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SUBTITUTION OF CORN MEAL WITH FERMENTED CORN COB MEAL IN TILAPIA FISH FEED (*Oreochromis niloticus*)

Subtitusi Tepung Jagung Dengan Tepung Bonggol Jagung Yang Difermentasi Pada Pakan Ikan Nila (*Oreochromis niloticus*)

Sahrul Alim*, Rismayanti, Dewi Putri Lestari

Aquaculture Study Program, Mataram University

Pendidikan Street No. 37, Mataram City, West Nusa Tenggara

*Coresponding author: sahrulalim@unram.ac.id

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ABSTRACT

Tilapia is a type of demersal fish that is often cultivated because it is very tolerant to environmental changes and grows quickly. Feed quality is very important for tilapia cultivation. The utilization of feed ingredients can be improved by using fermentation technology. The study aims to analyze the effect of the duration of cattle rumen fermentation on corn cob meal as a feed raw material on the performance of tilapia. This study was conducted in June – July 2025 at the Fish Production and Reproduction Laboratory of the Aquaculture Study Program, Faculty of Agriculture, University of Mataram. The research method used was a Completely Randomized Design (CRD), with 4 treatments and 3 replications. The treatments used in this study were control, corn cob fermentation for 5 days, corn cob fermentation for 10 days, and corn cob fermentation for 15 days. The tilapia were reared in 45-liter containers with a stocking density of 15 fish, and maintained for 45 days. The parameters used in this study were weight and length growth, survival rate, and water quality. The research results obtained showed that providing feed with different fermentations had a significant effect on the absolute length growth of tilapia, but did not have a significant effect on absolute weight and survival of tilapia.

Key words: Fermentation, Tilapia, Feed

ABSTRAK

Nila adalah jenis ikan domersal yang sering dibudidayakan karena sangat toleran terhadap perubahan lingkungan dan tumbuh dengan cepat. Kualitas pakan sangat penting untuk budidaya ikan nila. Pemanfaatan bahan pakan dapat ditingkatkan kualitasnya dengan menggunakan teknologi fermentasi. Penelitian bertujuan untuk menganalisa pengaruh lama waktu fermentasi rumen sapi pada tepung bonggol jagung sebagai bahan baku pakan terhadap performa ikan nila. Penelitian ini dilaksanakan pada bulan Juni – Juli 2025 yang berlokasi di Laboratorium Produksi dan Reproduksi Ikan, Fakultas Pertanian, Universitas Mataram. Metode penelitian yang digunakan yaitu menggunakan Rancangan Acak Lengkap (RAL),

dengan 4 perlakuan dan 3 kali ulangan. Adapun perlakuan yang digunakan dalam penelitian ini ialah kontrol, fermentasi bonggol jagung selama 5 hari, fermentasi bonggol jagung selama 10 hari, dan fermentasi bonggol jagung selama 15 hari. Pemeliharaan ikan nila ini dilakukan menggunakan kontainer berukuran 45 liter dan kepadatan 15 ekor, dan dipelihara selama 45 hari. Parameter yang digunakan dalam penelitian ini yaitu pertumbuhan bobot dan panjang, tingkat kelangsungan hidup, dan kualitas air. Hasil penelitian yang diperoleh menunjukkan bahwa pemberian pakan dengan fermentasi yang berbeda memberikan pengaruh nyata terhadap pertumbuhan panjang mutlak nila, namun tidak memberikan pengaruh nyata terhadap berat mutlak dan kelangsungan hidup ikan nila.

Kata Kunci: Fermentasi, Nila, Pakan

INTRODUCTION

Tilapia is a type of demersal fish that is widely cultivated because it is highly tolerant of environmental changes and grows rapidly. In addition, tilapia production reached 1.12 million tons in 2018, accounting for approximately 31.94% of Indonesia's total fisheries production. The production and economic value of tilapia aquaculture contribute significantly to national economic growth. Indonesia ranks fourth among the world's largest tilapia-producing countries. Communities have developed tilapia as an alternative freshwater fish, and it has become an important part of the fisheries revitalization program. Feed quality is crucial in tilapia farming, as tilapia growth is highly dependent on appropriate feed (Rizky *et al*., 2022).

Feed is one of the most important components in aquaculture activities, as it serves as the primary source of materials and energy to support fish survival and growth and also constitutes the largest component (50%–70%) of production costs. Therefore, feed must always be used as effectively as possible, because feed efficiency is directly related to the magnitude of profit or loss obtained (Hikmawati & Rasnijal, 2023). Most fish feed is still imported; thus, efforts to overcome dependence on imported feed ingredients include the utilization of local raw materials. The materials used should be nutritious, non-toxic, relatively inexpensive, abundantly available, and not in competition with human food needs (Surianti *et al*., 2022).

One agricultural by-product from corn cultivation that has considerable potential as an alternative feed ingredient is the corn cob. The nutritional composition of corn cobs consists of 90% dry matter (DM), 2.8% crude protein (CP), 0.7% crude fat (CF), 1.5% ash, 32.7% crude fiber (CF), 80% cell wall, 25% cellulose, 6% lignin, and 32% acid detergent fiber (ADF) (Fitriani & Asyari, 2017). Corn cobs can be used as a concentrate ingredient in feed; however, they have high crude fiber content and low protein levels and digestibility. Therefore, to be utilized as a feed ingredient, the quality of corn cobs needs to be improved through the application of fermentation technology (Rasyid *et al*., 2022).

Fermentation is a process involving changes in the chemical structure of organic materials through the utilization of biological agents, inoculants, and enzymes as biocatalysts. The purpose of fermentation is to harness the activity of microorganisms to break down fibrous materials into more easily digestible compounds. The microorganisms used may take the form of probiotics (bacteria, fungi, yeasts, or their combinations) or fermented products, one of which can be derived from cattle rumen (Farliansyah *et al*., 2020).

Cattle rumen plays a significant role as a site for microbial growth, with its unique characteristics allowing various types of feed to produce rumen fermentation products. The rumen itself contains large populations of microorganisms, including bacteria, protozoa, and fungi. Cattle rumen fluid can be used as a source of enzymes to aid fish digestion, as these enzymes are capable of hydrolyzing fiber, which is a raw material that is difficult to digest (Fitria *et al*., 2024).

Based on the description, it is necessary to conduct research on the effects of fermenting corn cobs using cattle rumen. Studies on the application of cattle rumen fermentation in aquaculture are still limited. Fermentation activities are presumed to influence the protein content of feed; therefore, this research is important to determine the benefits of cattle rumen when applied to plant-based feed ingredients, one of which is corn cobs. Research on the effect of fermentation duration on the protein and crude fiber content of corn cobs has been conducted by Rostini (2022), who reported that longer fermentation of corn cobs improved their nutritional characteristics by reducing crude fiber content and increasing crude protein levels, making them easier to hydrolyze and digest. Therefore, this study was conducted as a continuation of previous research by utilizing fermented corn cobs as a raw material for fish feed, with the aim of determining the effect of different fermentation durations of corn cobs on the growth and survival of tilapia.

METHODS

Place and Time

The research was carried out from June to August 2025 at the Environmental Laboratory of the Aquaculture Study Program, Department of Fisheries and Marine Sciences, Faculty of Agriculture, University of Mataram.

Design

This study utilized a laboratory experimental method. The experimental design applied was a Completely Randomized Design (CRD) with four treatments and three replications. The treatments in this research conducted a Fermented Corn Cob Meal (FCCM). First P1 (control), P2 FCCM 5 days, P3 FCCM 10 days, and P3 FCCM 15 days. The tilapia were reared in 45-liter containers with a stocking density of 15 fish, and maintained for 45 days. After the fish had acclimated, tilapia were fasted for one day to eliminate residual metabolic waste. The fish were then measured for length and weight to obtain baseline data for the study. Fish that had been selected based on length and weight were placed into the rearing containers. During the rearing period, the fish were fed three times daily at a rate of 3% of their body weight (at 07:00, 13:00, and 17:00 WITA). Water quality was monitored, and siphoning was conducted every two days to remove fish waste, followed by water replacement equivalent to the volume removed to maintain the quality of the rearing medium. In addition, water quality parameters were measured weekly throughout the rearing period. The amount of feed provided was also recorded to determine feed efficiency and feed conversion ratio.

Data Analysis

Experimental data were analyzed using Mini Tab Version 16. Analysis of variance (ANOVA) with a 95% confidence interval, if there was a significant effect, a further Tukey test was carried out (Steel & Torrie, 1993). Data is presented in the form of tables and graphs. liking for sensory testing (hedonic scale) with specifications, appearance, color, aroma, texture and taste.

RESULT

Proximate Analysis

Table 1. Proximate Analysis of Feed Ingredients

No	Raw Material	Nutrient Content				
		Water	Ash	Lipid	Fiber	Protein
1	Fish Meal	12,98	23,21	9,09	3,20	31,69
2	Soybean Meal	8,50	6,70	5,90	5,19	35,91

3	Corn Meal	11,05	1,42	4,26	1,94	10,45
4	FCCM 5 days	11,53	5,80	2,78	26,81	3,84
5	FCCM 5 days	9,76	4,11	0,30	25,73	4,10
6	FCCM 5 days	9,00	5,76	0,47	24,21	4,43

(Source: Primary data of the study, 2025)

Tabel 2. Proximate Analysis of Feed Treatments

No	Raw Material	Nutrient Content				
		Water	Ash	Lipid	Fiber	Protein
1	P1 (control)	7,21	11,42	12,67	3,18	27,78
2	FCCM 5 days	6,48	12,41	12,25	3,49	28,61
3	FCCM 5 days	6,50	12,89	12,03	3,82	28,87
4	FCCM 5 days	6,55	13,47	11,56	5,39	28,96

(Source: Primary data of the study, 2025)

Absolute Weight Gain

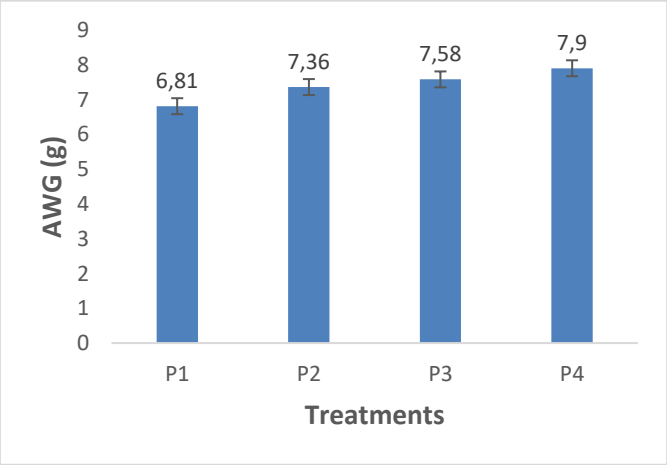

Figure 1. Absolute Weight Gain

Figure 1 shows that absolute weight gain (AWG) of tilapia increased progressively across feed treatments from P1 to P4, with values of 6.81 g in P1, 7.36 g in P2, 7.58 g in P3, and the highest gain of 7.9 g in P4. This trend indicates that the applied feed treatments had a positive effect on fish growth, where improvements in feed formulation likely enhanced nutrient utilization. Among all treatments, P4 resulted in the best growth performance, suggesting it was the most effective feed treatment in supporting tilapia weight gain.

Absolute Lenght

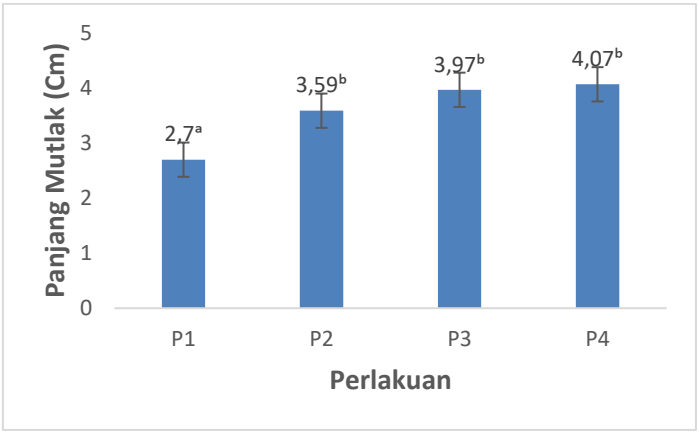

Figure 2. Absolute Lenght

Figure 2 shows that the absolute length growth of tilapia increased with different feed treatments, ranging from 2.7 cm in P1 to 4.07 cm in P4. Treatment P1 resulted in the lowest absolute length, while P2 (3.5 cm), P3 (3.97 cm), and P4 (4.07 cm) showed significantly higher values, as indicated by different superscript letters. This indicates that the feed treatments applied in P2–P4 were more effective in promoting length growth compared to P1, with P4 producing the greatest increase in absolute length.

Survival Rate

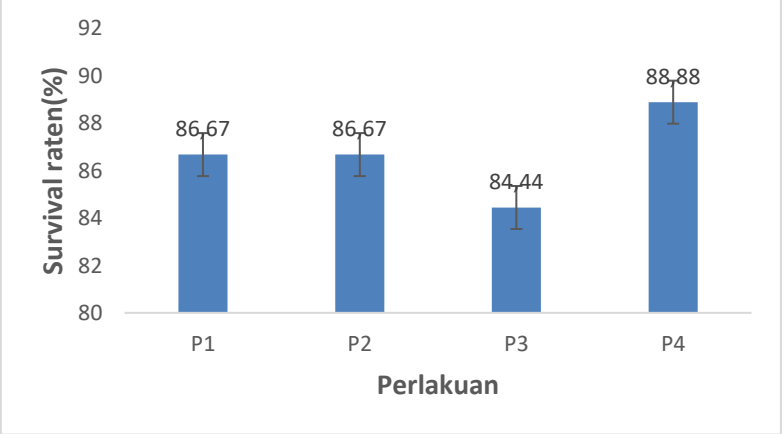

Figure 3. Survival Rate

Figure 3 shows that the survival rate of tilapia across feed treatments ranged from 84.44% to 88.88%. Treatments P1 and P2 resulted in the same survival rate of 86.67%, while the lowest survival rate was observed in P3 (84.44%). The highest survival rate occurred in P4 (88.88%), indicating that this feed treatment provided better support for fish survival. Overall, the results suggest that the feed treatments did not negatively affect fish viability and that treatment P4 tended to improve survival compared to the other treatments.

Water Quality

Table 3. Water Quality

No	Parameters	Range	Reference
1	Temperature	25,1-27℃	28-32℃ (Indriati & Hafiludin, 2022)
2	pH	7,1-8,9	7-8 (Indriati & Hafiludin, 2022)

3	DO	7,0-8,8 mg/l	>3 mg/l (Indriati & Hafiludin, 2022)

DISCUSSION

Absolute weight gain is used to calculate the increase in fish body weight during the rearing period (Zuhdi *et al*., 2014). The results of this study showed that the inclusion of fermented corn cob meal in the diet did not result in a significant difference in absolute weight gain compared to the control feed or feed without fermented corn cob meal. This finding is consistent with the statement of Klahan *et al*. (2016), who reported that utilization tests of tilapia feed containing corn cobs with different digestibility levels showed no significant differences. The digestibility and absorption of corn cobs tended to decrease and did not affect growth performance. In this study, fish weight increased over the 45-day rearing period, with growth rates varying among individual fish due to differences in feed intake, as well as variations in digestive and nutrient absorption capacities. Fish will grow optimally when the feed consumed can be efficiently utilized.

Absolute length increment is defined as the difference between fish length measured from the tip of the head to the end of the tail at the end of the experiment and the initial body length at the beginning of the study (Mulqan *et al*., 2017). The results showed that the inclusion of fermented corn cob meal in the diet resulted in higher absolute length growth compared to the control feed. This is in accordance with Novrianto *et al*. (2019), who reported that different levels of corn cob meal significantly affected the length growth of tawes fish; in their study, treatment 1 (157 g corn cob meal) produced very good length growth, whereas treatment 3 (177 g corn cob meal) resulted in very slow growth. Differences in length growth among treatments are attributed to variations in each fish's ability to digest and absorb the provided feed. Essentially, optimal fish growth is achieved when the feed consumed can be efficiently ingested and maximally utilized for growth. The results of this study indicate that P1 (control) differed significantly from P2 (5 days), P3 (10 days), and P4 (15 days) of fermentation; however, no significant differences were observed among P2, P3, and P4. This condition suggests that a 5-day fermentation period of corn cobs is sufficient to improve feed ingredient quality, allowing it to be optimally utilized by cattle rumen microorganisms. Longer fermentation durations did not provide additional significant effects; therefore, a 5-day fermentation period is more efficient and effective for practical application.

Survival rate (SR) is defined as the percentage of fish that remain alive at the end of the rearing period relative to the number of fish stocked at the beginning. The results of this study showed that the inclusion of fermented corn cob meal in the diet did not cause a significant difference in survival rate compared to the control feed or feed without fermented corn cob meal. This finding is consistent with Khang *et al*. (2025), who reported that growth performance and survival rate of fish fed diets containing different levels of fermented corn cob meal did not differ significantly among treatments, possibly because fish were reared under suboptimal environmental conditions, while poor nutrition is a major factor contributing to reduced survival rates. In this study, the average survival rate during the rearing period was above 80%. According to the Indonesian National Standard (SNI), the minimum acceptable survival rate for good-quality tilapia culture is 70%. This indicates that when fish are in good health or, in other words, not experiencing stress, the energy derived from feed can be efficiently utilized for growth (Scabra *et al*., 2022).

Water quality is one of the external factors that can affect fish survival. The water quality parameters measured in this study included temperature, dissolved oxygen (DO), and pH. Temperature measurements during the study ranged from 25 to 27 °C, which falls within the optimal range for tilapia culture. According to Indriati and Hafiludin (2022), the optimal temperature for tilapia seed production is 28–32 °C, as suitable temperatures can accelerate

metabolic processes and promote faster growth. Dissolved oxygen is a very important parameter in assessing water quality, as it reflects the physical and biological processes occurring in aquatic environments. The dissolved oxygen levels measured during the study ranged from 7.0 to 8.8 mg/L, which are still considered optimal for tilapia culture. Indriati and Hafiludin (2022) stated that higher dissolved oxygen concentrations are generally better for aquaculture, with an optimal range of 5–8 ppm. Adequate dissolved oxygen levels during the rearing period can enhance fish metabolism and growth. pH represents the concentration of hydrogen ions in water and indicates the level of acidity or alkalinity of an aquatic system. The pH values recorded during the study ranged from 7.1 to 8.9, which are still within the acceptable range for tilapia culture. According to Indriati and Hafiludin (2022), optimal growth and reproduction of tilapia require a pH range of 7–8. Stable pH conditions can enhance metabolic activity and improve feed absorption.

CONCLUSION

Based on the results of this study, it can be concluded that feeds with different fermentation durations produced significantly different effects on the absolute length of tilapia, in which the control treatment differed significantly from the fermented feed treatments. However, for the absolute length parameter, feed fermented for 5 days showed no significant difference compared to fermentation for 10 and 15 days. In contrast, absolute weight gain, specific growth rate (SGR), feed efficiency, feed conversion ratio (FCR), and survival rate did not show significant differences among treatments.

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REFERENCES

Farliansyah, F., Mustabi, J., & Syahrir, S. (2020). Kandungan Protein Kasar dan Serat Kasar Tongkol Jagung Fermentasi Menggunakan Cairan Rumen Sebagai Inokulan. *Buletin Nutrisi dan Makanan Ternak*, *14*(2), 28–40.

Fauzan, M. A. S., Fauzi, I. A., & Ekasari, J. (2022) Utilizayion of Hydrolyzed Corncob as a Carbohydrate Source in Diets For Red Nile Tilapia Oreochromis Niloticus. *Jurnal Akuakultur Indonesia, 21*(1), 32-40.

Fitria, S. R., Putra, B. S., & Darwin, D. (2024). Fermentasi Berbagai Jenis Pakan Silase pada Cairan Rumen Sapi. *Jurnal Ilmiah Mahasiswa Pertanian*, *9*(1), 1-32.

Fitriani, F., & Asyari, H. (2017). Kandungan Protein Kasar dan Serat Kasar Pakan Komplit Berbasis Tongkol Jagung dengan Penambahan Azolla Sebagai Pakan Ruminasia. *Journal Galung Tropika*. *6*(1), 12-18.

Fitriani. (2018). Kandungan Sellulosa, Hemisellulosa, dan Lignin Pakan Komplit Berbasis Tongkol Jagung yang Disubtitusi Azolla pada Level yang Berbeda. *Jurnal Galung Tropika*, *7*(3), 220-228.

Hikmawati, N., & Rasnijal, M. (2023). Pemberian Pakan Alami Azolla dengan Dosis Pakan Berbeda untuk Meningkatkan Pertumbuhan dan Kelangsungan Hidup Benih Ikan Nila. *Jurnal Insan Tani*, *2*(2), 235-243.

Iskandar, A., Nurfauziyyah, I., Herdiana, A., & Darmawangsa, G. M. (2021). Manajerial dan Analisa Usaha Pembenihan Ikan Nila Strain Sultana untuk Meningkatkan Performa Benih Ikan. *Jurnal Kemaritiman*, *2*(1), 39-52.

Indriati, P.A., & Hafiludin, H. (2022). Manajemen Kualitas Air pada Pemberian Pakan Ikan

Nila di Balai Benih Ikan Teja Timur Pemekasan. *Jurnal Ilmiah Kelautan dan Perikanan*, *3*(2), 27-31.

Klahan, R., Yotha, P., & Punyathong, M. (2016). Utilization of Corncob as Feedstutuff on Growth Performance, Feed Utilization and Carcass Composition of Nile Tilapia. *International Journal of Environment and Rural Development, 7*(2), 75-80.

Molo, N. J., Oematan., & Maranatha., G. (2023). Pengaruh Level dan Lama Waktu Fermentasi Bonggol Jagung Menggunakan EM4 Terhadap Kandungan Protein Kasar, Lemak Kasar, Kadar Abu, dan Energi. *Animal Agricultura*, *2*(1), 59-68.

Maulidin, R., Muchlisin, Z. A., & Muhammadar, A. A. (2016). Pertumbuhan dan pemanfaatan pakan ikan gabus (Channa striata) pada konsentrasi enzim papain yang berbeda. *Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unsyiah*, *1*(3), 280-290.

Maulizar, M., EL-Rahimi, S. A., Hasri, I., & Nurfadillah, N. (2019). Pengaruh Variasi Periode Penyinaran Terhadap Pertumbuhan dan Kelangsungan Hidup Benih Ikan Depik Rasbora Tawarensis. *Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unsyiah*, *4*(2), 74-81.

Mulqan, M., Rahimi, E., Afdhal, S., & Dewiyanti, I. (2017). Pertumbuhan dan Kelangsngan Hidup Benih Ikan Nila Gesit pada Sistem Akuaponik dengan Jenis Tanaman yang Berbeda. *Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unayiah*, *2*(1), 183-193.

Naim, M., Hardi, E. H., & Warlina, L. (2024). Transportasi Benih Ikan Nila *(Oreochromis niloticus)* dengan Menggunakan Bahan Alami Ekstrak Lempuyang (*Zingiber zerumbet*) Transportation of Nile Tilapia (*Oreochromis niloticus*) With Lempuyang Extract (*Zingiber zerumbet*). *13*(3), 323–336.

Novrianto, A., Yulfiperius, Y., Andriyeni, A, Nurhabib, A., &Supriyono, S. (2019). Pengaruh Pemberian Komposisi Pakan Tepung Tongkol Jagung yang Berbeda Terhadap Pertumbuhan Ikan Tawes. *Jurnal Agroqua*, *17*(1), 41-48.

Nuansa, F., El Rahimi, S. A.,& Mellisa, S. (2018). Pemberian Pakan Alami yang Berbeda Terhadap Pertumbuhan Benih Ikan Betutu. *Jurnal Ilmiah Mahasiswa Kelautan Perikanan Unsyiah, 3*(2), 45-54.

Rasyid, I., Sirajuddin, S, N., & Lestari, V. S. (2022). Proses Pembuatan Fermentasi Tongkol Jagung pada Kelompok Ternak Sapi Potong di Kecamatan Donri-Donri. *Jurnal Pengabdian Inovasi Dan Teknologi Kepada Masyarakat*, *2*(2), 99-102.

Rizky, P. N., Aisy, W. R., & Primasari, K. (2022). Budidaya Ikan Nila Jatimbulan dengan Sistem Semi Intensif. *Jurnal Penelitian Chanos Chanos*, *20*(2), 69- 76.

Rostini, T. (2022). Pengaruh Lama Fermentasi Terhadap Karakteristik, Kandungan Protein dan Serat Kasar Tongkol Jagung. *Ziraa'ah Majalah Ilmiah Pertanian*, *47*(2), 257-266.

Scabra, A. R., & Marzuki, M. (2022). Efektivitas Peningkatan Oksigen Terlarut Menggunakan Perangkat Microbubble Terhadap Produktivitas Ikan Nila (*Oreochromis niloticus*) The Effectiveness of Increasing Dissolved Oxygen Using a Microbubble Device on the Productivity of Tilapia (*Oreochromis niloticus)*. *12*(1), 13–21.

Setiawati, S. D., & Pangaribuan, R. D. (2017). Studi Makanan dan Pertumbuahan Ikan Nila di Rawa Biru Distrik Sota Kabupaten Maroke. *Jurnal Fisherina, 1*(1), 20-32.

Setyono, B.D.H., Marzuki, M., & Sudirman, S. (2020). Efektifitas Tepung Ikan Lokal dalam Penyusunan Ransum Pakan Ikan Nila. *Jurnal Perikanan Unram*. *10* (2), 183-194.

Shofura, H., Suminto, S., & Chilmawati, D. (2018). Pengaruh Penambahan "probio-7" pada Pakan Buatan Terhadap Efisiensi Pemanfaatan Pakan, Pertumbuhan dan Kelulushidupan Benih Ikan Nila Gift. *Indonesian Journal of Tropical Aquaculture*, *1*(1), 10-20.

Surianti, S., Hasrianti, H., Putri, R.S., & Wahyudi, W. (2022). Pemanfaatan Bahan Baku Lokal Sebagai Pakan Buatan untuk Ikan Nila di Kabupaten Sidenreng Rappang. *Journal of Community Service*, *2*(2), 43-50.

Syuhriatin, S. (2020). Analisis Pertumbuhan Ikan Nila Terhadap Pemberian Pakan yang

Berbeda Desa Sigerongan Kecamatan Lingsar, Kabupaten Lombok Barat. *Media Bina Ilmiah*, *14*(6), 2745-2748.

Tang Phuc Khang, L., Linh, N. V., Wisetkaeo, S., Therdtatha, P., Dinh-Hung, N., Phimolsirpol, Y., & Van Doan, H. (2025). Fermented Corn Stover Enchances Growth, Immune Response, Histology, Gut Microbiome, and Gene Expression in Cyprinus Carvio Var. Koi in Bioflock System. *Italian Journal of Animal Science*, *24*(1), 2359-2375.

Widaningsih, N., Dharmawati, S., & Puspitasari, N. (2018). Kandungan Protein Kasar dan Serat Kasar Bonggol Jagung yang Difermentasi dengan Menggunakan Tingkat Cairan Rumen Kerbau yang Berbeda. *Ziraa'ah*, *42*(3), 255-265.

Wiradana, S., Almadi, I. F., & Sukarti, K. (2024). Tingkat Retensi Protein dan Retensi Lemak Yang Berbeda Terhdap Pertumbuhan Ikan Betutu *(Oxyeleotris marmorata)*. *9*(4), 13–20.

Yanto, H., Setiadi, A. E., & Kurnaisih, D. (2019). Pengaruh Tingkat Karbohidrat Berbeda dalam Pakan Terhadap Kinerja Pertumbuhan Ikan Tengadak. *Jurnal Ruaya*, *7*(2), 39-46.

Yulfiperius, Y., Firman, F., & Hartini, S. (2024). Effect of Different Feeding Rates of Corn Cob Meal Supplemented-Feed on the Growth of Farmed *Osphronemus Gouramy*. *Jurnal Riset Akuakultur*, *19*(4), 315-329.

Yulfiperious, Firman & Pardiansyah, D. (2021) Wheat Corncob as the Replacement of Brain in Enviromentally Friendly Fish Feed Formulation. *Jounal of Jilin University*, *40*(1), 96-72.

Zuhdi, I., Prasetiyo, H., & Sasongko, A. S. (2024). Kajian Pemanfaatan Pakan Maggot (*Hermetia illucens*) Sebagai Pakan Alternatif Terhadap Pertumbuhan Benih Ikan Gabus (*Channa striata*). *Sains Akuakultur Tropis: Indonesian Journal of Tropical Aquaculture*, *8*(1), 86-93.