JMAI Jurnal Media Akuakultur INDONESIA
https://journal.unram.ac.id/index.php/jmai/index. E-ISSN : 2798-0553
Volume 5, Number 1, March 2025

PEMBERIAN PAKAN FORMULASI BERBAHAN BAKU TEPUNG RUMPUT LAUT Eucheuma cottonii HASIL FERMENTASI DENGAN BERBAGAI KONSENTRASI EM-4 DALAM BUDIDAYA IKAN NILA (*Oreochromis niloticus*)

Feeding Formulations Made From Raw Seaweed Flour Eucheuma Cottonii Results Of Fermentation With Various Concentrations Of Em-4 In Cultivation Of Tila Fish (Oreochromis niloticus)

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ABSTRAK

Ikan nila (*Oreochromis niloticus*) merupakan salah satu ikan air tawar yang memiliki nilai ekonomis yang sangat tinggi, adapun faktor penting dalam budidaya ikan nila adalah nutrisi pakan, Kandungan nutrisi yang dibutuhkan untuk memenuhi kebutuhan ikan terdiri dari protein, lemak, karbohidrat, mineral dan vitamin. Kualitas pakan tergantung dari jenis bahan baku yang digunakan untuk memenuhi kebutuhan nutrisi pada ikan. Adapun salah satu bahan baku yang potensial untuk dijadikan bahan baku pakan ikan adalah rumput laut jenis *Eucheuma cottoni*. yang mengandung mineral seperti kalsium, magnesium, natrium, besi, seng, yodium, serta vitamin C dan vitamin E. Namun permasalahan dalam rumput laut adalah tingginya kandungan karbohidrat yang menyebabkan tingginya kandungan serat, salah satu cara untuk menurunkan kandungan serat yaitu dengan proses fermentasi. Keberhasilan proses fermentasi juga ditentukan oleh jenis fermentor yang digunakan. Fermentor, EM-4 (*Effective Mikroorganisme*). merupakan salah asatu fermentor yang banyak digunkan karena mengandung mikroorganisme. Penelitian ini menggunakan benih ikan nila, dilakukan selama 50 hari dilaboratorium, adapun metode yang digunakan dalam penelitian ini dalah metode rancangan acak lengkap (RAL) menggunakan 4 perlakuan dan 3 pengulangan yaitu perlakuan P1: tanpa penambahan EM-4 (kontrol), perlakuan P2: penambahan runput laut *E. cottonii* dengan 2 ml EM-4, P3: penambahan runput laut *E. cottonii* dengan 4 ml EM-4, P4: penambahan runput laut *E. cottonii* dengan 6 ml EM-4. Parameter yang diuji pada penelitian ini adalah pertumbuhan berat mutlak, laju pertumbuhan spesifik, panjang mutlak, rasio konversi pakan, efisiensi pemanfaatan pakan dan kelangsungan hidup ikan nila serta kualitas air. Data dianalisis menggunakan *Analysis of Variance* (ANOVA) pada taraf kepercayaan 95%. Hasil penelitian menunjukkan bahwa penambahan tepung rumput laut *E.cottonii* dapat meningkatkan berat mutlak, panjang mutlak dan kelangsungan hidup ikan nila dengan nilai rata-rata berat mutlak ikan nila selama pemeliharaan berkisar antara 7.41– 7.65 g, panjang mutlak berkisar antara 4.95–5.1 cm, laju pertumbuhan spesifik berkisar anatara 2.147 – 2.203 %/hari, dengan rasio

konversi pakan berkisar antara 1.31– 1.57 dan efisiensi pemanfaatan pakan berkisar antara 75.97–81.09 %, serta kelangsungan hidup ikan nila berkisar antara 53.3–76.7 %. Kualitas air selama pemeliharaan masih berada pada kisaran normal untuk budidaya ikan nila yaitu suhu berkisar antara 27.2 – 29.7 ºC, pH berkisar antara 7.4– 8.6 dan DO berkisar antara 5.5–6.6 mg/l.

ABSTRACT

Tilapia fish (*Oreochromis niloticus*) is a freshwater fish that has very high economic value. An important factor in cultivating tilapia is feed nutrition. The nutritional content needed to meet fish needs consists of protein, fat, carbohydrates, minerals and vitamins.. The quality of feed depends on the type of raw material used to meet the nutritional needs of fish. One of the raw materials that has the potential to be used as raw material for fish feed is Eucheuma cottoni seaweed. which contains minerals such as calcium, magnesium, sodium, iron, zinc, iodine, as well as vitamin C and vitamin E. However, the problem with seaweed is the high carbohydrate content which causes the high fiber content. One way to reduce the fiber content is through the fermentation process. The success of the fermentation process is also determined by the type of fermenter used. Fermenter, EM-4 (Effective Microorganisms). is one of the fermenters that is widely used because it contains microorganisms. This research used tilapia fish seeds, carried out for 50 days in the laboratory. The method used in this research was a completely randomized design (CRD) method using 4 treatments and 3 repetitions, namely treatment P1: without the addition of EM-4 (control), treatment P2: addition of E. cottonii seaweed with 2 ml EM-4, P3: addition of E. cottonii seaweed with 4 ml EM-4, P4: addition of E. cottonii seaweed with 6 ml EM-4. The parameters tested in this study were absolute weight growth, specific growth rate, absolute length, feed conversion ratio, feed utilization efficiency and survival of tilapia and water quality. Data were analyzed using Analysis of Variance (ANOVA) at a confidence level of 95%. The research results showed that the addition of E.cottonii seaweed flour could increase the absolute weight, absolute length and survival of tilapia with the average absolute weight of tilapia during rearing ranging from 7.41–7.65 g, absolute length ranging from 4.95–5.1 cm, The specific growth rate ranges between 2,147– 2,203 %/day, with a feed conversion ratio ranging between 1.31– 1.57 and feed utilization efficiency ranging between 75.97– 81.09 %, and tilapia survival ranging between 53.3– 76.7 %. Water quality during maintenance is still within the normal range for tilapia cultivation, namely temperature ranging between 27.2–29.7 ºC, pH ranging between 7.4–8.6 and DO ranging between 5.5–6.6 mg/l.

Kata Kunci	*Ikan Nila, Fermentasi, E. cottoni*
Keywords	*Tilapia, Fermentation, E. cottoni*
Tracebility	Submission: 2/2/2025. Published : 27/3/2025
Panduan Kutipan (APPA 7th)	Safitri, M., Lumbessy, S. Y., & Lestari, D. P. L. (2025). Pemberian Pakan Formulasi Berbahan Baku Tepung Rumput Laut *Eucheuma cottoni* Hasil Fermentasi dengan Berbagai Konsentrasi EM-4 dalam Budidaya Ikan Nila (*Oreochromis niloticus*). *Jurnal Media Akuakultur Indonesia*, 5(1), 1-10. http://doi.org/10.29303/mediaakuakultur.v5i1.5121

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a freshwater fish that has a very high economic value. Tilapia is one of the fishery commodities that is popular with the community in meeting protein and animal needs because it has thick meat and a delicious taste. According to the Ministry of Marine Affairs and Fisheries (2020), tilapia production in Indonesia in 2017 and 2018 increased by 1,265,201 tons and 1,169,144 tons respectively when compared to tilapia production in 2016 which was only 1,114,156 tons. Furthermore, in 2019 tilapia production in Indonesia increased again to 1,474,742 tons, but in 2020 tilapia production fell 2% to 1,235,513 tons (Iskandar *et al.,* 2021).

The demand for fishery products to meet human nutrition is increasing, while the level of availability of potential fish resources is predicted to continue to decrease with increasing consumption. Therefore, alternative sources of fishery supply are expected to come from fish farming activities (Sukadi, 2002). Aquaculture is one solution that can be done considering that its production can be controlled both with innovation technology and its capacity (Anwar and Utpalasari, 2017). One of the important factors in fish farming is feed nutrition. The nutritional content needed to meet the needs of fish consists of protein, fat, carbohydrates, minerals and vitamins. The quality of feed depends on the type of raw material used to meet the nutritional needs of fish. One of the potential raw materials to be used as raw material for fish feed is seaweed of the Eucheuma cottoni type. which contains minerals such as calcium, magnesium, sodium, iron, zinc, iodine, and vitamins C and E. However, the problem with seaweed flour is the high fiber content caused by the high carbohydrate content in seaweed. One way to reduce fiber content so that it can maximize and improve feed quality is through the fermentation process. According to Anggrek *et al.,* (2020) fermentation is a process of chemical changes in organic compounds (carbohydrates, fats, proteins, and other organic materials) both in aerobic and anaerobic conditions, through the work of enzymes produced by microbes.
The success of the fermentation process is also determined by the type of fermentor used. Fermentor, EM-4 (Effective Microorganisms). is one of the fermentors that is widely used because it contains microorganisms. Such as Lactabacilus casei and Saccharomyces cerevisiae. These two microorganisms are types of bacteria and mold. These bacteria can increase the protein content of a material such as seaweed flour. The use of various types of microbes in the fermentation process has its own characteristics and performance systems in producing certain enzymes that can facilitate increasing feed nutrition (Chilmawati *et al.,* 2018)

According to the results of Lumbantu's research (2018), it shows that feed given EM4 probiotics produces better growth (g) and survival (SR%) of tilapia compared to feed without EM4 probiotics. In a study conducted by Aslamyah *et al.,* (2017) it was shown that fermentation of Sargasum sp seaweed flour, with a mix of microorganisms. (bacteria, fungi, yeast, and mold) as much as 10 ml/g of mix microorganisms. gave a positive response to the growth performance and chemical composition of the body of milkfish.

Based on the description above, it is necessary to conduct research on the provision of formulated feed made from fermented Eucheuma cottoni seaweed flour with various concentrations of EM-4 in tilapia cultivation (*O. niloticus*).

METHODS

Research Design

The method used in this study is an experimental method carried out in the laboratory. The design used is a completely randomized design (CRD) consisting of four treatments and three replications so that there are a total of 12 experimental units. The treatment tested was the addition of fermented Eucheuma cottonii seaweed flour using various different concentrations of EM4, namely:

P0 : Control (without adding EM_4)
P1 : 2 ml EM-4 / 100 g seaweed
P2 : 4 ml EM-4 / 100 g seaweed
P3 : 6 ml EM-4 / 100 g seaweed

Procedure

Research Prepration

Seed Preparation and Maintenance Containers

The tilapia used are fish that have the characteristics of uniform size, are not deformed, not injured and have a length of 5-6 cm and a weight of 2-5 g. The container used as a place to maintain tilapia is a container box consisting of twelve pieces with a size of 50 x 30 x 20 and filled with 20 L of water. Then, each container box is filled with 10 tilapia. Before use, the aquarium is washed using clean water, then dried and refilled with water and each container used is equipped with aeration to maintain the dissolved oxygen content.

Research Implementation

Fish Acclimatization

The seeds are acclimatized for 20 minutes which serves to adjust the temperature content in the plastic bag and the temperature in the cultivation container. After that, the plastic bag is opened and the fish inside are slowly removed. The fish being raised are fasted first for 24 hours. Feeding is done three times a day (morning, afternoon and evening). The adaptation process in fish is carried out with the aim of emptying the stomach of the fish so that it can absorb the new feed.

Feeding

The biota tested were given feed as much as 3% of their body weight with a feeding frequency of 3 times a day, namely at 08.00, 12.00, and 16.00 WITA.

Growth monitoring

Growth monitoring is done by sampling. Sampling is needed to overcome fish biomass. Sampling is done on days 0, 10, 20, 30, 40 and 50. Tilapia seeds are taken randomly and then the weight and length increases are measured.

Water Quality Management

Water quality management consists of siphoning, water changes, and water quality measurements. Siphoning is done once a day on the maintenance media using a siphon hose. Water changes are done as much as 10-20% to provide optimum conditions for the maintenance media. Water quality measurements are done in the morning. The water quality measured is temperature, pH, and dissolved oxygen. Water quality measurements are done every 10 (ten) days.

Research Parameters

The parameters observed during the study were the main and supporting parameters. The main parameters include absolute growth, specific growth rate (SGR), absolute length, feed conversion ratio (FCR), feed efficiency, survival rate (SR). While the supporting parameters are water quality which includes pH, temperature and DO.

Data Analysis

The data tested in this study include absolute growth, specific growth rate, absolute length, feed conversion ratio, feed utilization efficiency, and survival. The data obtained will be analyzed using Analysis of Variance (ANOVA) at a significance level of 5%. While DO, pH, and temperature were tested descriptively.

RESULT AND DISCUSSION

Result

Absolute Growth Rate

The results of the study showed that the absolute growth rate of tilapia in various treatments of adding different concentrations of fermented seaweed flour (E. cottonii) to the feed formulation ranged between 7.59 - 7.65 g (Figure 4.2).

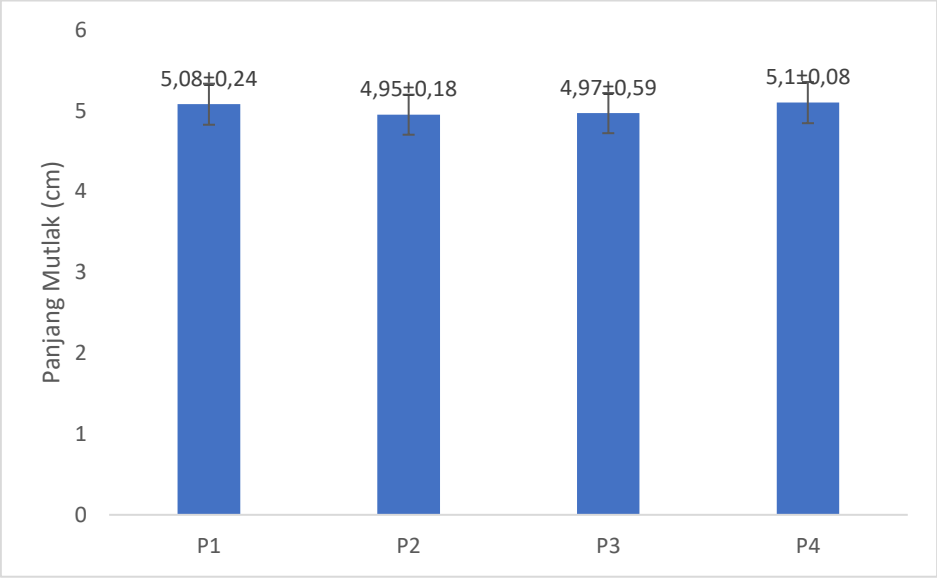

Figure 1. Absolute growth rate of Tilapia Fish (*O.niloticus*)

The results of the Analysis of Variance (ANOVA) showed that feed with the addition of fermented E. cottonii seaweed flour in the formulation of tilapia feed with a concentration that did not have a significant effect (P>0.0.5) on the absolute weight growth of tilapia (Appendix 2).

Absolute Length

The research results show that the absolute length of tilapia in various treatments of adding different concentrations of fermented seaweed flour (E. cottonii) to the feed formulation ranged between 4.95-5.1 cm (Figure 4.3).

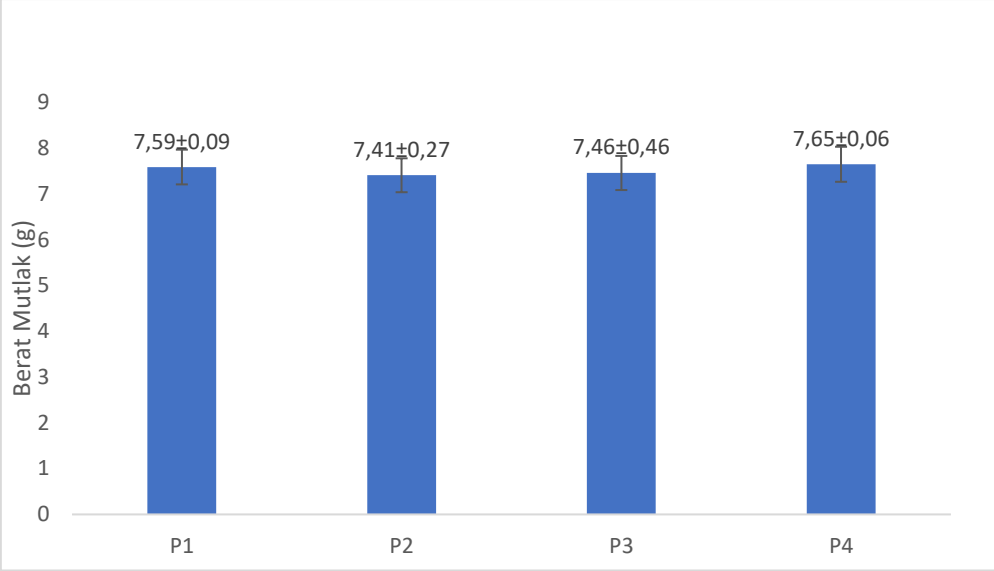

Figure 2. Average Absolute Length Value of Tilapia Fish (*O. niloticus*)

The results of the Analysis of Variance (ANOVA) showed that feed with the addition of fermented E. cottonii seaweed flour in the tilapia feed formulation with a concentration that did not have a significant effect (P>0.0.5) on the absolute length growth of tilapia (Appendix 2).

Specific Growth Rate (SGR)

The results of the study showed that the specific growth rate of tilapia in various treatments of adding different concentrations of fermented E. cottonii seaweed flour to the feed formulation ranged from 2,147 - 2,203% / day (Figure 4.4).

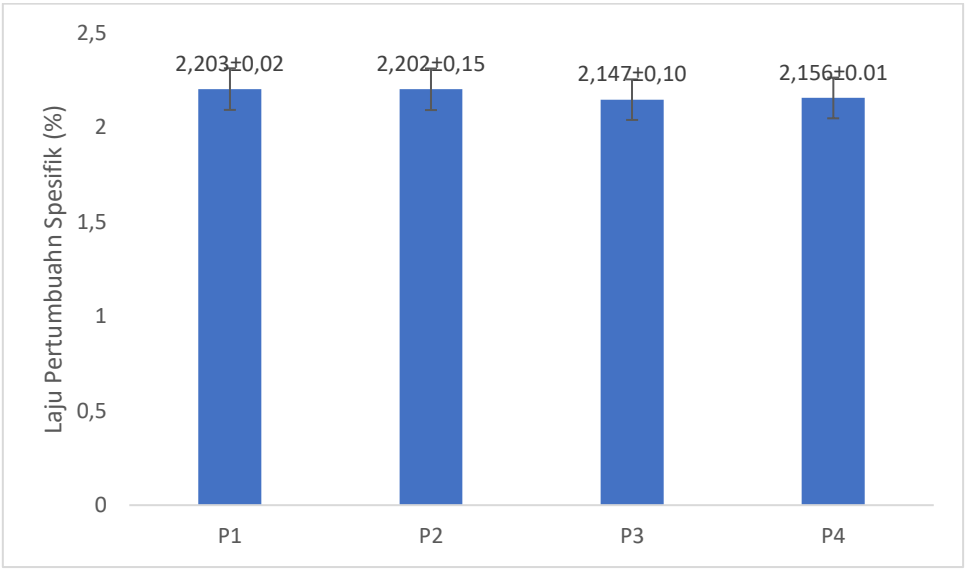

Figure 3. Average Value of Specific Growth Rate of Tilapia (*O. niloticus*)

The results of Analysis of Variance (ANOVA) show that feed with the addition of E. cottonii Fermented seaweed flour in the tilapia feed formulation with a concentration that does not have a significant effect (P>0.0.5) on the daily specific growth rate of tilapia.

Feed Convertion Ratio (FCR)

The results of the study showed that the feed conversion ratio of tilapia (*O. niloticus*) in various treatments of adding different concentrations of fermented seaweed flour E. cottonii to the feed formulation ranged from 1.31 to 1.57 (Figure 4.5).

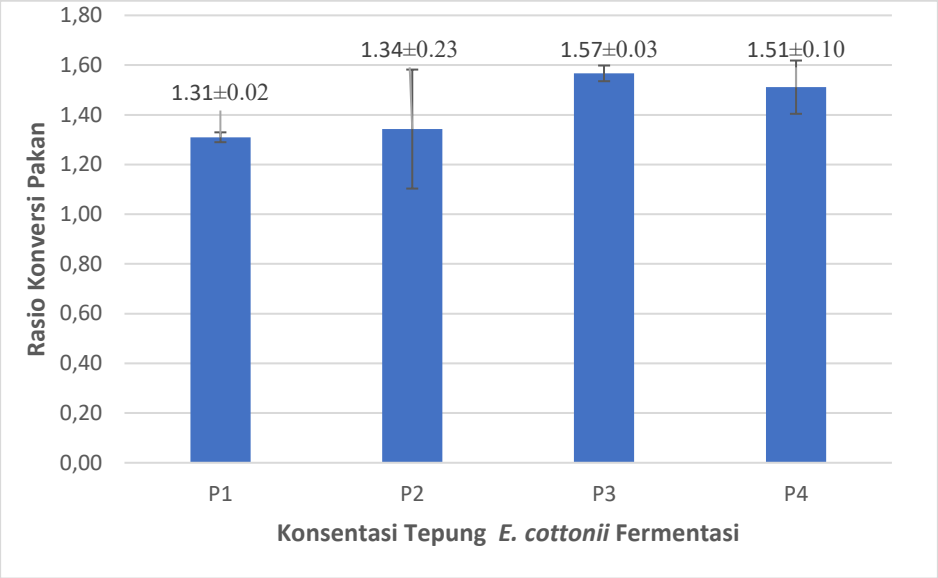

Figure 4. Average Value of Tilapia Feed Conversion Ratio (*O. niloticus*)

The results of the Analysis of Variance (ANOVA) showed that feed with the addition of fermented E. cottonii seaweed flour in the formulation of tilapia fish feed with a concentration that did not have a significant effect (P>0.0.5) on the feed conversion ratio of tilapia fish (Appendix 2).

Survival Rate (%)

The results of the study showed that the survival rate of tilapia (*O. niloticus*) in various treatments of adding different concentrations of fermented E. cottonii seaweed flour to the feed formulation ranged from 53.3 – 76.7% (Figure 4.7).

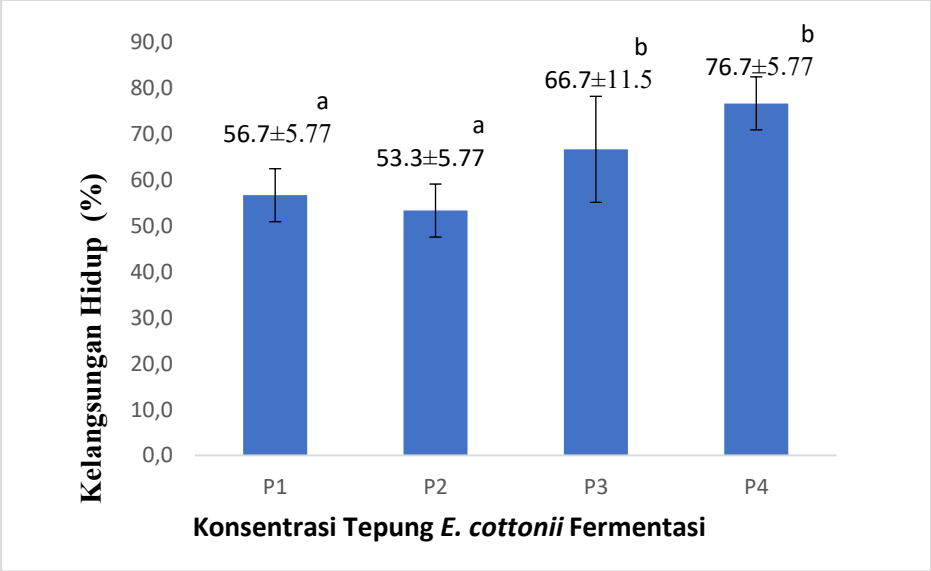

Figure 5. Average Value of Survival Rate of Tilapia Fish (*O. niloticus*)

Based on Figure 4.7 above, it shows that the highest survival rate of tilapia (O. niloticus) was found in the treatment of adding E. cottonii seaweed flour (P4) which was 76.7%, followed by treatment (P3) of 66.7%, then followed by control treatment (without EM4) of 56.7%, and the addition of fermented E. cottonii seaweed flour (P2) gave the lowest survival rate of 53.3%.

Analysis of Variance (ANOVA) showed that the treatment of adding E. cottonii seaweed flour in the feed formulation gave significantly different results ($P < 0.05$) (Appendix 2). The results of the Duncan further test showed the highest survival rate of tilapia (O. niloticus) which was 76.7% and significantly different from the treatment of adding E. cottonii seaweed flour (P1) and (P2), but not significantly different from the treatment (P3).

Water Quality

The results of water quality parameter measurements during the 50-day study for each treatment of adding different concentrations of E. cottonii seaweed flour fermentation to the feed formulation are presented in Table 4.8. The average value of water quality parameters in this study was temperature ranging from 27.2-29.7 °C, then pH ranging from 7.4-8.6 and dissolved oxygen (DO) ranging from 5.5-6.6 mg/L.

Table 1. Water quality parameters

	Treatment	Range Value	Optimal Value	References
Temperature °C	P1	27.2- 29.4	24– 32	Nugroho *et al*., 2013
	P2	27.2 – 29.3		
	P3	27.4 - 29.7		
	P4	28.4 – 29.7		
pH	P1	7.8 - 8.4	6.5 – 9	Nugroho *et al*., 2013
	P2	7.4 – 8.4		
	P3	7.4 – 8.4		
	P4	7.6 – 8.6		
DO (mg/l)	P1	5.6 – 6.6	> 3 (mg/l)	Nugroho *et al*., 2013
	P2	5.5- 6.1		
	P3	5.5- 6.3		
	P4	5.5 – 6.6		

Temperatur

Temperature plays a very important role as an environmental factor that affects growth and is closely related to the metabolic rate for respiration and reproduction. The temperature during the study ranged from 27.2-29.7 ºC. This shows that the temperature during the study was in good and optimal condition. According to Nugroho et al., (2013) the optimal temperature for fish ranges from 24-32 ºC. If the maintenance temperature

is less than the optimal range, it will cause a low metabolic rate in tilapia, causing the feed consumption rate to decrease (Putri *et al.,* 2021).

Degree of Acidity (pH)

The degree of acidity (pH) affects the growth and defense of the physiological functions of the fish body. The pH value during this study ranged from 7.4 -8.6 and was classified as good. In accordance with the opinion of Nugroho et al., (2013) which states that a good degree of acidity (pH) for fish is 6.5-9. If the pH value is outside this range, it will inhibit fish growth (Endraraswari et al., 2021).

Dissolved Oxygen (DO)

Dissolved oxygen (DO) is one of the parameters needed in water quality analysis. In tilapia, dissolved oxygen is a very important requirement, because this fish is a fish that has high survival and tilapia is also an active fish in water. The DO value obtained from this study ranges from 5.5-6.6 mg/L, where the dissolved oxygen (DO) content is in an optimal state and is good for fish growth. This is in accordance with Nugroho et al., (2013) which states that the optimal dissolved oxygen content for fish growth is> 3 mg/L, this dissolved oxygen content can also affect fish appetite and fish metabolism processes.

CONCLUSION AND SUGESSTIONS

Conclusion

The addition of E. cottonii flour fermented using EM-4 to the feed of O. niloticus tilapia can affect the survival rate of O. niloticus tilapia, but does not affect the absolute weight, absolute length, specific growth rate (SGR), feed conversion ratio (FCR), and feed utilization efficiency (EPP). The addition of E. cottonii flour fermented using 6 ml of EM-4 to the feed of O. niloticus tilapia is the best treatment because it can increase the survival rate of tilapia by 76.7%, and the addition of E. cottoni fermented using EM4 to the feed does not significantly affect the specific growth rate, but can provide good feed conversion ratio, feed utilization efficiency and survival of tilapia.

Sugesstion

It is recommended that further research is needed to improve the handling techniques for E. cottonii flour fermented with EM4 so that it can provide maximum results.

ACKNOWLEDGEMENT

All praise and gratitude the author prays to the presence of Allah SWT for all His grace and gifts, so that the thesis entitled "Provision of Formulated Feed Based on Fermented Eucheuma cottoni Seaweed Flour with Various Concentrations of EM-4 in Tilapia (Oreochromis niloticus) Cultivation", can be completed properly. On this occasion, the author would like to thank: Mr. Dr. Salnida Yuniarti Lumbessy, M.Si, as the main supervisor, Mrs. Dewi Putri Lestari, S.Pi., M.P as the assistant supervisor, Dr. Zaenal Abidin, S.Pi., M.Si as the Head of the Aquaculture Study Program, University of Mataram, Prof. Dr. Ir. Muhammad Junaidi, M.Si as the Head of the Fisheries and Marine Department, University of Mataram. The author would like to express his deepest gratitude to his parents and his beloved brother and sister, in short, his entire extended family who have given prayers, support and material so that he can complete all the processes of working on his thesis smoothly, as well as his friends who are involved and willing to help in the process of completing his thesis.

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