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FEED AND ECONOMIC EFFICIENCY THROUGH THE USE OF COMBINED PROTEIN SOURCES ON THE FEED OF SIAMESE CATFISH (PANGASIUS SP.)

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ABSTRACT

This research aims to identification the efficiency of the feed and the growth on Siamese Catfish (*Pangasius* sp), through combination of mackerel tuna canning waste and soybean meal as sources of feed. This research is conducted in March to June 2017 in the Floating Net Cage (FNC) of Office for General Water Fisheries and Ornamental Fish Conservation or Balai Pelestarian Perikanan Perairan Umum dan Ikan Hias (BPPPUIH) of Cirata Reservoir – West Java. The method used for this research is economic analysis randomized design factorial experiment that includes six treatments and three repeats. The combinations of mackerel tuna canning waste and soybean meal respectively are: feeds A (100%, 0%), B (87.5%, 12.5%), C (75%, 25%), D (62.5%, 37.5%), E (50%, 50%), and F (Commercial Feed). The Siamese catfish seed's size is 5.57 ± 0.23 g which is kept in 18 net cage units at a density level of 40 fish/net for 60 days. Production cost efficiency is calculated using value of benefit and cost with Daily Growth Rate as testing parameters. The influence of each treatment on parameters is analyzed using Analysis of Variance (ANOVA). The research results indicate that the test feeds with varied combinations of mackerel tuna waste and soybean meal as the protein sources give significant influence (P>0.05) on Daily Growth Rate. Combination of 75% mackerel tuna canning waste and 25% soybean meal in the feed of Siamese Catfish juvenile seeds delivers the best result on Daily Growth Rate at 3.34% and the most efficient treatment is treatment A with economic efficiency of 1.13.

INTRODUCTION

Freshwater fish cultivation has the potential to increase the national freshwater fish production. One of the currently rapidly-developing freshwater fish commodities is siamese catfish. Siamese catfish (*Pangasius* sp) is a fish commodity of high economic value. During 2010-2014 period, the total siamese catfish production shows a positive trend, i.e. increasing on average 30.73%. The siamese catfish production in 2010 is 147,888 ton, in 2011 it increases to 229,267 ton, in 2012 to 347,000 ton, in 2013 to 410.883 ton, and in 2014 the siamese catfish production reaches 403,132.80 ton (Ministry of Marine and Fisheries or *Kementerian Kelautan dan Perikanan*, 2014). Based on the data avove, it is highly likely that the total siamese catfish production increase will continue. To fulfill this production need, an intensive siamese catfish cultivation is needed.

In increasing the siamese catfish production, one of those factors which should be considered carefully for economic reasons is the technical efficiency of production input use, including the feed. To meet the need of protein in feed, raw materials for sources of protein both animal and vegetable ones are needed. In general, the protein in feed is supplied by fish meal. This is because fish meal has complete essential amino acid highly needed for the fish growth. However, at least two problems are in the way of providing fish meal. Firstly, to provide the fish meal many still rely on importing it. Secondly, the dependence on the currently irreplaceable artificial feed is high. Combined, these two problems lead to the high feed price. In turn, this surely results in the increasingly higher production costs, 60-70% of which is allocated to buy the feed. Thus, it is important to find alternative raw materials for sources of protein which can replace fish meal. In this light, local raw materials can be utilized.

One of local raw materials for feed potentially replacing fish meal is mackerel tuna waste which can be obtained from fish product packaging factory in Indramayu Regency. This waste has high availability, low price and sufficient nutrient. The proximate analysis on mackerel tuna waste find that it contains protein 38.54%, water 75.91%, ash 9.47%, fat 12.75%, fiber 0.00%, BETN 39.24%, Ca 0.67%, P 0.08% and gross energy of 4681 kcal. The protein level as the calcium level of feed raises will obstruct the retention of protein (Kaligis, 2015). Hence, the mackerel tuna waste when used as a source of protein of feed should be limited to an appropriate amount. This research aims at determining the technical and economic efficiencies of mackerel tuna waste and soybean meal flour as sources of protein of feed which produce the highest siamese catfish seed growth.

METHOD

This research was conducted in March - June 2017 at Keramba Jaring Apung Cirata. The technical and economic efficiency at Nutritrion Laboratorium, Fisheries and Marine Science Universitas Padjadjaran, Sumedang Regency and Gaul Cai Feed Mini Plant, West Bandung Regency. Feed proximate analysis was done at Ruminant Livestock Nutrition Laboratory and Animal Feed Chemicals Faculty of Animal Husbandry Universitas Padjadjaran Sumedang Regency.

The tools used in the study was net (1m x 1m x 1m) for 18 catfish fry breeding containers, digital scales were used with a precision of 0.1 grams to weigh feed and test fish during the research. Basin, grinding machine for smoothing feed raw materials, pellet machine used for making pellets, ruler, paper Millimeter block to measure the length of fish during the study. Seser to take test fish to be weighed, mercury thermometer to measure water temperature. DO digital meter to measure dissolved oxygen content, digital pH meter, stationery, digital camera.

The materials used in the study was fish test which catfish fry 5 – 8 cm (5,57 ± 0,23 gr) size (720 and 30 fish as a stock) from *Balai Pelestarian Perikanan Perairan Umum dan Ikan Hias Cianjur*. The feed used is artificial feed in the form of pellet with feed ingredients such as mackerel tuna canning waste, soybean meal, fine bran, tapioca starch, fish oil, and Top mix (Appendix 18). The formulation of the prepared feed has a protein content of 30%. As for comparative feed used is commercial feed HI - Provite 781 - 1 with protein content 31 - 33%.

The research method used in this research for technical efficiency of experimental method designed by using Completely Randomized Design (CRD) consists of 6 treatments with 3 replications. Treats are done as follows:

Treatment A: 100% mackerel tuna canning waste.

Treatment B: 87.5% mackerel tuna canning waste and 12.5% soybean meal flour.

Treatment C: 75% mackerel tuna canning waste and 25% soybean meal flour.

Treatment D: 62.5% mackerel tuna canning waste and 37.5% soybean meal flour.

Treatment E: 50% mackerel tuna canning waste and 50% soybean meal flour.

Treatment F: Commercial Feed.

Parameters

Daily Growth Rate (DGR)

Daily Growth Rate was calculated based on the Steffens' formula (1989):

$$DGR = \frac{(lnWt - lnW0)}{t} x\ 100\%$$

Description:
DGR = Daily Growth Rate
lnW0 = fish biomass day-0 (g)
lnWt = fish biomass day-t (g)
t = Length of Cultivation (day)
Fish Number day-0 (fish)

Benefit Cost Ratio

Eficiency = I / O

E = Eficiency ; O = Output ; I = Input

Result and Discussions

Daily Growth Rate

The daily growth rate of siamese catfish seed when they are kept ranges from 2.99% to 3.35%. This daily growth rate range can be said as fairly good when compared to the results of Obasa *et al*. (2011) research which finds that giving feed with various treatment substitution of fish meal with fish waste meal delivers a daily growth rate range of African catfish of 1.86%-2.40%. This shows that the feed with various combination of mackerel tuna waste and soybean meal flour has the nutrient which can support the growth of siamese catfish seed.

Good-quality feed can be digested easily and produce adequate energy supply for the fish. It is this energy from the feed which is used for *maintanance* requirement and the remaining amount is used for growth. As suggested by NRC (2011), the energy from feed is used by fish for their basic metabolism, movement, sexual organ production, maintenance of body parts and replacement of damaged cells and the remaining can then be used for their body growth. To discover the nutrients in treatment feed a proxymate analysis is conducted. The result of this proxymate analysis can be seen in Table 1.

Tabel 1. Nutritional Feed Content

Sample	Proximate Analysis Results (%)					
	Protein	Fat	Water	Ash	Fiber	Ca
A	29,80	7,49	11,55	17,45	3,07	1,67
B	27,93	6,13	8,09	16,72	4,3	1,25
C	27,06	5,54	11,95	16,41	5,45	1,05
D	27,05	5,05	9,84	17,42	5,75	1,11
E	25,89	5,01	13,25	16,64	6,02	1,21
F	31 – 33	4 - 6	9 - 10	-	3 - 5	-

Sources: Laboratory of Livestock Ruminants Nutrition and Feed Animal Chemicals Unpad 2017.

The need for energy is tightly related to the need for protein in feed. This is because energy constitutes the function of protein which is usually termed as *Digestible Energy* (DE)/Protein (Amanta et al. 2015). The use of protein in feed as a source of energy for growth is because protein can provide amino acid, be it essential or non-essential one, and the fish can benefit better from protein than from carbohydrate and fat.

Based on the result of proxymate analysis, the treatment feed has protein content at 25.89%-29.80% range (Table 2). The protein content in this feed is close to the protein requirement needed by siamese catfish seed at nursery stadium. According to SNI (2009), the protein need of siamese catfish seed at nursery stadium is at a minimum of 30%. Additionally, it is also supported by Mangalik (1986) in Lovell (1989) who suggests that *small channel catfish* can grow well with feed which contains 27% to 38% protein. The protein content in this treatment feed can be said as good enough when compared to the result of Lestari's (2013) research, i.e. the feed is made of local alternative raw materials such as fish meal, cornstarch, bran, and tofu grain at a protein range of 18.80%-26.06% in tilapia feed. This difference in protein levels in feed is suspected to cause the different daily growth rate in siamese catfish seed between treatments.

In addition to the protein content in feed, the nutrition component suspected to also have some influence on siamese catfish seed's daily growth rate is ash content. The ash content in feed is the amount of inorganic compound in the form of salt and mineral. The ash content in feed ranges from 16.41% to 17.45%. This ash content has exceeded the ash content maximum limit of feed for siamese catfish seed at nursery stadium. According to SNI (2009), the ash content in the feed of siamese catfish seed at nursery stadium is at a maximum of 12%. The feed's ash content in this research is lower than the feed's ash content in Lestari's (2013) research, i.e. 17.52%-19.43%.

In the feed formulation A (100% mackerel tuna waste) with no soybean meal addition as a source of protein in the feed, the lowest daily growth rate is obtained. It is suspected that this feed has no enough nutritional balance for siamese catfish seed's growth. The protein level in feed A is 29.87%. This protein level is higher than the protein level of other treatment feeds. However, the feed formulation A has its own weaknesses, i.e. its relatively high ash and calcium contents at 17.45% and 1.67% respectively. This indicates that the high protein level in feed does not necessarily improve the siamese catfish seed's growth. Yet, the increase in ash content in the feed is suspected to be able to obstruct the fish growth. According to Kaligis (2015) when the protein level in feed is high as the ash content rises, it can obstruct protein retention. This will surely result in the low siamese catfish seed's growth.

Davis *et al.* (1993) research finds that the addition of 4% calcium results in low growth in Vaname shrimp proves to result in weight gain as a result of reportedly phosphor assimilation disruption. Obasa *et al*. (2011) research finds that substituting fish meal with fish waste meal by over 50% results in low growth in catfish seed and it is suspected that it is due to the high ash content in the feed. In addition, Kaligis's (2015) research finds that feeding PL Vaname with high-protein (45%) and high-calcium (4%) feed can disrupt the protein retention.

Giving feed with 75% mackerel tuna waste and 25% soybean meal flour combination in treatment C shows a daily growth rate value close to that of commercial treatment feed. This combination can be said as good enough compared to other treatments. This research finding confirms the research conducted by Abadi (2010) which finds that a proportion of 75% salted fish waste meal and 25% soybean flour has the best growth by an ultimate weight of 1.45 gram. Suharman and Adelina's (2004) research finds that a substitution of 25% fish meal by soybean meal flour produces the best daily growth rate, i.e. 2.91% in yellow catfish (*Mystus nemurus*). Furthermore, this research finding is not too different from the finding of research conducted by Chou *et al.* (2004) that the highest growth of Cobia *Rachycenton canadum* juvenile is found in the treatment feed consisting of 80% fish meal and 20% soybean meal, gaining a weight of 114.5 g/fish.

Meanwhile, the highest growth rate of siamese catfish seed is found in feed F (commercial one). It is reasonably suspected that the nutrients in commercial feed has sufficed the fish's need for both its maintanance and growth. The protein content in commercial feed ranges from 31% to 33% (Table 8). This protein content is higher than other treatment feeds. Hence, the fish's protein need can be met optimally and it can improve the siamese catfish seed's growth.

The fact that these various treatment combinations of mackerel tuna waste and soybean meal flour as sources of protein in feed indicates that giving these feeds can indeed increase the siamese catfish seed's growth rate. It is suspected that this is a result of synergetic relation between mackerel tuna waste and soybean meal as well as other feed materials to support the growth. However, a combination which matches the fish's ability to digest the given feed is still needed. This is consistent with Afrianto and Liviawaty's (2005) opinion who suggest that in order to create a balance of nutrition in feed, it is better to use the protein deriving from both vegetable and animal sources consecutively.

Cost Efficiency

Economic Efficiency in Making the Feed

One of the processes of fish cultivation production is the use of production input, i.e. feed. Around 60-70% of production costs is used to purchase this feed. The technical and economic efficiency efforts of feed is done, among other things, by making the feed independently employing alternative raw materials. The calculation of costs for making the feed using mackerel tuna waste and soybean meal flour as the sources of protein for feed can be seen in Table 2.

Tabel 2. Economics Efficiency of feed

	Treatment					
	A	B	C	D	E	F
Cost/kg (Rp)	8778	8810	8856	8866	8891	11000
Saved Cost (%)/kg	20,2	19,9	19,5	19,4	19,2	-
Feed Efficiency (EPP) (%)	48,67	49,82	55,82	51,31	50,27	54,46

Based on Table 2, the cost spent to make the feed using the formulation of mackerel tuna waste and soybean meal flour combination can minimize around 19.2%-20.2% of the commercial feed price. Treatment A uses 100% mackerel tuna waste with no soybean meal flour addition and it costs lower than all treatments and it can even save up to 20.2% of the commercial feed price (Rp11,000.-), i.e. Rp 8,777.-. However, from the feed nutrition and efficiency perspectives, feed A is lower than other feeds.

Treatment C with its highest feed efficiency value has feed production cost of Rp8,855.86,-. This cost when compared to the commercial feed, is lower 19.5% with competitive output from the perspective of both the nutrition and efficiency of feed utilization (Rostika et al, 2017). As the mackerel tuna waste used decreases, the treatment feed price increases. This is because of the addition of soybean meal flour to the feed. The soybean meal flour costs Rp4,800.- (CV Misoury PS). This price is relatively more costly than other feed raw materials. Hence, the more soybean meal flour in the feed the higher the feed making would cost.

Conclusions

Based on the calculation of feed making cost, it is safe to say that the feed with formulation of mackerel tuna waste and soybean meal flour as the sources of protein in feed for siamese catfish seed is competitive to the commercial feed from the perspective of both its price and nutrition. This confirms Lestari's (2013) research which finds that the making of feed using lokal raw material can minimize around 24.19% of the commercial feed price. Meanwhile, according to Rahayu and Supayogi (2016) the making of feed using alternative raw materials (trash fish, tapioca flour, cornstarch, bran, palm oil and premix) can save 23.07% if the feed price is Rp13,000.- and if the feed price is Rp10,000.- then it can save around 30%.

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