments B, C and D. While the best results are produced by treatment D with an average daily length increase of 0.047 ± 0.001 cm and for treatments B and C each obtained results of 0.041 ± 0.002 cm and 0.041 ± 0.001 cm. These results indicate that the treatment of feed with the addition of Cr produces a better daily length growth than the control treatment or in other words in treatments B, C and D the length increase can occur faster than treatment A. Treatment D as the best treatment can grow 1, 6 times longer than treatment A in the same maintenance time.

Average fish fry length in all treatment at the beginning of maintenance (6.59 ± 0.12 cm)

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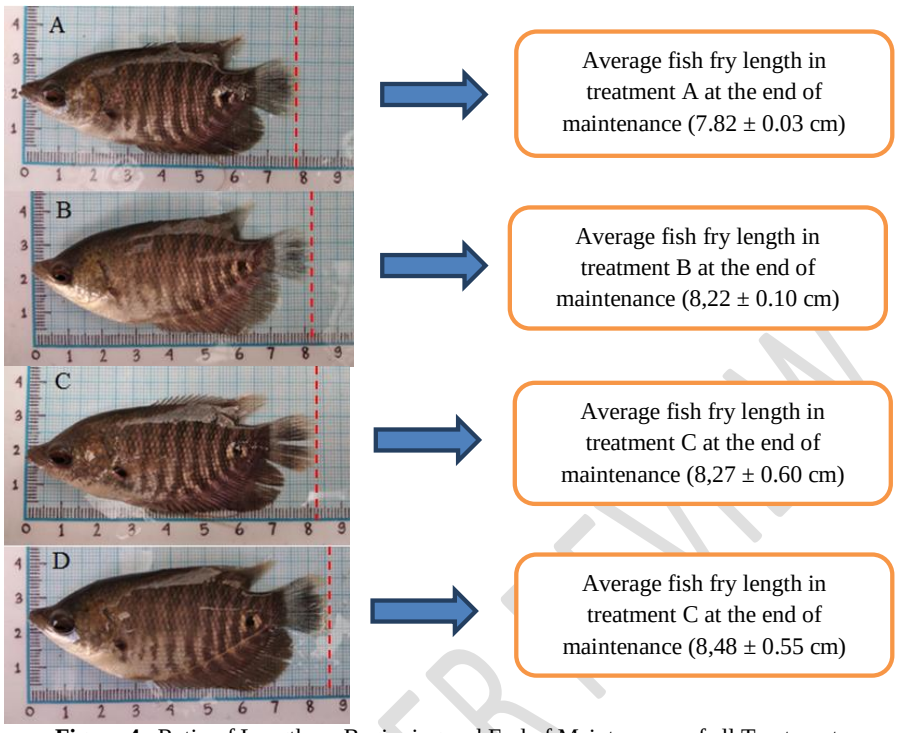

Figure 4. Ratio of Length on Beginning and End of Maintenance of all Treatment

If viewed in terms of maintenance time to achieve an absolute length increase of 2 cm for treatment A, it takes 66 days, treatment B 49 days, treatment C 47 days and treatment D 42 days. This clearly shows that the addition of Cr in the feed can reduce the maintenance time of gouramy fry, even up to 24 days compared to gouramy fed without adding Cr. The acceleration of this long increase time is very beneficial for the cultivators due to the shortened maintenance time, the cultivator can make faster harvest time and capital turnover, save on feed costs and accelerate the movement of fish to enter the next nursery stage.

Gouramy fry reared by chromium feed produce fry with fuller body characteristics. As shown in figure ~~Picture~~ 4., at the beginning of maintenance the average fish fry used were the same size. But at the end of the maintenance of fish fry in treatments B, C and D look longer and contain. This phenomenon is supported by the value of b for each treatment which increases with increasing Cr dose in feed. The value of b is presented in the graph of the ~~relationship of~~ length - ~~and~~ weight relationships ~~with the value of b for each treatment in a row of 2.48; 2.56; 2.53 and 2.76 for treatments A, B, C and D~~ (Figure 5). A value of close to 3 indicates that the length and weight gain of the fish is almost balanced (isometric). Chromium feed causes weight gain and length to approach the isometric growth pattern. This is because Cr increases the performance of insulin in synthesizing protein in muscle tissue, facilitates the transport of amino acids into muscle cells, increases the ribosome content of cells and the efficiency of translation and thus can increase protein anabolism in muscle cells (source). In addition, insulin reduces proteolysis by decreasing lysozyme activity in cells (Giri et al. 2014), and thus the growth of fish weight increases with increasing fish length.

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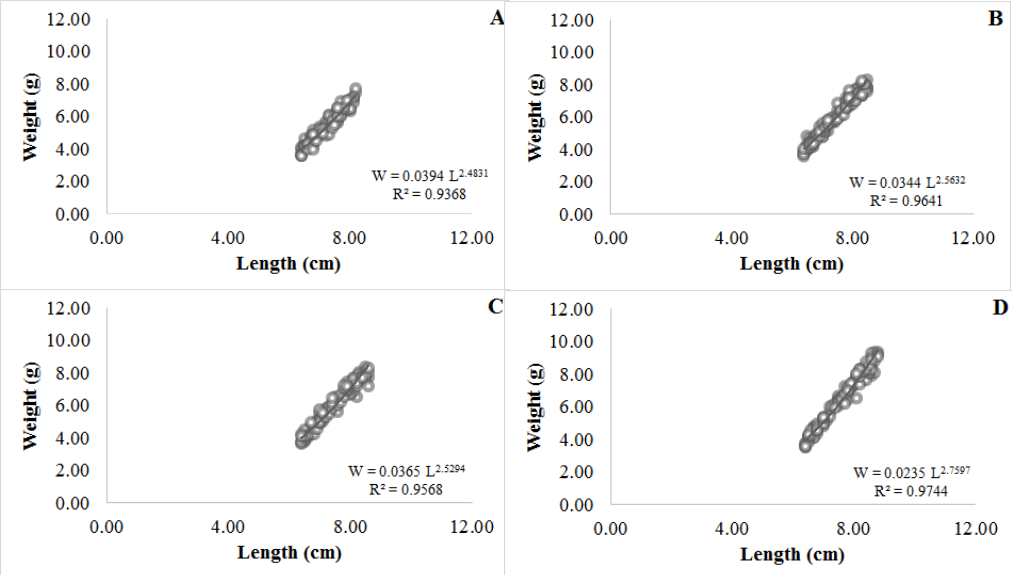

Figure 15. Length-Weight Relationship and ~~B~~ b value in all treatment

Even so, the results of this research are still below the standard compared to SNI. In the nursery of gouramy, an additional length of 2 cm should be achieved within 40 days. This is thought to be caused by different maintenance media. In SNI nursery is carried out in a pond while in this research it is carried out in an aquarium. Space limitations and availability of natural food become one of the factors that cause the growth of fish fry slower. There's a possibility if the maintenance at this research carried out in the pool will produce better growth.

CONCLUSION

The addition of Cr in commercial feed can give significantly different results on increasing the absolute length of gouramy fry, while in survival it does not give a real difference. Giving Lemna sp. with Cr 2,319 mg kg-1 content as much as 73.31 g kg-1 in commercial feed or equivalent to 1.7 ppm Cr produces a best result of survival rate, absolute length increase and efficiency of maintenance time in gouramy fry successively at 87.5 ± 5%; 1.89 ± 0.04 cm and with a maintenance time of 42 days to achieve an increase in length of 2 cm, 1.6 times faster than the control treatment.

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