Global Scientific JOURNALS

GSJ: Volume 8, Issue 12, December 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

LEVEL OF USE OF FERMENTED COCONUT TESTA BY *Neurospora sitophila* ON THE GROWTH OF RED TILAPIA FISH SEEDS (*Oreochromis niloticus*)

Ibrahim Abdullah * , Kiki Haetami ** , Yayat Dhahiyat** , Walim Lili**
*) Student of the Faculty of Fisheries and Marine Science Padjadjaran University
**) Lecturer at the Faculty of Fisheries and Marine Science Padjadjaran University
Email : ibrahim16001@mail.unpad.ac.id
Corresponding author : kiki.haetami@unpad.ac.id

ABSTRACT

This study aims to identify the level of use of coconut testa resulted from *Neurospora sitophila* fermentation in the most effective formulation of feed for the growth of red tilapia to providing a high survival rate. This research was conducted from December 2019 to February 2020 at the Building 4 of Aquaculture and Hatchery Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. It applied an experimental method using a completely randomized design (CRD) with five treatments and three replications. The treatment used feed formulation with different concentration of coconut testa content of A (0%), B (5%), C (10%), D (15%), and E (20%). The parameters measured include absolute weight growth, survival rate, and water quality. Absolute weight growth, and fish survival rates were analyzed using ANOVA with an error rate of 5%. Meanwhile, the water quality was analyzed using descriptive comparative analysis. The result showed that the use of 20% coconut testa produced by *N. sitophila* fermentation produces an optimal growth rate of red tilapia which is 0,74% with an absolut value of 0,77 gram.

Keywords : *Coconut testa*, *Neurospora sitophila*, *Red tilapia and feed*

INTRODUCTION

Red tilapia fish (*Oreochromis niloticus*) is a type of freshwater edible fish imported to Indonesia in early 1981 by the Research Institute for Freshwater Fisheries (Santoso 2000). Compared to other types of fish, the advantages of this fish are fast growth, easy breeding, efficient provision of additional feed, resistance to disease, and tolerance to environmental changes (Ningtiyas and Suwartiningsih 2019).

The feed is a crucial component in aquaculture activities. The quality of feed depends on the raw material. Hence, the quality and quantity of available raw materials have to be maintained. Fat source feed raw materials are the largest source of energy compared to protein and carbohydrates. The most common fat sources are raw materials from fatty grains or extraction results (oilcake and oil). Feed raw materials should have good nutritional value, easy to obtain, easy to digest, non-toxic, relatively cheap prices, and non-staple foods for humans (Afrianto and Liviawaty 2005). One of the alternative materials is coconut testa.

Coconuts are a tropical plant that has been widely known in Indonesia. All parts of coconuts can be utilized, from the meat, leaves, stems, shells, and coconut fibers. Coconut testa is the brown part covering coconut kernel, i.e.,brown skin and it has not been widely used (Appaiah et al. 2014). However, the high level of fat and crude fiber content causes the coconut testa not ideal for feed ingredients. Thus, it requires a fermentation process to increase the nutritional value of fish which will break down complex components into simpler ones.

Commonly, fibers are fermented using microorganisms in the form of mold as it can break down crude fiber. Solid substrate fermentation is easier to apply for sources of carbohydrates which are solid. One of the fungi that have high cellulolytic activity and are often used in the fermentation of fiber is *Neurospora sitophila* or widely known as *oncom* mushrooms (Chandel et al. 2007).

Molds are also known as carotenoids because they can produce carotenoid pigments (Nuraini et al. 2009). The advantage of fermentation using carotenogenic of *N. sitophila* compared to plant sources to produce β-carotene is more efficient in terms of time, place, and cost as it does not require plant planting time, large and heavy equipment, and large areas (Novianti et al. 2004). This mold can enrich the protein from coconut testa which becomes a substrate due to its lignocellulose content (Nurhaita et al. 2012).

METHOD

This research was conducted from December 2019 to February 2020 at the Building 4 of Aquaculture and Hatchery Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. It applied the experimental method using a completely randomized design (CRD) with five treatments and three replications. The treatments used were feeding with different concentrations of coconut testa content of A (0%), B (5%), C (10%), D (15%), and E (20%). The parameters observed were weight growth, survival, and water quality.

Table 1. Composition of Feed for Treatment

Raw materials	Composition of Feed for Treatment (%)				
	A	B	C	D	E
Soybean meal	11,86	13,64	13,76	13,89	14,01
Fish flour	11,86	13,64	13,76	13,89	14,01
Corn starch	23,43	20,57	18,82	17,08	15,33
Polar	23,43	20,57	18,82	17,08	15,33
Fine bran	23,43	20,57	18,82	17,08	15,33
Tapioca/Binder	5	5	5	5	5
Vitamin-Mineral	1	1	1	1	1
Fermented coconut testa	0	5	10	15	20
Total	100	100	100	100	100
Protein (%)					

Raw materials	Composition of Feed for Treatment (%)				
	A	B	C	D	E
	25	25	25	25	25
Fat (%)	5,84	6,37	6,96	7,54	8,13
Crude fiber (%)	5,52	5,66	5,91	6,16	6,40
DE (kkal/kg)*)	2076,32	2145,96	2205,79	2265,62	2325,44
DE/P	8,31	8,58	8,82	9,06	9,30

Notes: *) DE (*Digestible Energy*) = 70% x GE (*Gross Energy*) (Hepher 1988)

RESULT AND DISCUSSION

Growth

The result of research on red tilapia fish seeds with 42 days of growth showed that differences in the level of use of fermented coconut testa by *Neurospora sitophila* in feed formulations for red tilapia resulted in different individual weight gain. The average weight of red tilapia fish seeds has increased along with the maintenance period. At the beginning of the maintenance, the average individual weight of all treatments ranged from 4.62 - 5.08 grams, while at the end of the maintenance it ranged from 5.79 - 6.97 grams.

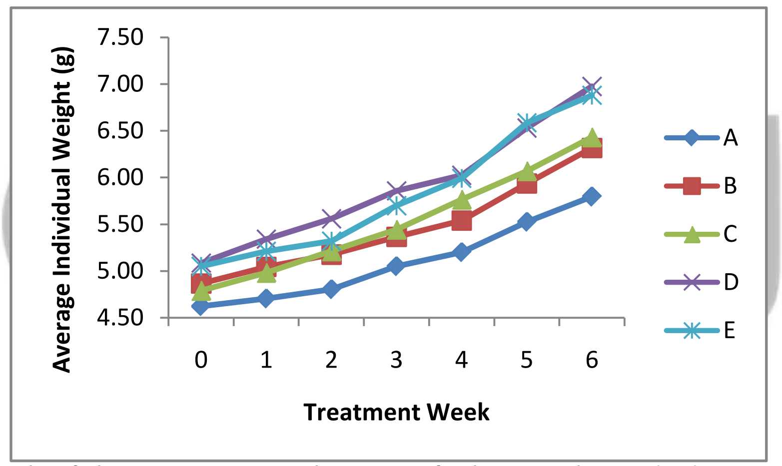

Figure 1. Graph of the Average Weight Gain of Tilapia Fish Seeds during the study (g)

The individual weight gain showed different values. It means that each feed has a different quality but it can meet the nutritional needs to help the growth of red tilapia fish seeds. Protein, which is the most important component of fish feed in this study, was formulated in each treatment with a level of 25%. It is in line with the protein requirements for red tilapia at the juvenile stage, ranging from 25-30% (Sahwan 2003). The effect of using fermented coconut testa by *N. sitophila* in feed can be seen in Figure 2.

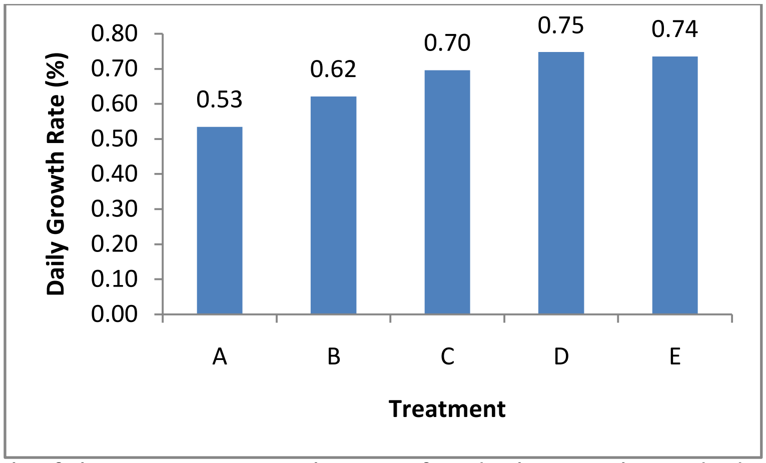

Figure 2. Graph of the Average Growth Rate of Red Tilapia Fish Seeds during the Study

Figure 2 shows that the use of fermented coconut testa by *N. sitophila* in the feed formulation affected the growth rates of red tilapia fish seeds ranging from 0.53 to 0.75%. Treatment D with 15% fermented coconut testa in the feed formulation showed the highest growth rate of 0.75%. Meanwhile, treatment A (control) produced the lowest growth rate of 0.53%. It indicates that the use of fermented coconut testa by *N. sitophila* affected the growth rate of fish. The result of the analysis of variance revealed that the use of coconut testa did not have a significant effect on the growth rate of red tilapia fish seeds. The results of the analysis of the differences between treatments based on the Duncan test are presented in table 2.

Table 2. Average Daily Growth Rate of Red Tilapia Fish Seeds

Treatment	Daily Growth Rate (%)
A	0,53±0,08a
B	0,62±0,13a
C	0,70±0,12a
D	0,75±0,09a
E	0,74±0,12a

Treatment D (15%) showed the highest growth rate, especially compared to treatment A (0%). Optimum fish growth can be realized if the nutrients of the feed meet the fish need. Proteins are useful for body maintenance, body tissue formation, replacement of damaged tissue, addition (synthesis) of body protein in the process of growth. (Maiyulianti et al. 2017). The difference in the results of the growth rate of each treatment is influenced by the nutritional balance as presented in the following table.

Table 3. Nutritional Content of Feed and Needs for Tilapia

Content	A*	B*	C*	**D***	E*	The Need for Tilapia Seeds (%)**
Protein	25	25	25	**25**	25	20-25
Fat	5,84	6,37	6,96	**7,54**	8,13	6-8
Crude fiber	5,52	5,66	5,91	**6,16**	6,4	6-8

Note: *) Conversion of Feed Ingredient Analysis Results according to Hartadi, *et al*. 1990 and *Pearson & Square*.
**) The Need for Tilapia Seeds according to Sahwan 2003

Treatment D (15%) showed the most optimum composition to support the growth of red tilapia fish seeds. Fat is one of the essential elements in feed formulation as it acts as a source of energy or protein-sparing effect (Munisa et al. 2015). Thus, protein can be used to support fish growth. The use of 15% fermented coconut testa by *N. sitophila* in the feed formulation resulted in fat content of 7.54%. Therefore, the red tilapia fish seeds can digest the feed well.

Treatment A (0%) produced the lowest growth rate. In this treatment, fat content fulfills the minimum fat requirement for red tilapia. Thus, the protein in the fish body is absorbed as a supplier of energy for movement and other activities. Meanwhile, the residual protein that functions as a builder for new tissue cells declined and caused a low growth rate. Then, treatment E (20%) had a fat content that exceeds the optimum growth limit of tilapia and caused difficulty in digesting the feed and even the fish gets full quickly (Goenarso et al. 2011). Too-high fat content also caused nutritional pathologies such as fat accumulation and liver degeneration. Besides, excessive use of fat in the feed also reduced feed consumption which finally will reduce fish growth (Usman et al. 2010).

Crude fibers also affect the growth of tilapia, because they play a role in digestion. It can be seen that treatment D and treatment E show ideal crude fiber content according to Sahwan (2003). Meanwhile, treatment A, treatment B, and treatment C contain a minimum limit of crude fiber for red tilapia. Good fish food contains balanced nutrients (protein, fat, ash, water, and crude fiber) and in accordance with the needs (Iskandar and Fitriadi 2017). It is another factor that causes treatment A, treatment B, and treatment C have lower growth rates compared to treatment D and treatment E.

Survival

Survival is the ratio between the number of living fish in a certain period of time compared to the total number of fish at the beginning of maintenance. Fish with high survival have high endurance and tolerance levels for the environment. Siregar and Adelina (2009) stated that survival or life span can be influenced by biotic and abiotic factors. Biotic factors consist of age and ability of fish to meet feed needs. Meanwhile, abiotic factors include food availability and the quality of living media.

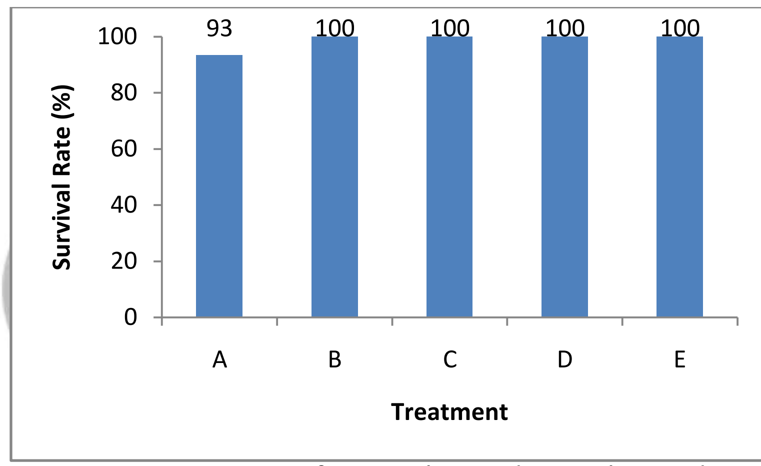

Figure 4. Diagram of Survival Rate during the Study

Figure 4 shows that the survival rate of red tilapia ranges from 93 - 100%. The lowest survival rate was 93% in treatment A (0%) while other treatments show a survival rate of 100%. Overall, the survival rate of red tilapia in this study was high.

Table 5. Survival rates

Treatment	Survival Rate (%)
A	92,00±0,00a
B	92,00±0,00a
C	94,33±9,82a
D	91,67±8,51a
E	86,00±5,2a

The result of the analysis of variance showed that the level of coconut testa used in the feed formulation did not have a significant effect on feeding efficiency (Table 5). Based on the further analysis using Duncan's multiple range test at the 5% confidence level, the survival rate of red tilapia was not significantly different.

Water quality

Water quality parameters measured in this study covered temperature, pH, and dissolved oxygen. Overall, the water quality was in a suitable range for the growth of red tilapia. The temperature ranged from

22.8 - 24.3 ^{o}C which is still in the feasibility level for rearing this fish. According to SNI 7550 (2009), the optimum temperature for fish ranges from 25 - 32^{o}C. The dissolved oxygen content was 5.7 - 8.1 mg/L. This range is suitable for the growth of this fish. Suyanto (2010) states that the optimal growth for tilapia is in dissolved oxygen of 4 - 7 mg/L. The pH ranged from 7.09 - 8.37 which is optimal for the survival of this fish as Suyanto (2010) stated that tilapia can live in a pH ranges from 6 - 8.5. Purbomartono et al. (2009) explained that continuous changes in pH will inhibit fish growth.

CONCLUSION

Based on the result of the analysis, it can be concluded that :

1. The use of fermented coconut testa by *Neurospora sitophila* in the feed formulation did not affect the growth rate and survival rate of red tilapia fish seeds.
2. The use of fermented coconut testa by *N. sitophila* of 20% produces an optimal growth rate of red tilapia which is 0,74% and absolut value of 0,77 gram.

REFERENCES

[1] Afrianto, Eddy and Liviawaty, Evi. 2005. Fish Feed. Yogyakarta: Kanisius.
[2] Appaiah, P., Sunil, L., Prasanth Kumar, P.K., Gopala Krishna, A.G. (2014). Compositionof Coconut Testa, Coconut Kernel and Its Oil. J Am Oil Chem Soc. 91:917–924.
[3] Chandel, A.K., Chan., Rudravaram, Narasu, L.V., Rao, and Ravindra. 2007. Economics and Environmental Impact of Bioetanol Production Technologies : An Appraisal. Biotechnology and Molecular Biology Review. Vol. 2 (1): 14-32.
[4] Goenarso, D., Suripto, K. I., Susanthi. (2003). Consumption of Oxygen, Hb Blood Levels, and Growth of Goldfish (*Cyprinus carpio*) Given a Mixed Feed of Coconut Dregs. Journal of Mathematics and Science. 8(2), 51-56.
[5] Hartadi, H. S., Reksohadiprodjo, A. D., Tillman, 1990. Composition of feed ingredients for Indonesia. Gadja Mada University Press, Yogyakarta.
[6] Hepher, B. 1988. *Nutrition Of Food Fisheries*. Cambridge University. New York. 388 hlm.
[7] Iskandar, R., Fitriadi, F. 2017. Proximate Analysis of Processed Feed from Fish Cultivators in Banjar Regency, South Kalimantan. Banjarmasin. Ziraa'ah, Volume 42 No. 1, February 2017 page 65 -68
[8] Maiyulianti, Mulyadi, Tang, U.N., 2017. The Influence of Different Types of Feed on Growth and Feed Efficiency of Seeds of Selais (*Cryptopterus Lais*). Journal of the Faculty of Fisheries and Marine Affairs, University of Riau.
[9] Munisa, Q., Subandiono, Pinandoyo. 2015. The Effect of Different Fat and Energy Content in the Feed on Feed Utilization and Growth of Patin (*Pangasius pangasius*). Journal of Fisheries Studies Program, Dipenogoro University.
[10] Ningtiyas, N.K., and Suwartiningsih, N. 2019. Growth and Survival Rate of Red Tilapia (*Oreochromis* sp.) Nilasa at Several Salinity. Journal of the Faculty of Science and Applied Technology, Ahmad Dahlan University, Yogyakarta.
[11] Novianti, T., Wignyanto, Nurika, I. 2004. Optimization of β-carotene spore production from Neurospora sitophila fungi using the response surface method. J Agricultural Technology. 5: 64-75.
[12] Nuraini, Sabrina, Latif, S.A. 2009. *Improving the Quality of Tapioca by Product Through Fermentation by Neurospora crassa to Produce $ Carotene Rich Feed*. Pakistan Journal of Nutrition 8 (4): 487-490.
[13] Nurhaita, Rita, W., Definiati, N., Zurina, R. 2012. Sugarcane Bagase Fermentation with Neurospora sitophila and Its Effect on Nutritional Value and Digestibility in Vitro. Embrio Journal Vol. 5 (1) P. 1-7
[14] Purbomartono, C., Hartoyo, A. Kurniawan. 2009. Compensated Growth in Red Tilapia (*Oreochromis niloticus*) with Different Fasting Time Intervals. Journal of Fisheries, Vol. 11, No. 1, pp. 19-24.
[15] Sahwan, M. F. 2003. Fish and Shrimp Feed, Formulation, Manufacture, Economic Analysis. Self-help spreader, Jakarta. 96 p.
[16] Santoso, U. 2000. Cultivation of Red Tilapia. Bharata Karya Akasara. Jakarta.
[17] Siregar, Y.I. and Adelina. 2009. Effect of Vitamin C on Increasing Hemoglobin (Hb) Blood and Survival of Goldfish (*Cyprinus carpio*). J. Natur Indonesia XXI (I): 75- 81.

[18] SNI 7550. 2009. Production of rearing grade tilapia (*Oreochromis niloticus* Bleeker) in still water ponds. National Standardization Body. Jakarta.
[19] Suyanto, S. R. 2010. Tilapia hatchery and rearing. Depok: Self-help spreader.
[20] Usman, Palinggi, N.N., Kamaruddin, Makmur, Rachmansyah. 2010. Effect of Levels of Protein and Feed Fat on Growth and Body Composition of Tiger Grouper, Epinephelus Fuscoguttatus. Journal of Aquaculture Research, Vol. 5 No. 2 p. 277-286.