TIK-98 Fermentation Of Solid Waste Palm Oil (Elaeis) As A Gran Subtitution For Gouramy Fry (Osphronemus Gouramy) Feed

by - Turnitin

Submission date: 19-Jun-2024 02:57PM (UTC+0700)
Submission ID: 2405221006
File name: TIK-98.pdf (543.33K)
Word count: 4662
Character count: 22426

UDC 639

FERMENTATION OF SOLID WASTE PALM OIL (ELAEIS) AS A GRAN SUBTITUTION FOR GOURAMY FRY (OSPHRONEMUS GOURAMY) FEED

Ernida*
Postgraduate Study Program of Fisheries Science, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia

Fatmawati, **Herliwati**
Faculty of Fisheries and Marine Science, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia

*E-mail: butetsiagian47@gmail.com

ABSTRACT
Gourami fish is a consumption fish with quite high economic value. Palm oil sludge as a waste product from palm oil production has a protein content that is not much different from rice bran. This study aims to analyze the effect of bran substitution with palm oil mud fermentation in artificial feed and analyze the percentage of the best dose for growth (GR) and survival (SR) of gourami fry (*Osphronemus gouramy*). The method used was experimental, Completely Randomized Design (CRD) with 5 treatments and 3 replications each with different doses of palm oil sludge fermentation and bran substitutes. Ferlawite dose in each treatment P1 (0%); P2 (2.5%); P3 (5%); P4 (7.5%); P5 (10%). The research was carried out from March – October 2023, carried out in 2 places, feed formulation and printing was carried out at the Nutrition Laboratory of the Faculty of Fisheries and Marine Affairs, Lambung Mangkurat University, for fish rearing was carried out in the farmer's pond located in Labuan Tabu Village, Martapura District, Banjar Regency City. The research results were based on statistical analysis, the substitution of bran with fermented palm oil mud (ferlawit) had no significant effect ($F_{hit}<F_{table}$) on GR, SGR, FCR, and SR. The best percentage of substitution of bran with ferlawite for GR (12.55%) and SR (90%) gourami fish seeds is at a dose of 5% (ferlawite 5% and bran 5%).

KEY WORDS
Aspergillus niger, palm oil mud, gouramy, substitution.

The popular use of rice bran in artificial feed formulations has been going on for more than five decades. Not only used in fisheries, rice bran is also popularly used as livestock and poultry feed. Based on data published on the website of the Central Bureau of Statistics of South Kalimantan Province, there has been a continuous decline in rice production of more than 100.000 tons each year since 2018. Rice production in 2022 is reported to be 873,130 tons, which correlates with the vulnerability of rice bran availabitiy as an ingredient in artificial feed formulation.

It ranks ninth as a province with oil palm (*Elaeis*) potential with a land area of mor than 426,948 hectares spread across several district. Its is reported that South Kalimantan's oil palm production in 2021 reached 1,134,684 tons, with this amount of oil palm production capability, it is estimated that the waste in the form of palm sludge (lawit) produced around 45,387 tons, because about 4% lawit was produced from each ton (BPS, 2023). The use of lawit as a feed ingredient has been carried out in many studies with various treatments and test animals. Giving 10% dry lawit in the ration of 5-6 week old rabbits for 7 weeks resulted in better growth and feed use efficiency and did not cause differences in mortality and percentage of carcasses produced (Abu & Ekpenyong, 1993 in Sinurat, et al. 2012).

Gouramy (*Osphronemus gouramy*) is a fish with high and stable economic value. The high mortality rate at the seed stage, which reaches 50-70%, and the slow growth rate are the two main problems often faced by farmers (Sulatika, 2019). The cause of the low growth

rate of gourami is the low utilization efficiency of the material and energy contained in the feed provided so that the available energy is not sufficiently used for the growth of gouramy (Kurnia, 1997 in Firmansyah, et al. 2021).

The project increase in oil palm production in South Kalimantan Province each year specifically encourages researchers to conduct experiments to utilize ferlawit as a substitute for rice bran in feed preparation. This experiment is one of the responses that can be given to the possibility of potential problems that may occur in the next few periods of time, namely the competition for the use of rice bran for the purposes of fisheries and livestock which is getting higher. The selection of gouramy (*Osphronemus gouramy*) as a test fish for research materials, are classified as vegetable protein sources because they come from plants. Efforts to substitute rice bran with ferlawit are expected to provide results that are not much different for the growth and survival of gouramy at each dose, so that ferlawit can replaced the role of bran in the formulation of artificial feed for fish.

MATERIALS AND METHODS OF RESEARCH

The research was conducted for 8 months starting form March to November 2023. The series of activities from fermentation of palm sludge (lawit) to formulation and molding of feed were carried out at the Nutrition Laboratory of the Faculty of Fisheries and Marine Science, Lambung Mangkurat University, Banjarbaru. Gourami (*Osphronemus gouramy*) test fish were reared using 18 hapa measuring 1m x 1m x 1m in an earthen pond equipped with inlet and outlet channels owned by a fish farmer located in Labuan Tabu village, Martapura Kota sub-district, Banjar Regency, South Kalimantan.

Table 1 – Tools used in the study

No.	Tools	Function
1.	Steaming pot	Steaming lawit
2.	Digital scales	Weighing materials and test fish (obervation)
3.	Basin	Feed ingredient mixing container
4.	Plastic tray	Lawit aerobic fermentation container
5.	Plastic spoon	Stirring ingredients
6.	Plastic	Lawit anaerobic fermentation container
7.	Tarpaulin	Pedestal for drying the fermented lawit
8.	Blender	Pulverizing feed raw materials
9.	Hapa size (1x1x1) m	Fish rearing container
10.	Banners	Hapa labeling
11.	Fountain pen	Writing required (observation)
12.	Ruler	Measuring fish (observation)
13.	Manual grinder	Printing feed
14.	Sieve	Screening coarse materials
15.	Thermometer	Measuring pond water temperature
16.	pH meter	Measuring the pH of the pond
17.	Digital camera	Documenting the research process
18.	Oven	Drying lawn and feed

Table 2 – Materials used in the study

No.	Tools	Function
1.	- ZA (*Ammonium sulfate*) - Urea - NaH_2PO_4 (*Monosodium phosphate*) - KCL (*Pottasium chloride*) - $MnSO_4$ (*Manganase* (II) *sulfate*)	Minerals for lawit fermentation
2.	*Aspergillus niger* mold starter	Microba for lawit fermentation
3.	70% alcohol	Sterilization of aerobic fermentation container
4.	Lawit	Feed ingredients
5.	Fish flour protein 55,74%	Feed ingredients
6.	Corn flour protein 7,69%	Feed ingredients
7.	Soy flour protein 59,72%	Feed ingredients
8.	Rice bran protein 13,33%	Feed ingredients
9.	Ferlawit flour protein 15,71%	Feed ingredients
10.	Mineral and vitamin mix	Feed ingredients
11.	Tapioca flour	Feed ingredients
12.	Commercial fish feed protein 38%	Feed (controls)

The research was conducted using tha Completely Randomized Design method, consisting of five treatments with 3 replications, the treatments in the study consisted of:

- P0: commercial feed;
- P1: rice bran 10 %: ferlawit 0%;
- P2: rice bran 7,5%: ferlawit 2,5%;
- P3: rice bran 5%: ferlawit 5%;
- P4: rice bran 2,5%: ferlawit 7,5%;
- P5: rice bran 0%: ferlawit 10%.

The process of adapting the test fish to the pond environment and test feed was carried out for 14 days before maintenance, the fish were fed for 1 day to empty the stomach before the process of measuring the length and body weight of the fish as initial data. Fish maintenance was carried out for 45 days to determine the effect of feed on fish growth and survival. Gouramy fry with a size of 5-7 cm were stocked in a hapa measuring 1m x 1m x 1m as many as 18 unit with a water level of 50 cm. Maintenance was carried out in an earthen pond. The density of gouramy fish at the time of maintenance at the fourth breeding level (P IV) was 45 fish/m^2 with a harvest size of 6-8 cm in P IV, feeding is done as much as 5% of the biomass with a frequency of 3 times per day (BSN, 2000). The frequency of feeding is done in the morning, afternoon, and evening (07.00, 12.00, and 17.00 Wita).

In this study, a stocking density of 20 fish was used considering the size of the hapa used. Sampling 25% of the total population, samples were randomly selected from each hapa. Measurements were made on body lenght using a ruler, while measurements of fish body weight used digital scales. Measurements were made every 15 days of the rearing periode, namely on days 0, 15, 30, and 45. Observation of the test feed were carried out with proximate tests to determine the nutritional content of the test feed in the form of protein, fat, crude fiber and protein. Obervation of water quality were made at the beggining and at the end of the study. Parameters measured were temperatur, dissolved oxygen, pH, and ammonia.

Parameters observed during the study were absolute growth rate and specific growth rate, survival rate, feed conversion ratio and water quality. The effect of treatment on the obervation parameters was analyzed using analysis of variance (ANOVA) to determine the effect of bran subtitution with fermented palam sludge on artificial feed on the growth and survival of gouramy fish fry. If there is a significant difference between treatments, it will be continued with the Duncan test at the 95% confidence interval. For water quality data, descriptive analysis will be carried out based on the observations made during the study.

RESULTS AND DISCUSSION

The results of the protein parameter proximate test showed that the highest value of protein content of 34,28% was obtained in treatment P4, and the fifth lowest protein content of 30,18% was obtained in treatment P3. When compared with the commercial feed protein value of 38,26%, there is a difference of about 4-8% with the artificial feed prepared. The results of testing the protein of artificial feed with ferlawit ingredients decrease by a value of approximately 8% from the design of the protein content formulation prepared by the percentage composition method, but all treatments had a protein levels of more than 30% as stated in the requirements for carp seed production (BSN, 2000).

Table 3 – Proximate test result of commercial feed and artificial feed

Treatment	Parameters (%)		
	Protein	Fiber	Fat
P0 (control)	38,26	-	-
P1 (0% dosage)	34,18	3,43	4,43
P2 (2,5% dosage)	32,50	5,85	5,59
P3 (5% dosage)	30,18	3,72	3,58
P4 (7,5% dosage)	34,28	5,78	4,10
P5 (10% dosage)	33,91	7,02	3,37

Description: Testing conducted by the BPBAT Mandiangin Testing Laboratory.

Table 4 – Comparison of design protein values and laboratory test results

Treatment	Protein content (%)	
	Design	Laboratory Test Results
P1 (0% dosage)	41,90	34,18
P2 (2,5% dosage)	41,96	32,50
P3 (5% dosage)	42,02	30,18
P4 (7,5% dosage)	42,08	34,28
P5 (10% dosage)	39,53	33,91

The decrease in protein value in artificial feed is due to the heating process in the feed drying process. As stated in Sundari's research (2015), there is a decrease in protein content in the material after undergoing the cooking process, high temperature is the main cause of protein damage, the higher the temperature used, the lower the protein content of a material. Protein is prone to be damaged by high temperature heating. Protein function for the fish body as a building substance that forms various new tissues for growth, replaces damage tissues, and is used to reproduce (Zaenuri et al. 2014).

Proximate testing for protein, fiber, fat, and water parameters was also carried out on palm sludge that had been treated with fermentation using *Aspergillus niger* fungi for approximately 10 days. The purpose of proximate testing is to determine changes in the value of nutrient content that occurs. Based on the results of the proximate test of palm oil sludge before and after fermentation using *Aspergillus niger*, there were changes in the value of each parameter. Fermentation treatment of oil palm sludge (lawit) increase the crude protein value from 9,95% to 15,71%. When compared to the protein content of bran used in the study with a value of 13,33%, femented palm sludge has a higher protein content. As a subtitute for artificial feed, ferlawit has a higher protein value than bran.

Table 5 – Absolute length and weight growth of gourami (*Osphronemus gouramy*) fry

Treatment	Absolute growth	
	Length (cm)	Weight (cm)
P0 (control)	3,32	10,93
P1 (0% dosage)	3,23	10,2
P2 (2,5% dosage)	2,61	7,4
P3 (5% dosage)	2,95	12,55
P4 (7,5% dosage)	3,17	11,73
P5 (10% dosage)	3,04	9,9

Based on the results of the calculation of absolute length and absolute weight of gourami fish seeds in each treatment with different dosage of ferlawit, it shows that the average length and weight growth of each individual has a different length. The highest length growth with a size of 3,23 cm was in treatment P1, the lowest length growth was 2,61 cm in treatment P2. In accordance with the estimated length increase in gourami fish fry which will enter half of the V breeding phase in accordance with BSN (2000). Where the enlargement target starts from size 4-6 cm until the fish fry size reaches 6-8 cm with 40 days of maintenance. In the study, gouramy fish fry with a size of 5-7 cm were used, after 45 days of maintenance, the fry length was 9,37-10,26.

The highest weight growth of gourami fish fry with a value of 12,55 g in the P3 treatment. When compared to commercial feed, with a weight growth value of 10,93 g, the use of artificial feed with a mixture of ferlawit produces better weight growth. When viewed from the growth of fish weight, as a subtitute for bran, ferlawit is able to subtitute bran up to a dosage of 7,5%, because the growth of gourami fish fry is P4 is better than P2 and P0 (commercial feed). When viewed from the maximum growth achieved by gourami fish fry during the 45 days of research, the P3 treatment with dosage of 5% ferlawit and 5% bran is the maximum growth. The P3 treatment produces feed with a protein value of 30,18%, fiber 3,72%, and fat 3,58%. On the production of carp fry of the scatter fry class requires artificial feed with a protein content of more than 30% (BSN, 2000). Requires a minimum requirement for gourami with a size of 5-15 cm minimum fat 6% and maximum fiber 6%.

According to Effendi, 2002 in Salim et al. 2019, there are two pattern of isometric and allometric growth. Isometric growth is intended as a continuous change in proportion

between length or weight in the fish body, while allometric growth is explained as a change between size and weight that is not proportional. In this study, the results of the calculation of the value of b>3, means that the growth of fish weight is faster than fish length (positive allometric), causing the physical fish to look plump.

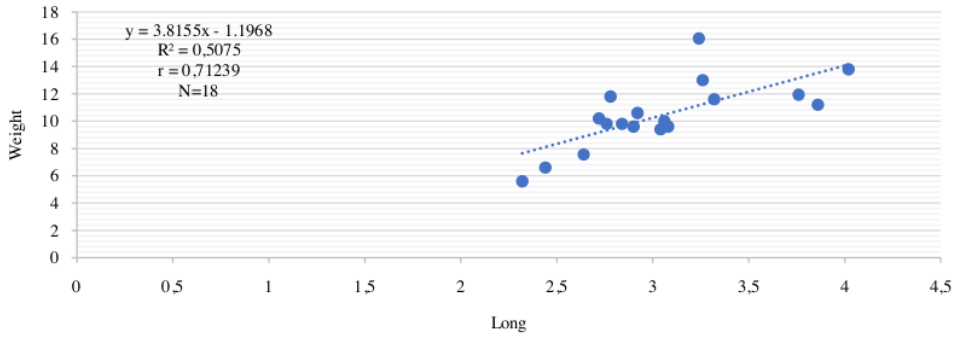

Figure 1 – Gourami fry Length and weigh relationship

Based on the results of the analysis of variance above, the absolute length and weight growth of gourami fish fry (*O. gouramy*) showed that the provision of ferlawit dosage in different feeds had no significant effect on the weight and length growth of gourami fish fry given 5 different treatment. Not significantly different between treatments on growth. The best weigh growth was produced in the P3 treatment. While the lowest growth was produced in the P2 treatment.

Table 6 – Specific growth rate of gourami (*O.gouramy*) fry

Treatment	Specific growth rate (%/day)
P0 (control)	2,83
P1 (0% dosage)	2,71
P2 (2,5% dosage)	0,78
P3 (5% dosage)	2,41
P4 (7,5% dosage)	2,24
P5 (10% dosage)	2,18

Table 7 – Food convertion ratio of 45 day rearing gourami (*Osphronemus gouramy*) fish fry

Treatment	Repeat	Initial weight (gr)	Final weight (gr)	Amount of feed given (gr)	FCR	Average
P0	1	17	86	68,25	0,989130435	1,35
	2	21	68	73,5	1,563829787	
	3	27	75	75,75	1,578125	
P1	1	16	72	59,25	1,058035714	1,36
	2	24	72	69,75	1,453125	
	3	26	75	78,75	1,607142857	
P2	1	30	80	85,5	1,71	2,52
	2	32	60	93,75	3,348214286	
	3	27	60	83,25	2,522727273	
P3	1	33	92	105	1,779661017	1,69
	2	31	80	106,5	2,173469388	
	3	30,7	111	98,025	1,220734745	
P4	1	35	100	101,25	1,557692308	1,69
	2	34	87	97,5	1,839622642	
	3	32	90	97,5	1,681034483	
P5	1	34,2	72	101,4	2,682539683	1,94
	2	24,3	84	75,975	1,272613065	
	3	32	83	96	1,882352941	

Based on the calculation of the specific growth rate of gourami fish fry per day in each treatment with different dosage of ferlawit, the highest growth rate was treatment P1 with a value of 2,71%. The second highest growth rate was the P3 treatment with a value of 2,41%.

The lowest growth rate was in treatment P2 with a value of 0,78%. The results of the analysis above, the spesific growth rate of gouramy fish fry shows that the provision of different dosage of ferlawit not have an effect on the specific growth rate of gourami fry. The treatment given was not significantly different on the daily growth rate.

The largest food convertion ratio value of 2,52 was found in the P2 treatment, while the smallest feed convertion ratio of 1,36 was found in the P1 treatment. In the P3 treatment which gave the best growth results, the FCR value produced was 1,69, in this case it means that to produce 1 kg of gouramy meat, 1,69 kg of feed is needed. In the research of (Wijayanti et al. 2019) which used gourami fry measuring 5-7 cm, the resulting FCR was 5,97. The average FCR of gourami is 5,00-15,21. In the research of Sulastika et al. (2019) which used gourami fry measuring 4-7 cm obtained an FCR value of 1:2:3. The use of ferlawit in feed as a subtitute for bran can be optimally utilized by gourami fish fry. Feed is able to meet nutritional needs, good quality feed is feed that has complete nutritional value so that it can meet the nutritional needs of fish (Amarwati et al. 2015). The lower the FCR value, the fish utilize feed optimally to grow so that the feed will be absorbed into the body and converted into meat (Putri et al. 2012 in Apriani et al. 2019). Craig & Helfrich, 2009 in Sari et al. 2018, stated that FCR values of 1,5 to 2,0 are considered good for the growth of almost all organisms. The calculation of food convertion ratio in each treatment with ANOVA analysis obtained insignificat results, indicating that there was no significat difference in each treatment on the FCR value.

Table 8 – The results of the calculation of survival rate of gourami fish fry

Treatment	Survival Rate (%)
P0 (control)	70
P1 (0% dosage)	66,67
P2 (2,5% dosage)	75
P3 (5% dosage)	90
P4 (7,5% dosage)	60
P5 (10% dosage)	80

The highest survival rate in the P3 treatment was 90%, linear with the highest absolute weight growth in P3 12,55%. P3 treatment with 5% ferlawit dosage and 5% bran gave the best result in absolute weight growth and the highest survival rate. The result of the calculation of variance in the survival rate of gouramy fish fry gave results that were not significantly different, indicating that there was no difference in quality between the fry studied. The difference in the dosage of ferlawit has no significat effect on the survival rate of gourami fish fry (Taufik et al. 2017). The survival rate of gouramy fish reared for 45 days has a range 30-98%. In biofloc media, the survival rate of gouramy is higher, namely 80-98% with an average of 89%, while in media without biofloc the survival rate of gourami is between 30-40% (Wijayanti et al. 2019). (Effendi, 2004 in Suteja et al. 2019), the degree of survival is influenced by biotic factors, namely competition, parasites, age, predator, density and human handling, while abiotic factor are physical and chemical properties in waters. The high and low survial rate of a cultures biota is influenced by several factors, one of which is inappropriate feed nutrition. The survival rate of gourami fish with the addition of bromelain enzyme in feed ranges from 71,66-88,33 (Firmansyah et al. 2021). Survival rate of 30-50% is classified as moderate and survival rate <30% is not good for aquaculture activities.

Table 9 – Water quality analisis results

Parameters	Inlet	Outlet	Standard
Temperature	30,6	30,4	25-30^{o}C (BSN, 2000)
pH	6,93	6,36	6,5-8,5 (BSN, 2000)
DO	5,6	4,9	4-6
Ammonia, NH_3	0,61	0,86	0,1

Water quality measured during the study was temperature, pH, DO, and ammonia. The maintenance temperature obtained during the study ranged from 30,4-30,6^{o}C, the temperatur

value exceeded the SNI by 0,4-0,6°C. According to BSN (2000) gourami fish fry can live well at a temperature of 25-30O°C. The measurement results are the number influenced by the sampling time carried out in the afternoon, so that the gourami fish fry maintenance media water (*Osphronemus gouramy*) is at the highest temperature of heat. Temperature is a factor that affects the metabolic rate and solubility of gases in water, the higher the temperature the higher the metabolic rate of the fish so that the fish has a high appetite, and vice versa. Changes in temperature of 3-4°C will cause temperature shock, increase the toxicity of dissolved contaminants, reduce DO and death in fish (Effendi, 2003 in Jumaidi et al. 2017).

During 45 days of maintenance, 4 times monitoring of the acidity parameter value was carried out. The value of the pH parameter recorded is between 6,36-6,39, the pH value still meets the maintenance of gourami fish fry. According to Khairuman and Amri (2003) in Anggara et al (2018) the pH of water that is suitable for carp fry and good for cultivation is 5-9. Boyd (1990) states tha pH value that is deadly to fish is less than 4 and more than 11. The pH value also effects the toxicity of a chemical compound, a high pH is more ammonia which is not ionized and is toxic. The measurement of DO value during the study was 4,9-5,6 mg/L, meeting BSN (2000). The dissolved oxygen content helps the metabolic process to produce energy for the life and growth of gourami fry. The decrease in dissolved oxygen in the maintenance media is in line with the amount of metabolic waste. Gourami have a labyrinth that can take oxygen directly from the air so that oxygen levels in water do not really affect gourami (Firmansyah et al. 2021).

The measurement of ammonia value in the gourami fry rearing pond is 0,61-0,86 mg/L. The critical limit of fish to dissolved ammonia content is 0,6 mg/L. Ammonia content that exceeds the critical limit of tolerance will be toxic to fish. The ammonia content that can be tolerated by gourami is <1 mg/L (Jumaidi et al. 2017). High levels of ammonia in the water will cause a decrease in appetite. Ammonia is the result of protein decomposition which is toxic to fish. The concentration of ammonia in the water is influenced by density, feed, pH, and water temperature. High ammonia levels can cause an increase in blood pH levels and have an effect on the reaction of various enzymes (Usman et al. 2022).

CONCLUSION

The conclusions that can be drawn from this research are:

- Based on statistical analysis, the substitution of bran with fermented palm sludge (ferlawit) has no significat effect on the growth and survival rate of gourami fish fry (*Osphronemus gouramy*). Based on the result of the proximate test, the protein value of fermented palm sludge (ferlawit) is higher than that of bran;
- The best percentage dosage of fermented palm sludge (ferlawit) to substitute bran in artificial feed for gourami fish fry (*Osphronemus gouramy*) is at a dosage of 5%. At a dose 5% subtitution can achieve the highest absolute weight growth value of 12,55% with the highest survival rate with a value of 90%.

ACKNOWLEDGMENTS

Some suggestions that can be given are to conduct research to increase the dosage of ferlawit as a substitute for vegetable protein sources that are used quite a lot in the percentage of feed preparation, for example ingredients such as soy flour and corn flour.

REFERENCES

1. Amarwati, H. Subandiyono & Pinandoyo. (2015). Utilization of fermented cassava (Manihot utilissima) leaf flour in artificial feed on the growth of red tilapia (Oreochromis niloticus) fry. Journal of aquaculture management and technology, 4(2).
2. Anggara, Y. T., Prayogo, S. & Argianti, W. (2018). Growth and survival of carp (Osphronemus gouramy) fry at various dosage of temulawak juice. Journal of fisheries and aquaculture science, 13(2).

3. Apriani, F., Eva, P., & Syahputra, E. (2019). Growth performance of gourami (Osphronemus gouramy) fry by feeding commercial feed supplemented with fermented gamal (Gliricidia sepium) leaf meal. Journal of fisheries science, 10(2).
4. Boyd, C. E. (1990). Water quality in ponds for aquaculture. Alabama: Elsevier science.
5. Firmansyah, A., Pamukas, N. A. & Mulyadi. (2021). Growth and survival of gourami (Osphronemus gouramy) with different dosage of bromelain enzyme in feed in aquaponic recirculation system. Sebatin aquaculture journal, 2(1).
6. Jumaidi, A., Yulianto, H. & Efendi, E. (2016). Effect of water discharge on water quality improvement in recirculation system and it's relationship with survival and growth of carp fry (Osphronemus gouramy). Journal of aquaculture engineering and technology, 5(1).
7. Salim, G., Firdaus, M. & Heriyana. (2019). Analysis of length, weight and condition factor of tempakul fish (Periopthalmus barbarus) in mangrove and proboscis monkey conservation are (kkmb) tarakan city. Journal of borneo harpodon, 12(1).
8. Sari, P. M., Hariani, D. & Trimulyono, G. (2018). Application of probiotics, prebiotics and synbiotics in feed on the growth of gourami (Osphronemus gouramy Lac.). LenteraBio, 7(2).
9. Sinurat, A. P., Mathius, I. W. & Purwadaria, T. (2012). Processing and utilization of palm oil industry by-products as feed ingredients. Iaard press.
10. Sulatika, I. G. B., Restu, I. W., & Suryaningtyas, E. W. (2019). Effect of different feed protein levels on the growth rate of juvenile gourami (Osphronemus gouramy) in tarpaulin ponds. Current trends in aquatic science, II(1).
11. Suteja, G. P., Arthana, I. W. & Dewi, A. P. W. K. (2019). Potential development of gourami (Osphronemus gouramy) aquaculture in floating network cages of lake batur kintamani, Bali, Current trends in aquatic science, 2(2).
12. Usman, Z., Kurniaji, A., Saridu, S. A., Anton., & Rikayanti. (2022). Production of juvenile carp (Osphronemus gouramy) using recirculating aquaculture system technology. Aquaculture, 10(2).
13. Wijayanti, R., Muarif., & Lemana, D. (2019). Survival rate and feed convertion ratio in gourami (Osphronemus gouramy Lac.) cultivation with biofloc system and feeding different protein levels. Journal of mina sains, 5(1).
14. Zaenuri, R., Suharto, B., Haji, A. T. S. (2014). Quality of pelleted fish feed from agricultural waste. Journal of natural resources and environment.

TIK-98 Fermentation Of Solid Waste Palm Oil (Elaeis) As A Gran Subtitution For Gouramy Fry (Osphronemus Gouramy) Feed

ORIGINALITY REPORT

4%	2%	4%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

3%

★ D Islama, N Nurhatijah, A S Batubara, A Supriatna, L Arjuni, S Diansyah, F Rahmayanti, J Juliawati. "Supplementation of Gamal leaves flour (Gliricidia sepium) in commercial feed on the growth of Nirwana tilapia (Oreochromis niloticus) fingerlings", IOP Conference Series: Earth and Environmental Science, 2021

Publication

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		