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FEEDING STUDY OF TOFU WASTE FERMENTATION ALTERNATIVE IN THE BUSINESS CULTURE OF NILE TILAPIA FISH (*Oreochromis niloticus*) IN CILONGOK DISTRICT, BANYUMAS DISTRICT

Kajian Pakan Alternatif Fermentasi Ampas Tahu Pada Usaha Budidaya Ikan Nila (Oreochromis Niloticus) di Kecamatan Cilongok Kabupaten Banyumas

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ABSTRACT

The results of fish cultivation businesses are influenced by three equally important factors, namely breeding (breeding, seeds), feeding (feed) and management (management). Feed needs require the most costs, namely 60-70% of all production costs, so feed management must be considered adequate (Andriani, 2018). This research aims to examine alternative feed made from tofu dregs to reduce production costs, especially feed costs by 10-20% in tilapia rearing businesses. In Kalisari Village, Cilongok sub-district, there is tofu dregs waste that has not been utilized. The nutritional content of tofu apas is crude protein 27.55%, fat 4.93%, crude fiber 7.11%, BETN 44.50%, making fish food with tofu dregs can be done through a fermentation process with probiotics. This descriptive analysis method is used for qualitative data presented in the form of simple descriptions and tabulations such as tables, diagrams, graphs. The data collected is in the form of primary data and secondary data, primary data using the interview method, k uestionnaire using direct observation in the field while secondary data using literature study. The research was carried out in Cilongok District from 2 February to 2 May 2023. Based on the data analysis that has been carried out, it shows that providing alternative feed with a percentage of pellets and fermented tofu dregs (50%:50%) is 58.9% or worth Rp. 2,102,109,- (tarpaulin pool) and 59.8% or Rp. 2,181,909,- (ground pool). Then in ponds with cultivation treatment according to SNI and providing alternative feed with a percentage of pellets and fermented tofu dregs (75%:25%) of 50.2% or worth Rp. 1,475,109,- Use of fermented tofu dregs as alternative feed if converted on a scale A business with an average pool area of main actors/businesses in Cilongok District (190 m^2), can reduce production costs for feed production by IDR 866,805.- or 16.85%.

Keywords: Tofu dregs, alternative feed, waste

ABSTRAK

Hasil usaha budidaya ikan di pengaruhi tiga faktor yang sama pentingnya, yaitu breeding (pemuliaan biakan, bibit), feeding (pakan) dan management (tata laksana). Kebutuhan pakan memerlukan biaya yang paling banyak yaitu 60-70% dari seluruh biaya produksi, maka manajemen pakan harus diperhatikan dengan benar (Andriani, 2018). Penelitian ini bertujuan untuk mengkaji pakan alternatif berbahan baku ampas tahu untuk menekan biaya produksi terutama biaya pakan sebesar 10-20% pada usaha pembesaran ikan nila. Ikan nila termasuk pemakan segala (hewan dan tumbuhan) (Kodri, 2010). Di Desa Kalisari, kecamatan Cilongok terdapat limbah ampas tahu yang belum dimanfaatkan. Kandungan gizi ampas tahu protein kasar 27,55%, lemak 4,93%, serat kasar 7,11%, BETN 44,50%, Pembuatan pakan ikan dengan ampas tahu dapat dilakukan melalui proses fermentasi dengan probiotik. Metode analisis deskriptif ini digunakan untuk data kualitatif yang disajikan dalam bentuk uraian dan tabulasi sederhana seperti tabel, diagram, grafik. Data yang dikumpulkan yaitu berupa data primer dan data sekunder, data primer dengan menggunakan metode wawancara, kuisioner dengan observasi langsung ke lapangan sedangkan data sekunder dengan cara studi literature. Penelitian dilaksanakan di Kecamatan Cilongok pada tanggal 2 Februari sampai dengan 2 Mei 2023. Berdasarkan analisis data yang telah di lakukan, menunjukkan bahwa pemberian pakan alternatif dengan presentase pelet dan fermentasi ampas tahu (50%:50%) sebesar 58,9% atau senilai Rp 2.102.109,- (kolam terpal) dan sebesar 59,8% atau senilai Rp 2.181.909,- (kolam tanah). Kemudian pada kolam dengan perlakuan budidaya sesuai SNI dan pemberian pakan alternatif dengan presentase pelet dan fermentasi ampas tahu (75%:25%) sebesar 50,2% atau senilai Rp 1.475.109,- Penggunaan fermentasi ampas tahu sebagai pakan alternatif jika dikonversikan pada skala usaha dengan rata-rata luas kolam pelaku utama/usaha di Kecamatan Cilongok (190m2), dapat menekan produksi biaya pada produksi pakan sebanyak Rp 866.805.- atau sebesar 16,85%.

Kata Kunci : Ampas Tahu, pakan alternative, limbah

INTRODUCTION

Success business Fish cultivation is greatly influenced by three equally important factors, namely breeding (breeding, seeds), feeding (feed) and management (management). However, if you look at the total production costs in fish cultivation, the cost of feed requirements is at most around 60-70%, so that in cultivation activities, food management must really be paid attention to (Andriani, 2018) . Selecting and providing the right feed can increase the productivity of fisheries cultivation as well as increase business profits (Amalia *et al*., 2018) . However, business actors have limitations in providing pellet feed because prices are high and always increasing. Feed costs in business activities can be reduced by using alternative feed which has a lower price but with nutritional content that meets the needs of the fish. In Kalisari Village, Cilongok District, there is a tofu factory with the waste produced in the form of tofu dregs. Tofu dregs waste in Cilongok District has not been utilized optimally and is only used as factory waste. Tofu dregs contain quite high crude protein, namely 27.55% and other nutrient contents are fat 4.93%, crude fiber 7.11%, BETN 44.50%, so it can be used as raw material for making feed. Making fish food with tofu dregs can be done through a fermentation process with probiotics.

Application metabolism microbes to convert raw materials into more valuable products, can be done through fermentation. to obtain products such as organic acids, single cell proteins, biopolymers and antibiotics. The mixture of tofu dregs through formulation after fermentation will produce a more distinctive feed aroma and the feed will not rot easily (Mulia *et al.*, 2015).

Tilapia is an omnivorous animal (which eats everything/animals and plants) and tends to be a herbivore . In nature, small fish will search for food in shallow waters , while larger fish will search for food in deeper waters (Kordi, 2010).

Sub -district is one of the Minapolitan areas where this area consists of production, processing and marketing centers in an integrated agibusiness system with complete infrastructure and other interrelated activities (Harsasto & Taufiq, 2013) . The Cilongok District area has a wet tropical climate with an average temperature of 25°C, a minimum temperature of 22.3°C and a maximum temperature of 29.6°C and quite high rainfall (2958 mm) because geographically it is located at the foot of Mount Slamet, Located at an altitude of 75-880m above sea level (asl), the land elevation conditions are undulating areas, plateaus and there are hills with mostly Latosol soil types (Na'ma, 2023).

District area Cilongok reaches ± 105.33 km² consisting of 20 villages, with a distance of 26 km from the west and 13 km from north to south. The land used for the pool is 43.5 Ha or around 1% of the area. It has a main water source originating from the Logawa River with a length of around 25 km and abundant springs that are always available throughout the year. The population at the end of 2021 was 133,897 people with 67,944 men and 65,953 women, with an average population density of Cilongok District reaching 1,271.2 people per km2.

Source Power people in Cilongok sub-district are members of 45 fish cultivator groups (Pokdakan) and four (4) Marketer Processor Groups (Poklahsar) with business activity segmentation for hatching and rearing commodity fish tilapia, catfish, gourami, ornamental fish, tilapia rearing using the mina padi system as well as fisheries product processors with processed products in the form of shredded tilapia fish, shredded catfish, tilapia spine crackers, shredded tilapia pastels, shredded tilapia pineapple pineapple, tilapia spine brownies, fried tilapia meatballs. Cultivation business activities carried out in Cilongok District still use traditional systems and management at each stage of business activities which are not in accordance with the Indonesian National Standards (SNI) for Tilapia Cultivation which causes production results and income to be suboptimal.

The average monthly income in the tilapia hatchery segment is IDR 1,559. 464,- , growing tilapia Rp. 1,466,091,-, growing tilapia using the mina padi system Rp . data from the Department of Industrial Manpower, Cooperatives, Small and Medium Enterprises, namely IDR 1,983,261.84 (Na'ma, 2023). Based on With this description , it is necessary to carry out research on alternative feed and good cultivation management, to increase production and business income cultivator .

METHODS

The research was carried out from February 2 2023 to May 2 2023, in Cilongok District, Banyumas Regency. The research is qualitative descriptive in nature, namely photographing the situation being studied thoroughly . and quantitative descriptive namely providing a variable description of the actual situation and what it is with supporting data in the form of the resulting numbers . The results of the analysis in the form of qualitative data are presented in simple forms of description and tabulation such as tables, diagrams, graphs. The variables observed were the characteristics of the respondents, demonstration of feed making, demonstration of the application of tofu dregs to cultivation businesses, growth development of cultivated fish in pond ponds.

Stages making fermentation Tofu dregs begin with preparing the tools and ingredients according to the measurements. Tools and materials used in the demonstration activity on how to make fermented tofu dregs in the Research 60 liter drum, large basin, 1 m hose, 15 kg plastic. Ingredients for Fermented Tofu Dregs, tofu dregs, fine bran, yeast, fish meal, molasses, probiotic EM4.

Procedure preparation, mix all the ingredients in a container and stir until evenly mixed. After mixing completely, the mixture is placed in a plastic bag with air holes using a hose to circulate air during the fermentation process. Next, put it in the drum and close it. Alternative feed is fermented for 5 (five) days. Analysis for three experimental designs (ponds without

alternative feed, with 25% alternative feed, and with 50% alternative feed) were analyzed using variance (ANOVA) to determine the significance of differences in average weight and length in fish treated with fermented feed. with those who do not use fermented feed (Prihatini, 2017).

RESULTS AND DISCUSSION

Target Characteristics

The targets of the research were all members of Pokdakan Mratani and representatives of members from Pokdakan in the tilapia rearing segmentation in Cilongok District, especially Sokawera Village. Target characteristics based on age, education level, land area and length of business can be seen in Table 1.

Table 1. Target Characteristics

Criteria	Category	Number of people)	Percentage (%)
Age	Not yet Productive (<15 years)	0	0
	Productive (15-60 years)	17	85
	Less Productive (>60 yrs)	3	15
Level of education	Elementary/Low (SD-SMP)	17	85
	Intermediate/Medium (SMA/SMK)	1	5
	High (D1 – S3)	2	10
Length of Business	New (<10 yrs)	2	10
	Old (10 – 32 years)	14	70
	Old (>32 yrs)	4	2

Source: Primary Data 2023

According to (Ukkas, 2017) , age productive a person in work is in the range of 15 – 60 years, then < 15 years is included in the unproductive category and > 60 years is included in the less productive category. Apart from age, the level of education also influences the level of income in the business (Dewi & Utari, 2014) . Based on Law No. 20 of 2003 concerning the National Education System, elementary-middle school education levels are included in the basic category, high school and equivalent are included in the middle category and D1-D3, S3 are included in the high category (UU. number 20, 2003). (Rusmusi & Maghfira, 2018) states that business experience (length of business) has a positive and significant influence on income, meaning that the longer a person has been in his business field, the greater the opportunity to earn income. The fermentation of tofu dregs involves cultivators so they can understand better method making her :

Table 2. Cost of alternative feed for fermented tofu dregs

No	Material	Amount	Unit	Unit Price (Rp)	Total Cost (Rp)
1	Tofu Dregs	5	Kg	1,000	5,000
2	Fine Bran	5	Kg	4,000	20,000
3	Molasses	1	Kg	6,000	6,000
4	Fish flour	1	Kg	15,000	15,000
5	Probiotics (EM4)	0.2	Liter	28,000	5,600
6	Yeast	20	G	400	8,000
Total		**12.22**	**Kg**		**59,600**
Total / kg (Rp)					**4,877**

Source: Primary Data 2023

Based on Table 2, it can be seen that this alternative feed can reduce production costs, especially feed. This can be seen from the costs incurred for 1 kg of alternative feed which is only IDR 4,877 ,- while the price of 1 kg of commercial pellets is IDR 11,700,- so we get a percentage reduction in production costs (feed) worth IDR 6,823,- or 58.3 % .

Pilot Demonstration of Application of Using Fermented Tofu Dregs Feed in Tilapia Cultivation According to Indonesian National Standards (SNI)

SNI Tilapia cultivation is found in SNI. 7550-2009 concerning the production of grow-out class tilapia (*Oreochromis niloticus Bleeker*) in still water ponds. There are several stages that must be known in fish farming activities, namely starting from pond preparation, stocking of fish seeds, disease prevention, and harvesting period (Andriani, 2018) .

Dempond Technical Aspects of Application of Using Fermented Tofu Dregs Feed in Tilapia Cultivation According to SNI

In this research, a pilot demonstration of tilapia cultivation according to SNI was carried out using 5 (five) large ponds 25m ^{2} in 2 (two) locations, namely Sokawera Village using 2 (two) earthen ponds and Panembangan Village using 3 (three) tarpaulin ponds with different treatments.

Table 3. Preparation Activities for Dempond Activity Containers

Information	**Pool**				
	A	**B**	**C**	**D**	**E**
Drying	√	√	√	√	√
Subgrade reversal	-	-	-	√	-
Liming (kg)	-	-	-	2.5	-
Fertilization					
-Urea (g)	-	-	-	188	-
-TSP (g)	-	-	-	125	-
-Manure (kg)	-	-	-	2.5	-
Water filling (cm)	80	80	80	100	100

Source: Primary Data 2023

The seeds used in ponds A, B, and D (treatment ponds according to SNI) are the *Prima Black Tilapia type* from Panembangan Village with the characteristics: uniform size, no defects, active movement and healthy (no pain/injuries) while in pond C and E, namely seeds obtained from seeding in the surrounding community. The stocking density used is 7 fish/m^2 or 175 fish in each rearing pond with an average weight of 20g/head. This is in accordance with SNI. 6140-2009, Black tilapia fish seeds (*Oreochromis niloticus Bleeker*) spread seed class.

During maintenance, regular sampling is carried out to determine the growth in weight and length of the tilapia every week. The following is data on the growth in weight and length of tilapia every week during the maintenance period. Sampling activities can be seen in Figure 1.

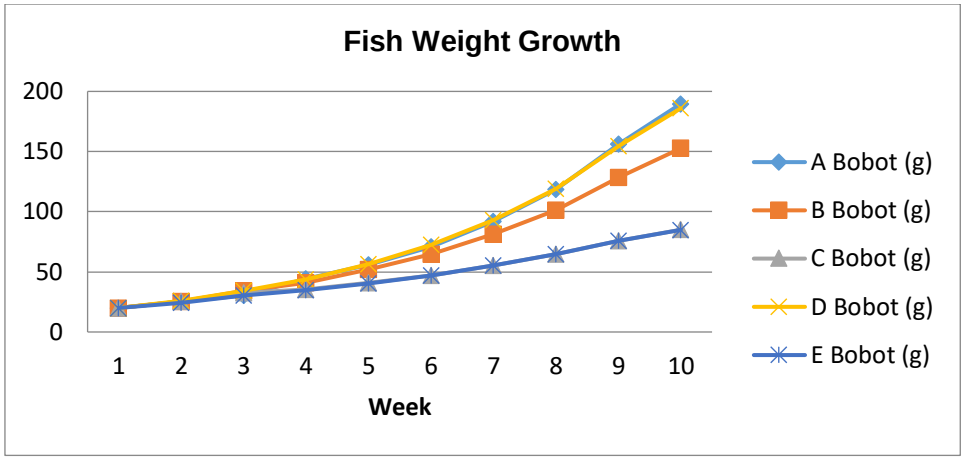

Figure 1. Tilapia Fish Weight Growth Graph

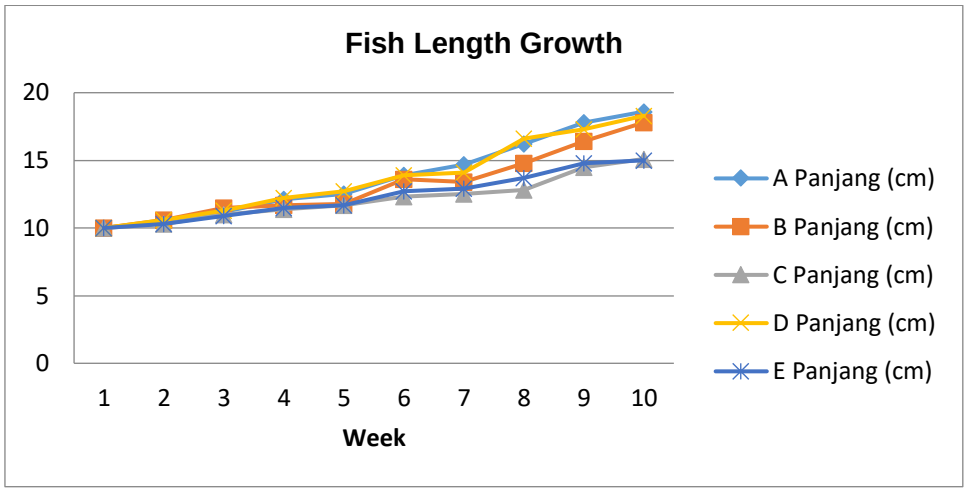

Figure 2. Tilapia Length Growth Graph

Based on Graphs 5 and 6, it is known that the highest weight growth was found in fish kept in ponds A and D, namely grow-out ponds according to SNI with the application of pellet and alternative feed at a percentage of 50%: 50%, then followed by pond B, namely grow-out ponds according to SNI with the application of pellet and alternative feed at a percentage of 75%: 25%, and in the ponds with the lowest growth there were fish kept in ponds C and E, namely growing ponds that did not comply with SNI and without using alternative feed. then the length growth is not too different and is almost the same as the highest length growth in pools A and E which are then followed by B, C and E. This is confirmed by the Anova test which is a statistical method for comparing and finding out significance difference between the two groups .

Table 4. ANOVA Test Results (Analysis of Variances)

Independent Samples Test

			Bobot		Panjang	
			Equal variances assumed	Equal variances not assumed	Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		.		.	
	Sig.		.		.	
t-test for Equality of Means	t		55.601	55.601	21.503	21.503
	df		2	1.001	2	1.220
	Sig. (2-tailed)		.000	.011	.002	.016
	Mean Difference		102.90000	102.90000	3.40000	3.40000
	Std. Error Difference		1.85068	1.85068	.15811	.15811
	95% Confidence Interval of the Difference	Lower	94.93719	79.46585	2.71969	2.07279
		Upper	110.86281	126.33415	4.08031	4.72721

Source: Primary Data 2023

Ponds with cultivation treatment according to SNI, the seeds used are seeds that meet the requirements (*SNI* 6140:2009) have a higher growth graph compared to ponds with cultivation treatment that does not comply with SNI (community habits). Ponds using seeds according to SNI have ADG (*Average Daily Gowth*) or average daily growth of 2.6 g/day in pond A, 2.5 g/day in pond D, and 2.04 g/day in pond B Meanwhile, the ADG of ponds with seeds that do not comply with SNI is only 1g/day in ponds C and E.

The results of the t test in Table 6. with test criteria based on probability (significance) *of equal variances assumed* (assuming both variants are the same), the results show that the average weight of fish in ponds with alternative feeding methods is significantly different (Sig) from the average weight of fish in ponds without alternative feeding. Fish length was obtained from the results of the average length of fish in ponds with alternative feeding methods being significantly different (Sig) from the average length of fish in ponds without alternative feeding methods.

Water quality management in tilapia rearing activities is carried out through water quality monitoring with measured parameters, namely temperature, pH, brightness and DO (*Dissolved oxygen*) every week during the rearing period. To support optimal growth and development of tilapia, water quality needs to be controlled regularly. In water for fish to live and grow, there are several factors, namely oxygen levels (O2), temperature, pH and brightness which must be in good condition (Maulianawati & Lembang, 2022) .

Results of monitoring water quality parameters in pilot ponds in Panembangan Village:

Table 5. Water Quality Data (Panembangan)

Location	**Pool**	**Temperature (°C)**	**pH**	**Brightness (cm)**	**DO mg/l**
Panembangan Village	Range A,B,C	28-31	6	21-35	2.7-5.2
Sokawera Village	Range D, E	27-30	6	29-41	4.4-5.7

Source: Primary Data 2023

With the results of the water quality parameters presented in Table. 7 it can be seen that the water quality in the tilapia cultivation media meets the requirements and needs of biota in accordance with SNI. 7550-2009 concerning tilapia production in still water ponds.

Pest prevention for tarpaulin ponds during tilapia rearing is by using a waring at the top of the pond as a barrier for dirt and animals from entering the rearing container. Meanwhile, in earthen ponds, prevention is carried out by using pandan plants with their smell around the pond to prevent pests from entering the maintenance container.

Harvesting is carried out on fish that have reached consumption size, namely 200-250 g/head (SNI 7550., 2009) . Harvesting is done in the morning by reducing the water to 10-15 cm, then the fish are herded to the kemalir and taken using *a scoopnet* and weighed. Before harvesting, the fish are fasted for one day (24 hours). This aims to reduce dirt during the distribution process so that the fish can survive and be fresher (Winarno, 2017) , by drying the pond completely or partially. In ponds that are harvested in their entirety, the pond is completely drained. The following harvest activities are carried out:

Table 8. Production data for dempond activities

Information	**Unit**	**Pool**				
		A	**B**	**C**	**D**	**E**
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Wide	M ^{2}	25	25	25	25	25
Spread	Kg	3.5	3.5	3.5	3.5	3.5
	Tail	175	175	175	175	175
x̄ Initial Weight	g/head	20	20	20	20	20
Stocking Dense	Tail/m ^{2}	7	7	7	7	7
Cycle	Day	65	65	65	65	65
Harvest	Kg	31.3	25.8	14.4	32	14.6
	Tail	165	169	170	172	172
x̄ Final Weight	g/head	189.7	152.7	85	186	84.9
SR	%	94.3	96.6	97.1	98.3	98.3
FCR	-	1.18	1.35	1.25	1.21	1.23
ADG	g/day	2.6	2.04	1.0	2.5	1.0
Productivity	kg/m2	1.25	1.03	0.58	1.28	0.58

Source: Primary Data 2023

Table 8 shows the highest production in pond D (32kg) and pond A (31.3kg) with tilapia rearing treatment according to SNI and the use of alternative feed with a feeding percentage of 50% : 50%, then followed by pond B (25.8kg) by carrying out tilapia fish rearing according to SNI and using alternative feed with a percentage of pelleted feed and fermented feed of 75% : 25%, and the lowest production in ponds E (14.6 kg) and C (14.2 kg), namely inappropriate tilapia rearing SNI and without the use of alternative feed.

SR (*Survival Rate*) or the highest survival rate in dempond activities was obtained in pools D and E (ground pools) which was 98.3%, followed by pool C which was 97.1%, pool B was 96.6%, and pool A was 94.3 %.

FCR (*Feed Conversion Ratio*) or feed conversion to fish weight, namely the comparison of the amount of feed given in a certain period with the additional weight of fish produced. Based on Table 8, the best results were obtained in pond A, namely 1.18, where one kg of fish weight resulted from feeding 1.18 kg, followed by pond D at 1.21, pond E at 1.23, pond C at 1.25 and pond B at 1.35.

The average final weight in this dempond activity obtained the highest value in ponds A and D with rearing treatment according to SNI and the use of alternative feed at a percentage of giving pellets and fermenting tofu dregs of 50%:50%, namely 189.7g/head and 186g/head, respectively. then pond B with enlargement treatment according to SNI and the use of alternative feed with a percentage of giving pellets and fermented tofu dregs of 75%:25%, and the pond with the lowest average final weight in ponds C and E, namely 85g/head and 84.9g/ tail. With the average weight at the end of rearing, the ADG (*Average Daily Gowth*) or average daily weight gain of fish in a certain period of time during pond activities obtained the highest values in pools A and D of 2.6 g/day and 2.6 g/day. .5 g/day, then pool B at 2.04 g/day, and the pool with the lowest ADG in pools C and E at 1.0 g/day. The highest productivity was found in pond D (1.28kg/m ^{2}) and pond A (1.25kg/m ^{2}) with rearing treatment according to SNI and the use of alternative feed at a percentage of 50%:50%, then pond B (1.03kg /m ^{2}) with tilapia grow-out treatment according to SNI and using alternative feed at a percentage of 75%:25%, then the lowest productivity in ponds C and E was 0.58 kg/day with grow-out treatment not according to SNI and without using alternative feed . Overall, the production aspect with the best value was obtained by pools A and D, followed by pool B and the lowest in pools C and E.

This is in accordance with the results of research by Prihatini, 2017 , in alternative feed for tofu dregs fermented with probiotics as additional feed for the growth of tilapia (*Oreochromis niloticus*) where the highest growth rate was obtained in fish treated with feed with a percentage of fermented tofu dregs of 50% and feed pellets 50%. Ferment yourself *is* a process of chemical change, from complex compounds to simpler ones by microorganisms, through the resulting enzyme activity . In making tofu dregs fermentation, use the help of probiotics, namely EM4 which contains the bacteria Lactobacillus sp., Acetobacter sp., Streptomycetes sp., and Yeast.

CONCLUSIONS

The conclusion from this research is that there is a real difference in the weight and length of fish that are kept according to SNI standards and given alternative food such as tofu dregs which is superior compared to the results of fish that are kept without paying attention to SNI and fed using pure pellets without tofu dregs. Thus, tofu dregs can be recommended for use as an alternative feed for raising tilapia fish. Apart from that, the costs incurred for feed needs can be minimized.

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