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THE USE OF TUNA WASTE AND SOYBEAN MEAL AS A RAW MATERIAL SOURCE OF PROTEIN FODDER JUVENILE SANGKURIANG CAT-FISH (*CLARIAS GARIEPINUS*).

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Clarias Gariepinus, Mackerel, Soybean Meal, Growth, Survival, Efficiency of Feed Utilization

ABSTRACT

This research aims to determine and find out how much the use of tuna waste and Soybean Meal best as artificial feed for catfish juvenile growth. This research was carried out in June – August 2018 in the great Hall of Freshwater Aquaculture (BBPBAT), Sukabumi, West Java. The research method used i.e. experimental methods with Complete Random Design (RAL), which consists of six treatments and three times the combination of waste treatment of Deuteronomy, tuna and soy for cake respectively feed A (100%-0%), B (87.5% -12.5%), C (75%-25%), D (62.5%-37.5%), E (50%-50%), and F (commercial feed). Sangkuriang catfish used measuring 3 – 4 cm (3.5 ± 1.09 g) was observed in 18 units at the aquarium with 40 fishstocking the Aquarium for 30 days. The observed parameters include the daily growth rate, absolute growth weight, efficiency utilization of feed, and water quaMTL y. The influence of each treatment of parameters were analyzed using analysis of Variance or Analysis of variety (ANOVA) and continued with Test Duncan. Results of the study on seed treatment that sangkuriang Catfish feeding a combination of 75% tuna waste and 25% soybean meal flour can increase the daily growth rate of 3.09%, absolute growth amounted to 126.3 grams, efficiency utilization of feed (EPP) amounted to 68.48%, and survival of 82.50%.

INTRODUCTION

Catfish is one freshwater fish widely farmed by the society, particularly in Java Island. Catfish farming rapidly grows since it may be farmed on limited sized land and water source with high stocking density. Besides its high growth and breeding rate, catfish is also a fish the society likes for consumption. Its typical taste makes many people interested in its consumption. Its price gets increasing in line with increasing demand.

Catfish business development may start from juvenile to consumption size, with each segment may be profitable (Kholish 2008). Besides for local consumption, catfish has reached export market with relatively high demand. This is indicated with an increasing amount of catfish production. This increasing amount of production is caused by increasing market demand for catfish. This catfish demand has increased to 1,771,867 tons annually in 2017 according to the Director General of Farming Fishery, Ministry of Maritime Affairs and Fisheries (2018). This information shows that efforts are needed to improve catfish production.

One requirement for the success of this catfish farming business is the availability of good quality feed. This good quality feed is one which must fulfill nutritional content such as protein, fat, carbohydrate, vitamin, and mineral for fish growth and production. Fishes like this commercial feed in pellet form, but it costs quite high. The reason this pellet is expensive is that fish meal costs quite high, thus an alternative to other feed material for self-production like utilization of local-sourced materials from fish leftover with cheaper price and high protein content is required.

Leftover generated by industrial or domestic (household) activities in fishery are solid like fish flesh slices, scales and gills. One local feed material which may potentially replace fish meal is mackerel tuna. Mackerel tuna leftover may be in the form of flesh slice, innards, bone, head and fin. Mackerel tuna leftover has relatively high nutritional contents, including: crude protein 38.54%, crude fat 12.75%, crude fiber 0%, ash 30.37%, Energy 4681 Kkal/kg, water 65.91% and BETN 39.24% (Faculty of Animal Husbandry, Padjadjaran University, 2017).

On the other hand, however, mackerel tuna leftover has a weakness, in which it contains relatively high ash (Ca) content. According to Kaligis (2015), high ash (Ca) content may inhibit growth process since it will interrupt protein absorption process. Therefore, a combination with other feed materials is needed to hold down the ash content, one of which is by using soybean meal. Soybean meal is a source of vegetable protein, since its high protein and complete amino acid contents in comparison with other plant-sourced raw materials. As foodstuff with protein source originated from plant, this soybean meal has different protein contents pursuant to the soybean quality. The ash content in soybean meal is relatively low of 6%. Soybean meal's protein content ranging from 44-51%. Besides soybean quality, the type of oil extraction process also determines its quality.

In addition to high protein content, soybean meal powder has amino acid content which is good for growth in comparison with other vegetable proteins. Based on these, information of a combination between mackerel tuna leftover and soybean meal powder as a source of proteins for fish feed is not yet available, particularly for juvenile catfish. Therefore, further researches are needed to determine an effective combination of both materials of protein source which may present the best growth for juvenile catfish in nursery stadia.

METHOD

A trial design used in the research is the completely randomized design (RAL) with 6 treatments and 3 repetitions. The treatments are:

A. 100% Mackerel Tuna Leftover;

B. 87.5% Mackerel Tuna Leftover and 12.5% Soybean Meal;

C. 75% Mackerel Tuna Leftover and 25% Soybean Meal;

D. 62,5% Mackerel Tuna Leftover and 37,5% Soybean Meal;

E. 50% Mackerel Tuna Leftover and 50% Soybean Meal;

F. Commercial Feed.

Research Procedure

The research procedure is conducted in some stages, including making of test feed, preparing culture tanks, preparing test fishes, and research implementation.

Test Feed

The formulation is calculated using the *Pearson Square* method based on dry weight, which is then converted to wet weight of feed. The formulation of treatment feed based on dry weight may be found in Table 1.

Table 1. Feed Formulation Trreatment (% Dry weight)(g/100 g feed)

Feed Raw Material	Treatment (Mackarel tuna leftover: Soybean Meal)				
	A (100: 0)	B (87,5: 12,5)	C (75: 25)	D (62,5: 37,5)	E (50: 50)
Mackarel tuna leftover	89,30	81,42	68,24	54,61	42,02
Soybean Meal	0	11,63	22,74	32,76	42,02
Fine bran	4,65	0,94	2,91	6,6	9,93
Tapioka flor	3	3	3	3	3
Fish Oil	1	1	1	1	1
Premix	2	2	2	2	2
Total (%)	100	100	100	100	100

Table 2. Formulasi Pakan Perlakuan (%Wet weight*)

Feed Raw Material	Treatment (Mackarel tuna leftover: Soybean Meal)				
	A (100: 0)	B (87,5: 12,5)	C (75: 25)	D (62,5: 37,5)	E (50: 50)
Mackarel tuna leftover	370,69	337,98	283,27	226,69	174,42
Soybean Meal	0	11,63	22,74	32,76	42,02
Fine bran	4,65	0,94	2,91	6,6	9,93
Tapioka flor	3	3	3	3	3
Fish Oil	1	1	1	1	1
Premix	2	2	2	2	2

Preparing Culture Tanks

Preparing catfish culture tanks in nursery stadia includes preparing aquarium, arranging aquarium layout and pacing aquarium at 10 – 20 cm of water height.

Preparing Test Fishes

Preparing test fishes includes taking 750 heads (180 heads for stock) of juvenile catfish in size of 3 – 4 cm with average weight of (3.5 ± 1.09 g) and acclimatization for 2 days for adaptation to new environmental condition and treatment feed. The fishes are weighed using digital scale for initial weight data.

Research Implementation

The culture is performed with a density of 40 heads per aquarium for 30 days. Feeding is performed with a *feeding rate* (FR) of 5% of body weight, twice daily at 08.00 and 15.00 WIB. For growth data, body sampling is performed once in 10 days to 25% of total population of each enclosure. Feed adaptation is made after sampling. Besides, the amount of feed given during the research is recorded for feed efficiency data and the population at the start and at the end of research is calculated for survivabiMTL y data.

Research Parameter

The growth performance is observed by measuring the body weight, feed weight utilized, and then input them in the following formula:

Survival Rate (SR)
Survival Rate is calculated using the following formula (Effendie, 2002):

$$SR = \frac{Nt}{N0} x\ 100\%$$

Description:
SR = Survival Rate (%)
Nt = Fish Number day-t (fish)
N0 = Fish Number day-0 (fish)

Feed Efficiency Utilization (FEU)
Feed Efficiency Utilization (FEU) is calculated using Tacon's formula (1987):

$$FEU = \frac{(Wt - W0)}{F} x\ 100\%$$

Description:
FEU = Feed Efficiency utilization (%)
W0 = fish biomass day-0 (g)
Wt = fish biomass day-t (g)
F = fish feed amount consumed during the study (g)

Daily Growth Rate (DGR)
Daily Growth Rate is calculated based on of 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)

RESULT AND DISCUSSIONS

Growth

The effect of treatment on juvenile catfish growth rate may be obtained from the result of analysis of variance. The result of analysis of variance shows that juvenile catfish's daily growth rate presents significantly different results between treatments. The differences in daily average growth rate of each treatment are then tested using the Duncan's Multiple Range Test with results as presented in Table 3.

Table 3. Daily Growth Rate of *Clarias gariepinus* (%)

Treatment	Daily Growth Rate (%)
A (100% MTL)	3,07 ± 0,10 [b]
B (87,5% MTL + 12,5% TBK)	3,03 ± 0,27 [a]
C (75% MTL + 25% TBK)	3,09 ± 0,14 [b]
D (62,5% MTL + 37,5% TBK)	2,94 ± 0,10 [a]
E (50% MTL + 50% TBK)	2,69 ± 0,06 [a]
F (Kontrol)	2,60 ± 0,28 [a]

Keterangan : MTL = Mackarel Tuna Leftover, SM= Soybean meal

Duncan's Multiple Range Test at 5% (Table 6) shows that feeding with treatment F does not presents significant effect with treatments B, D and E, but presents significant difference with feed of treatments A and C. This is caused by the absorption process of different treatment feed by fishes with each treatment. The juvenile catfish's growth rate during period of culture ranges from 2.60% – 3.09%. This daily growth rate range may be stated good in comparison with the results of research conducted by Obasa *et al*. (2011), in which feeding with various treatments of fish meal substitution with fish leftover powder results in African juvenile cat-

fish's daily growth rate ranging from 1.86% – 2.40%. This shows that various combinations of mackerel tuna leftover and soybean meal powder have nutritional contents which may support juvenile catfish growth rate. The nutritional contents of treatment feed obtained with a proximate analysis are presented in Table 4.

Table 4. The nutritional contents of treatment feed obtained with a proximate analysis **(%)**

Treatment	Result of Proximate Analysis (%)					
	Protein	Fat	Water	Cinder	Fibre	Carbohidrate
A	32,75	8,10	13,91	12,95	8,35	37,85
B	32,13	7,45	8,81	13,63	4,3	38,67
C	30,47	7,97	7,31	14,28	5,45	38,45
D	29,35	8,80	6,14	14,05	5,75	39,08
E	28,45	8,10	11,44	14,76	6,02	40,62
F	39-41	5	10	16	6	-

Source: Ruminants Animal Nutrition Laboratory and Animal Food Chemistry

The result of analysis of variance shows that the juvenile catfish's absolute growth presents insignificantly different results between treatments. The differences in average values of daily growth rate with each treatment are then tested using Duncan's Multiple Range Test with results as presented in Table 5.

Table 5. Average Absolute Growth (%)

Treatment	Average
A (100% MTL)	3,60 ± 0,11[a]
B (87,5% MTL + 12,5% BK)	3,89 ± 0,61[a]
C (75% MTL + 25% BK)	4,12 ± 0,39 [a]
D (62,5% MTL + 37,5% BK)	3,72 ± 0,28 [a]
E (50% MTL + 50% BK)	3,36 ± 0,13 [a]
F (Control)	3,22 ± 0,48 [a]

The absolute growth ranges from 3.22 g – 4.12%. The factor influencing fish growth is the protein content in feed, since protein serves to form new tissues for growth and replace damaged tissues. According to Kordi (2009), protein shortage negatively influences feed consumption, which consequently leads to reduction of weight growth. According to Kordi (2009), excess protein and fat may lead to fish's fat accumulation and reduction of appetite. The nutritional values of feeds may generally be examined in its nutritional substance composition and some important nutritional components which must be available in feed such as protein, fat, carbohydrate, and vitamin.

Feed Utilization Efficiency

Feed utilization efficiency is food presentation convertejd to flesh or weight increase. Besides, feed utilization efficiency may be described as the effect of feeding on fish which consumes it and an overview of utilization of feed given which may increase fish growth (Gusrina 2008). The results of analysis of variance of juvenile catfish feed efficiency are presented in Table 6.

Table 6. Variance of juvenile catfish feed efficiency (%)

Treatment	Catfish feed efficiency (%)
A (100% MTL)	75,08 ± 2,40 [a]
B (87,5% MTL + 12,5% SM)	71,61 ± 1,92 [a]
C (75% MTL + 25% SM)	68,48 ± 1,46 [a]
D (62,5% MTL + 37,5% SM)	72,94 ± 3,27 [a]
E (50% MTL + 50% SM)	71,40 ± 2,28 [a]
F (Control)	72,41 ± 2,10 [a]

The feed utilization efficiency value in this research ranges from 68.48% - 75.08%. This feed utilization efficiency may be stated good since it is higher than 50%. This is in line with the opinion of Craig and Helfrich (2002) that a feed utilization efficiency value will be stated good if it is higher than 50%. The efficiency value of juvenile catfish with feed based on combination of protein

source shows the best value when the combinations are mutually complementary and pursuant to fish's feed utilization ability. Feed utilization efficiency level may become a reference to examine whether or not a given feed is of good quality. Higher efficiency level of feed used by fish to grow indicates that the feed is of good quality (Utomo *et al*. 2013).

Survivability

Survivability level may be used to examine fish's tolerance and ability to live. The results of analysis of variance show that feeding with various combinations of mackerel tuna leftover and soybean meal powder as source of proteins does not present significant effect on juvenile catfish's survivability (Table 7).

Table 7. Catfish's survivability (%)

Treatment	Survival Rate (%)
A (100% MTL)	78,33 ± 2,89 [a]
B (87,5% MTL + 12,5% SM)	80,83 ± 7,64 [a]
C (75% MTL + 25% SM)	82,50 ± 6,61 [a]
D (62,5% MTL + 37,5% SM)	77,50 ± 4,33 [a]
E (50% MTL + 50% SM)	76,67 ± 2,89 [a]
F (Control)	69,33 ± 6,03 [a]

The result of analysis of variance at juvenile catfish's survivability level shows insignificantly different result. This indicates that the treatment of feed with combinations of source of protein of mackerel tuna leftover and soybean meal powder and commercial feed can be digested and do not impose negative effect on juvenile catfish's survivability level during the course of farming.

Fish's survivabiMTL y is influenced by changes of external factors which may put fishes under pressure and have them stressed. This conforms to the opinion of Effendi *et al.* (2006) that the stress impacts caused by pressure on fishes may decrease their body endurance and even lead to death.

Water Quality

Water quality is assessed in order to examine the condition of water used as the farming medium, both for its physical and chemical properties. Water quality is one important parameter to support the success of farming and to influence fish growth. The water is assessed three times for its quality at the initial and end of the research. The quality assessed includes temperature, dissolved oxygen (DO) and acidity (pH). The water quality assessment results may be found in Table 10.

Table 1. Water Quality During Research

Parameters	Result	Standard	Source
Temperature	25– 26^{0}C	25 – 33^{0}C	
pH	6,5 – 6,9	6,5 – 8,5	SNI 6484,4;2014
DO	4,6 – 5,3mg/L	3 - 7 mg/L	

Temperature is one important physical factor of water in fish farming, since it influences growth performance and utilization efficiency. The temperature in the fish farming ranges from 25 – 26.0^{0}C. This temperature is said to be good since it falls into the standard range for juvenile catfish. This does not conform to the Indonesian National Standard (2014) for temperature for catfish nursery of 25 – 30^{0}C. The influence imposed by temperature on fish growth is related to fish's metabolism. Any change to water temperature will cause a change to the metabolism rate, which will eventually change juvenile catfish's feed consumption and growth rate. At low temperature, fish's metabolism tends to be slow and will increase in line with a temperature increase. This is supported by Ekubo and Abowei (2011), in which water temperature may influence fish's dietary pattern, growth and spawning rate.

Acidity (pH) also plays a role in supporting fish growth, thus pH must be within optimal range. According to observation, the pH during the research ranges from 6.5 – 6.9. This value is still within a good pH range for juvenile catfish nursery according to SNI (2014) of 6.5 – 8.5. Neutral pH in fish farming ranges from 7 - 9 but will be optimal at 7.5 – 8.5. pH value is related to temperature, that if the temperature is high, fishes will be more sensitive to any pH change. Water pH value also significantly influences toxic materials.

Dissolved oxygen content plays an important role as an indicator of water quality and supports fish growth. The observation on DO parameter during the research obtains a value ranging from 4.6 – 5.3 mg/L. This DO range falls within tolerance limit for juvenile catfish. This is pursuant to the opinion of Mahyudin (2010) that oxygen content which may support fish farming ranges from 3 – 7 mg/L.

Conclusions

According to the research results, we may conclude that feed with a combination of 75% mackerel tuna leftover and 25% soybean meal powder may present daily growth rate of 3.09%, absolute growth of 126.3 grams, feed utilization efficiency (EPP) of 68.48%, and survivabiMTL y 82.50% juvenile catfish in nursery stadia.

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