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Economic Efficiency and Cost Reduction through the Use of Non-organic Feed on the Farming of Transgenic Mutiara Catifish (*Clarias* sp.) F1 Hybrid

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Abstract: This research aims to identification the efficiency of the feed and the growth on mutiara catfish F1 hybrid. Experiment is conducted in Aquaculture Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran, Jatinangor from June to August 2016. The method used for this research is economic analysis randomized design factorial experiment that includes three treatment factors: F1 hybrid from transgenic mutiara catfish and sangkuriang catfish, non-transgenic mutiara catfish and sangkuriang catfish, and sangkuriang catfish and sangkuriang catfish. The fish are treated with two feeding levels of 5% and 7% of biomass weight with three repetitions. The feed is the non-organic Hi-Provit 781 with the frequency of two times per day. Production cost efficiency is calculated using value of benefit and cost with average daily gain and survival rate as testing parameters. The results show that treatment on hybrid of transgenic mutiara catfish and sangkuriang catfish with feeding level of 5% induces the leading result with insignificant difference of survival rates in every treatment. The most efficient treatment is treatment A with economic efficiency of 1.13.

Key words: average daily gain, survival rate, economic efficiency, cost reduction, transgenic mutiara catfish

INTRODUCTION

Catfish farming of the genus Clarias, specifically African catfish, Clarias gariepinus, has been one of important aquaculture business in Indonesia (Imron, *et al.* 2015). The savoury taste of the fish makes the consumption rate is high, as well as the high protein level of 20%. The fish have been farmed for years and the industry has also grown rapidly in the last few years with significant environmental survival rate and the possibility of being cultivated in limited amount of water. In addition, the farming is supported by trouble-free marketing and efficient production cost that people expand their catfish farming into a superior choice (Darseno, 2010). Various attempts had been conducted to increase its productivity including through genetic quality improvement (Dewi, *et al.* 2016)

In 2014 Fish Breeding Research Institute (Balai Penelitian Pemuliaan Ikan; BPPI) Sukamandi succeeded in producing the third generation of catfish through breeding with strain name "mutiara" which stands for "*mutu tinggi tiada tara*" (unbelievably high quality). The new breed is the result from strain crossbreeding through individual selection that includes python catfish, dumbo catfish, sangkuriang catfish, and egyptian catfish (BPPI 2014). The crossbreeding results in superior qualities that include faster growth of 20-70% compared to dumbo or sangkuriang.

The transgenic mutiara catfish started to be developed in 2015 but with growth hormone (GH) insertion from dumbo (Buwono, *et. al.,* 2015) (Buwono, *et al.* 2016). The breeding is conducted with electroporation process on the fish sperms which is intended to insert dumbo's GH into mutiara's eggs. The research inserts the GH of dumbo grown for four months and results in fast growth compared to normal (non-transgenic) mutiara catfish. This type is the transgenic one with new phenotype whose growth expansion exceeds the normal fish. Meanwhile, a research conducted by Marnis, *et. al.* (2015) results in transgenic catfish using GH from river catfish (Pangasius hypophthalmus) and has qualities, such as high growth level, immunity to stress, adaptability to both fresh and non-organic feeds, and low growth efficiency below 1 high growth rate that gives more time for farming for shorter consumption level and less feeding.

In order to increase the production of transgenic mutiara catfish, crossbreeding between transgenic mutiara catfish and sangkuriang catfish is resorted. The hybridisation is to improve the growth quality and feeding efficiency; moreover, it also can prevent inbreeding that would decrease the genetic quality of the fish (Imron, *et. al.*, 2014). The aim to produce the superior type of fish makes this breeding applied in the farming. The crossbreeding serves to identify whether the transgenic mutiara catfish F1 hybrid seed would succeed the superior character of the parent (Fo transgenic mutiara catfish) as seen from the growth rate and feeding efficiency.

Replacement of feed meal is one of the most important issues in the acuaculture industry because of continuously increasing demand unstable supply and high price of fish meal (Lim et al. 2011). Reducing the amount of feed meal diet formulation is one of alternative solution (Kader et. Al. 2012).The different feeding levels are intended to prove the feeding efficiency on mutiara catfish F1 hybrid offsprings is more effective than non-transgenic fish. This research, therefore, ams to identify the feeding efficiency and growth rate on mutiara catfish F1 hybrid.

RESEARCH OBJECT AND METHOD

This research focuses on crossbreeding of F1 hybrid of transgenic mutiara catfish seeds and sangkuriang fish, non-transgenic mutiara catfish seeds and sangkuriang catfish, and sangkuriang catfish seeds in the density of 10 fish per aquarium and fed with Hi-Pro Vit 781.

The method use for the identification is complete randomised design factorial experiment that consists of two factors with three repetitions. The factors include:

1. Treatment A: seeds from crossbreeding between F_0 transgenic mutiara catfish parents and sangkuriang catfish with 5% of feeding level.

2. Treatment B: seeds from crossbreeding between F_0 transgenic mutiara catfish parents and sangkuriang catfish with 7% of feeding level.
3. Treatment C: seeds from crossbreeding between F_0 non-transgenic mutiara catfish parents and sangkuriang catfish with 5% of feeding level.
4. Treatment D: seeds from crossbreeding between F_0 non-transgenic mutiara catfish parents and sangkuriang catfish with 7% of feeding level.
5. Treatment E: seeds from controlled crossbreeding between sangkuriang catfish parents and sangkuriang catfish with 5% of feeding level.
6. Treatment F: seeds from controlled crossbreeding between sangkuriang catfish parents and sangkuriang catfish with 7% of feeding level.

Research Parameter

- Average Daily Gain (ADG)

Measured by using the following equation (Effendi, 1997; Rostika 2016) :

$$\text{ADG} = \frac{Wt - W0}{t}$$

ADG = Average Daily Gain (gram/day)

Wt = Fish biomass at the end of research (gram)

Wo = Fish biomass at the initial of research (gram)

t = duration (day)

- Survival Rate

Measured by using the following equation (Effendie 1997; Rostika 2016) :

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

SR = Survival Rate

N_0 = Number of fish at the initial of research (pieces)

N_t = Number of fish at the initial of research (pieces)

- Benefit Cost Ratio

According to Rizal (2015), measuring efficiency serves three purposes. First, it serves as a benchmark to obtain a relative efficiency, making it easier to compare one economic unit to another. Second, in a case where the efficiency level varies among a number of business units, further analysis can be done to investigate what factors cause such a variation and find an appropriate solution. Third, information about efficiency has a policy impact because it can help policy makers decide the right policy.

Efficiency is achieved when either of the following occurs: first, when the same amount of input yields a bigger amount of output; second, when a smaller input yields the same amount of output; and three, when bigger input yields even bigger output. If efficiency is to be defined in terms of input-output ration, then it can be expressed by the following equation.

Eficiency = I / O (Rizal, 2015).

E = Eficiency

O = Output

I = Input

RESULT AND DISCUSSION

Average Daily Gain

The results from F-test with p.value of 95% show significant variance only on the hybrid factor, while that on feeding factor and interaction factor do not show different results.

Commercial feed of non-organic feed in general has been formulated to contain standardised nutrition by the manufacturer. Hi-Provit 781(-1) as one of the non-organic feeds available in the market contains 31-33% of protein level that enables catfish to grow optimally because it provides the protein need for fish which is 30% (BPPI 2014).

Table 1
Average Daily Gain

Treatment	*Average Daily Gain (Gram/day)*	*Notation*
♂ MT >< ♀ S (5%)	1,39 ± 0,27	a
♂ MT >< ♀ S (7%)	1,02 ± 0,23	b
♂ MNT >< ♀ S (5%)	0,65 ± 0,30	d
♂ MNT >< ♀ S (7%)	0,95 ± 0,30	c
♂ S >< ♀ (5%)	0,54 ± 0,11	e
♂ S >< ♀ (7%)	0,42 ± 0,26	f

Same notation mean not significant using Duncan Multiple Tange Test by the 95% confidence intervals

MT : Mutiara Transgenik

MNT : Mutiara Non Transgenik

S : Sangkuriang

This research shows growth data of catfish that indicate more effective crossbreeding of transgenic mutiara catfish compared to that conducted by Muzni (2014) on sangkuriang catfish where the daily growth rate is 2.528% or 1.39 gram/day with the same protein level in the feeding. In addition, it also results in more satisfactory outcome than Ramadhan's (2016) where the daily growth rate for hybrid factor on the offsprings of transgenic mutiara catfish and sangkuriang catfish is 3.41% and on the offsprings of non-transgenic mutiara catfish and sangkuriang catfish is 3.22%. Moreover, based on the results of proximate test analysis, the protein level of hybrid of transgenic mutiara catfish and sangkuriang catfish is also high, which is 58.87% and hybrid of non-transgenic mutiara catfish and sangkuriang catfish contains 56.84% of protein level.

Survival Rate

The results from analysis of variance with p.value of 95% show insignificant difference of life expectancy in every treatment. The highest variance value is seen in Treatment A, B, C D with 97%, and the lowest variance value is evident in Treatment F with 87% (Figure 2).

The average value in all treatments reaches to 90%, while the lowest value is in controlled treatment of sangkuriang catfish, which is 87%. On the other hand, the statistics analysis results in insignificant variance. There is no influence of feeding level on the leftovers and the quality of the water. Water quality is one of the factors that supports growth and life expectancy of the fish (Mulyadi, *et. al.,* 2010).

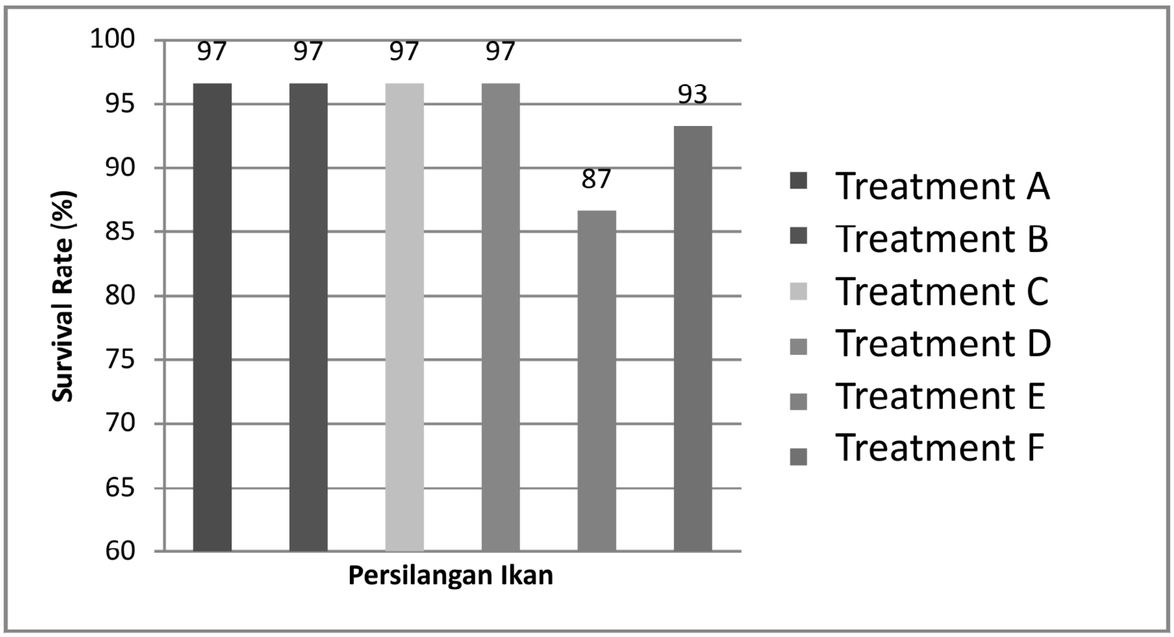

Figure 2: Survival Rate of Catfish Hybrid

Water Quality

Water quality is measured to identify the expediency of a fish-farming media. It is also crucial in farming because it affects the growth. The results from the measurement on the media show that the water quality meets the determined standard (Table 2).

Table 2
Comparison of Water Quality along research

Water Quality	*Observed*	*SNI*
Suhu (^{o}C)	28-29	25 – 30
pH	7	6,5 – 8,5
DO (mg/L)	4	>2

Several parameters are used to measure water quality in this research that include temperature, pH level, and demand oxygen (DO). The temperature is between 28-29 °C, pH level of 7, and DO of 4 mg/L (Table 6) and they are still tolerable based on SNI standard (2006).

The result from the measurement of the temperature derives from the setting on the numbers during the research using heater to meet the SNI standard. pH level becomes attention and is kept in SNI standard for catfish because if the level is too high or too low, it causes stress on the fish. Demand oxygen is an important environmental factor for fish's growth because the oxygen needed for breathing and metabolism is used to mobility, growth, and reproduction. The optimal value of demand oxygen boosts appetite that supports high feeding and fish seed's growth rate (Effendi, 2004).

Efficiency

Based on the table, the efficiency value varies among the treatments. The highest efficiency is shown in Treatment A with the efficiency value of 1.13 that derives from the feeding level of each treatment. It can be concluded that it is efficient because low feeding level results in relatively similar growth.

Table 3
Benefit Cost Analisis

Indicator	*Each*	*Treatment*					
		A	*B*	*C*	*D*	*E*	*F*
Amount of feed given/grams fish	g	0.49	0.43	0.34	0.41	0.26	0.25
Amount of feed given for 42 days	g	250.86	224.73	139.59	222.51	143.31	130.92
Amount of feed cost	Rp	1,756	1,573	977	1,558	1,003	916
Amount of fry cost	Rp	269	202	167	186	178	153
Amount of medicine	Rp	3,000	3,000	3,000	3,000	3,000	3,000
Total cost/research unit	Rp	5,025	4,775	4,144	4,744	4,181	4,069
Total harvest	g	201.93	148.83	99.12	137.85	86.19	68.73
Revenue	g	5654.04	4167.24	2775.36	3859.8	2413.32	1924.44
Efficiency = Output/Input		1.13	0.87	0.67	0.81	0.58	0.47

CONCLUSION

It can be concluded based on the findings and analysis that the result from crossbreeding between transgenic mutiara catfish and sangkuriang catfish with feeding level of 5% is the most optimal treatment with the insignificantly varied life expectancy in each treatment. The most efficient treatment is evident in Treatment A with the cost efficiency of 1.13.

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