DEPIK
Jurnal Ilmu-Ilmu Perairan, Pesisir dan Perikanan
Journal homepage: www.jurnal.usk.ac.id/depik

Effect of different feed pellet on growth rate and survival levels of tilapia seeds (*Oreochromis niloticus*)

Muhammad Ikhsan Wamnebo*, Siti Hadijah, Andi Hamdillah

Departement of aquaculture, Faculty of Fisheries and Marine Sciences, Universitas Muslim Indonesia, Makassar, Indonesia.

ARTICLE INFO

Keywords:
Tilapia
Feed
Growth
Survival

DOI: 10.13170/depik.12.2.29174

ABSTRACT

Tilapia (*Oreochromis niloticus*, Linnaeus, 1758) is a dominant commodity in the Indonesian freshwater fishery industry, and its growth relies on feed. Pellet are feed that is processed through a factory mechanism or human intervention, based on the cultivators' needs. Therefore, the purpose of this study was to determine the effect of pelleted feed with varying protein content on growth and survival of tilapia (*Oreochromis niloticus*) fry. This was conducted from April 2022 to June 2022, in Tasiwalie Village, Suppa District, Pinrang Regency. The test animals used were tilapia aged 30 days, and feed include omega-3, Hi-Pro-vite 781, and Prima feed 500 grams each. An experimental method was employed using a Completely Randomized Design (CRD) with three treatment and replications, where treatment A, B, and C were Prima Feed (39 – 41%), Hi-Pro Vite (protein 31 – 33%), and Omega feed (protein 13 – 16%), respectively. Artificial feed was given at a dose of 5%/body weight 3 times a day. Also, water quality management was carried out by measuring temperature, dissolved oxygen, pH, and ammonia. The results showed that different feed affected protein retention with the highest average value of 43.23%, the highest average fat retention of 48.56%, absolute weight growth of 1.58 g, absolute length growth of 2.33 cm, daily specific weight growth rate of 3.75%, daily specific length growth rate of 5.56%, and feed utilization efficiency 70.60%. Furthermore, the best growth was obtained in treatment A, involving Prime Feed from 39 – 41%. This study showed that the percentage of protein had a significant effect on growth and survival of tilapia. Therefore, the feed industry is needed to formulate requirements based on tilapia fish, to increase production.

Introduction

Tilapia (*Oreochromis niloticus*, Linnaeus, 1758) is an essential commodity in Indonesia's freshwater fishery production, experiencing a significant increase on a yearly basis (Mulqan *et al.*, 2017). According to data (KKP, 2020), tilapia production in 2015, 2016, and 2017 was 1,084,281 tons, 1,114,156 tons, and 1,288,733 tons (Arafat *et al.*, 2015; Yildirim and Turan, 2010).

Feed is a source of material and energy for survival and growth of fish (Prabu *et al.*, 2017), and it is the largest component (50-70%) of production costs (Perius, 2011). The issue of increasing feed prices without an increase in the selling price of fish poses a challenge to fish cultivators (Nurhayati *et al.*, 2018). Therefore, cost-effective, and easily accessible alternative feed, particularly natural ones, are required to reduce production costs. Pellet are feed processed through factory mechanisms or human intervention (Arief *et al.*, 2009; Devani & Basriati, 2015). The protein requirements of tilapia range from 28-35% for optimal growth. In semi-intensive commercial fish farming, feed consumed by the cultured fish primarily depends on the supply provided by the cultivators (Haeruddin *et al.*, 2018; Wahyuningsih, 2009). Feed used in this study includes Omega-3 pellet feed, Hi-Pro Vite 781-1, and Prima Feed 500.

This study aimed to determine the effect of different pellets on growth and survival of tilapia fry (*Oreochromis niloticus*) and to identify the most effective feed. The findings contribute to the

* Corresponding author.
Email address: ikhsanwamnebo25@gmail.com

p-ISSN 2089-7790; e-ISSN 2502-6194
Received 25 November 2022; Received in revised form 27 April 2023; Accepted 17 May 2023
Available online 28 June 2023

knowledge and application of nutritional and energy requirements in tilapia farming. This provides benefits to readers, especially tilapia aquaculture businesses, in producing feed with maximum results in the industry.

Materials and Methods

Location and time of research

This study was conducted from April 2022 to June 2022, in Tasiwalie Village, Suppa District, Pinrang Regency. An experimental method designed with a Completely Randomized Design (CRD) was used, consisting of three treatment with replications. Treatment were arranged as follows according to Mahendra, 2018:

- Treatment A feed Prima Feed (protein 39 – 41%).
- Treatment B of Hi-Pro Vite feed (31 – 33% protein).
- Treatment C Omega feed (protein 13 – 16%).

Data analysis

About 9 Styrofoam containers with a volume of 20 liters were used. The containers were washed with soap and a sponge, rinsed with clean water, and then dried in the sun. Subsequently, each styrofoam was filled with 15 liters of filtered and precipitated water and then aerated. The test animals were tilapia seeds measuring 3 cm, with an average weight of 0.32 grams. Before use, tilapia seeds were adapted for 20 minutes. The study was conducted for 42 days, where feed and water quality management were implemented. Furthermore, the dosage of feed was 5% /biomass (Ghufron and Kordi, 2010) 3 times a day. The water quality parameters measured include temperature, pH of dissolved oxygen (DO), and ammonia. Additionally, the SPSS version 24 program was used to analyze the data.

Results

The protein retention value in tilapia is reflected by the contribution of consumed feed (Soedibya, 2013). Figure 1 shows Protein retention.

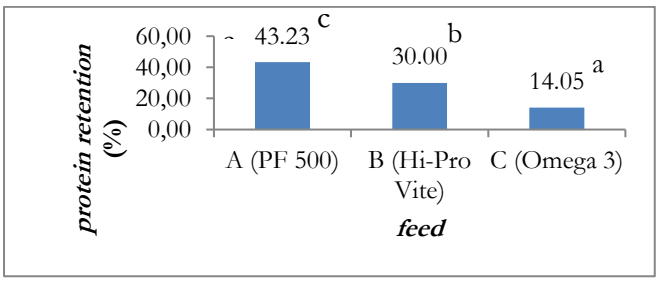

Figure 1. Protein Retention.

Protein retention in treatment A, B, and C was 43.23%, 30.00%, and 14.05 %, respectively.

Fat is a potential energy source that is easily digested. In addition, it is a carrier of soluble vitamins, strengthens cell membrane resistance, and increases nutrient absorption (Wahyudi, 2017). Figure 2 illustrated the Fat retention.

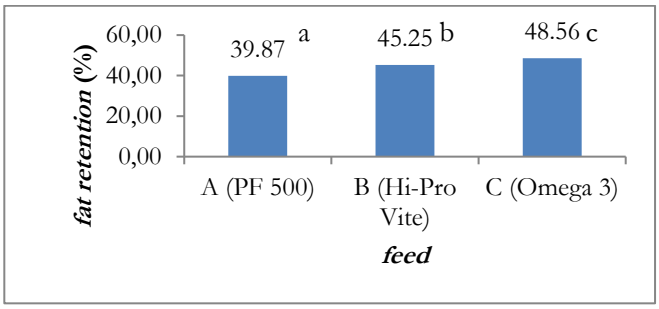

Figure 2. Fat Retention.

The fat retention of tilapia in treatment A, B, and C was 39.87%, 45.25%, and 48.56%, respectively.

Figure 3 showed the absolute weight growth, representing the difference between the average body weight of fish at the end and the beginning of the 42 days maintenance period.

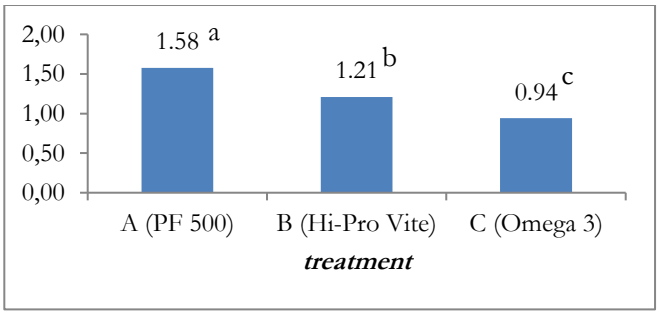

Figure 3. Absolute Weight Growth.

The absolute weight growth of tilapia obtained in treatment A, B, and C was 1.58, 1.21, and 0.94 grams. Figure 4 showed the absolute length growth.

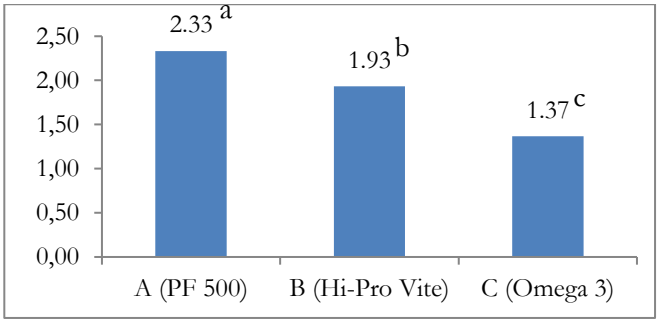

Figure 4. Absolute Length Growth.

The absolute length growth of tilapia in treatment A, B, and C was 2.33 cm, 1.93 cm, and 1.37 cm, respectively. Figures 5,6,7, and 8 displayed the daily specific growth rate.

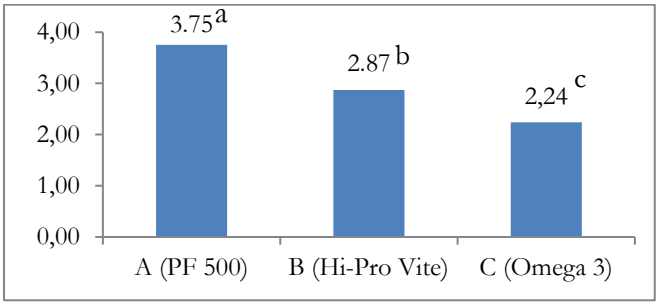

Figure 5. Specific Weight Growth.

The specific weight growth of tilapia in treatment A, B, and C was 3.75%, 2.87%, and 2.24%, respectively.

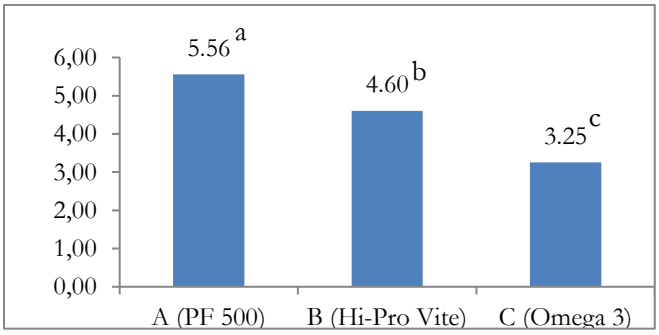

Figure 6. Specific Length Growth.

The specific length growth of tilapia in treatment A, B, and C was 5.56%, 4.60%, and 3.25%, respectively.

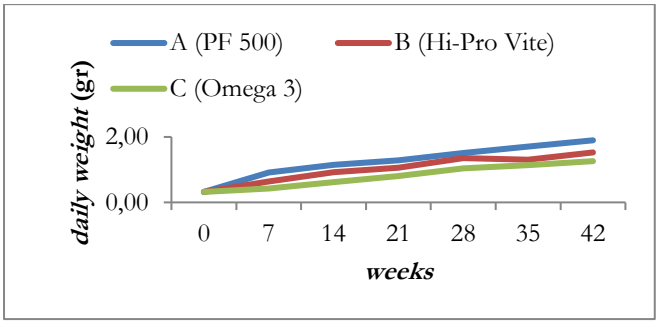

Figure 7. Daily/Week Weight Growth Rate.

Figure 7 showed that at the beginning of the maintenance period, growth rate was the same in all treatment, including PF-500, Hi-provite, and Omega 3. However, with an increase in rearing time and the weight of tilapia in the first week, treatment A (PF 500) showed a higher growth rate compared to treatment B (Hi-provite) and C (Omega 3).

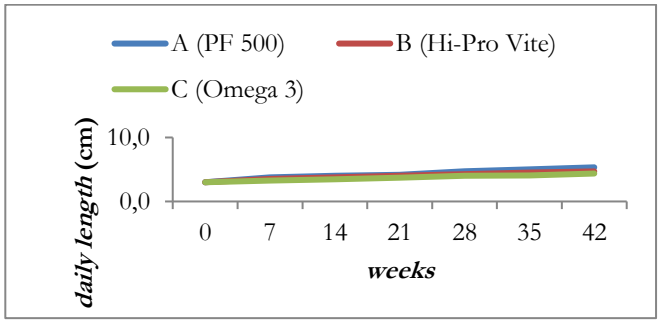

Figure 8. Daily/Week Length Growth Rate.

Figure 8 showed that the daily specific length growth in treatment A was better than in B and C. Growth at weeks 0 and 2 was the same. However, the length of growth in treatment A increased from weeks 3 to 6 compared to others, due to the ability to support feed requirements of tilapia seeds. This is in line with Sukadi (2003), where inadequate quantity and quality of feed can impede fish growth. According to Djarijah (2006), growth of tilapia relies on the energy obtained from feed being greater than the energy used for basic living activities. The fish consumes and digests its feed in the digestive tract and then produces energy for living activities, while the excess energy is stored in the form of meat for growth. Survival rate (SR) is observed in Figure 9.

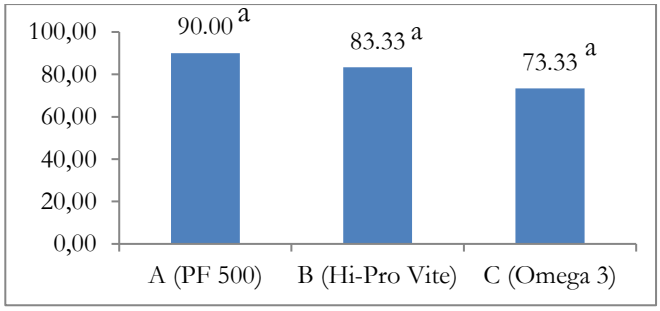

Figure 9. Survival Rate.

Survival rate of tilapia in treatment A, B, and C were 90.00%, 83.33%, and 73.33%.

Figure 10 illustrates the efficiency of feed utilization, obtained by comparing the increase in body weight of the fish and the amount of feed consumed.

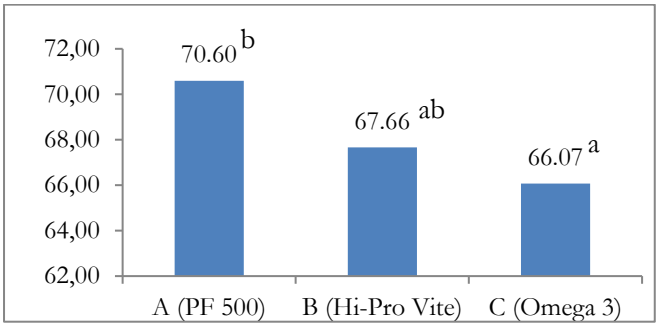

Figure 10. Feed Utilization Efficiency.

The efficiency of tilapia feed utilization obtained in treatment A, B, and C were 70.60%, 67.66%, and 66.0%. Table 1 showed the measurement of water quality.

Table 1. Results of Water Quality Measurement in Maintenance Containers.

parametre	treatment	Value range	Optimum value
temperature (°C)	A B C	27.4-29.8 27.4-29.8 27.1-29.8	25 – 32°C (SNI 7550:2009)
DO (ppm)	A B C	4.29-5.45 4.29-5.7 4.29-5.7	>3 (SNI 7550:2009)
pH	A B C	7.65- 8.39 7.62-8.31 7.46-8.4	6,5 – 8.5 SNI 7550:2009
NH3	A B C	0.109-0.1556 0.1123 0.1542 0.1124 0.2756	0.1- 0.2 (SNI 7550:2009)

During the study, the temperature range from 26.8-29°C, though the ranged in SNI 7550:2009 was 27.1-29.8°C. Water temperature affects fish life, with lethal temperatures ranging from 10-11°C for several days. The temperatures below 16-17°C reduce fish appetite, while those below 21°C facilitate disease attacks. According to Sucipto and Prihartono (2007) in Arifin (2016), the optimal temperature for fish cultivation ranges from 28–32 C.

Dissolved oxygen during the study ranged from 4.29 to 5.45 ppm. According to SNI 7550:2009, a favorable dissolved oxygen levels is more than 3 mg/liter. The fish require dissolved oxygen for respiration and metabolizing food, to produce energy for swimming, growth, reproduction, and others. Furthermore, the dissolved oxygen content in the water should be maintained above 5 mg/liter to increase fish productivity, because below 3 mg/liter decreases fish growth rate (Sucipto and Prihartono, 2007 in Arifin, 2016).

The pH ranges from 7.46-8.41 in this study, outside the recommended range of 6.5–8.5 according to SNI 7550:2009. This value illustrates the ability of water to produce mineral salts, which inhibit growth of fish if the needs of the organism are not met. Generally, the ideal pH is between 4-9, but for optimal growth of tilapia, it is between 6-8 according to (Kordi, 1997 in Arifin, 2016).

The ammonia levels are in the optimal range of 0.109 -0.2756 mg/l. These levels in freshwater should not be more than 0.2 mg/l because they can are toxic to some fishes. The toxicity of ammonia to aquatic organisms rises with a decrease in dissolved oxygen levels, and an increase in pH and temperature (Effendi, 2014).

Discussion

Treatment A (PF 500) had the highest protein retention because they were directly digested into the meat and the rest was excreted as feces. According to Wahyudi, 2017, some of the food eaten turns into energy for living activities, and the rest is eliminated.

Protein retention shows the body tissue protein deposition index used for growth. Also, it describes the quantity of protein in the fish body, and with the use of feed protein, the value increases or growth occurs (Wahyudi, 2017).

Treatment C exhibited the highest fat retention due to the high-fat content. Fat retention describes the ability of fish to store and utilize dietary fat. The excess fat is stored as fish body fat (Wahyudi, 2017). In addition, fat serves as a potential energy source, a carrier for soluble vitamins, a component of cell membranes contributing to membrane resistance, and increases nutrient absorption.

PF 500 feed has a higher protein content than others. This is in line with Asyari and Muflikhah (2005), where protein is an essential food for generating energy and growth. Also, it is the largest part of fish meat (Alfia *et al.*, 2013). Sukadi (2003) explained that the higher the protein content, the more effective effect on the absolute weight growth of fish (Yolanda, 2013). According to Hutabarat (2018), achieving optimum fish growth necessitates the use of high-quality feed that meets the nutritional requirements of fish. The nutritional value of feed is observed from the composition of

nutrients such as protein, carbohydrates, vitamins, and minerals.

The result of the absolute length measurement showed that treatment A had better growth than others due to the higher protein content. Individual growth occurs through the addition of tissue due to the addition of cells by mitosis. This is facilitated by excess energy-producing food substances and proteins that encourage growth process (Taufik *et al*., 2016; Hutabarat, 2018).

Treatment A provided a better survival rate than others. Survival of fish is influenced by various factors including environmental conditions, feed availability, competition between organisms and their physical condition, and water quality. These factors affect the mortality rate of the organism (Mulyani, 2014). Furthermore, the above factors should be managed to ensure a high survival rate. Survival rate of 50%, 30%-50%, and less than 30% survival is good, moderate, and unfavorable, respectively. Based on this study, survival rate of tilapia during maintenance was good, indicating that feeding frequency of different treatment affects survival of tilapia (Mulyani, 2014). According to Rukman (2000) in Rosyana, *et al*., (2016), the relationship between feed and growth for a particular type of fish is important to avoid wastage due to excess feed or lack of feed, resulting in stunted fish growth.

The utilization of feed in treatment A (PF 500) was more efficient than other treatment. This is due to the differences in protein content and energy values. The higher the energy in feed, the lower levels of feed consumption, because fish consume energy from feed, rather than the quantity given. According to Kim *et al.* (2005) in Putrianti *et al.* (2015), the ability of fish to digest feed affects the value of the protein efficiency ratio. This ability is influenced by several factors, such as the composition of feed, where the higher the protein used by the body, the more efficient the protein utilized by the fish. Craig and Helfrich., 2002, in Putrianti *et al*., 2015, stated that feed efficiency is influenced by energy levels. High energy levels cause satisfaction in the fish and they stop feeding immediately. Also, increased levels of non-protein in feed raise the total energy beyond the needs of the fish.

Fish production in aquaculture relies on a high-quality water supply (Mas'ud, 2014). The cultivation is unsuccessful if it is carried out with disturbed or polluted water quality without any countermeasures (Sumule *et al.,* 2017).

Conclusion

The use of different feeds affected protein retention, fat retention, absolute weight growth, absolute length growth, daily specific growth rate, and feed utilization efficiency. However, it does not affect survival rates. Treatment A (PF 500 pellet feed) demonstrated a good growth rate compared to others.

References

Afrianto, E., E. Lifiawaty. 2005. Fish Feed and Its Development. Kanisius, Yogyakarta.

Aina, S. 2020. Final Project. Feed Management Techniques on Raising Tilapia (*Oreochromis niloticus*) at Fish Seed Center (BBI) Bontomanai, Gowa.

Alfia, A. R., E. Arini, T. Elfitasari. (2013). The Effect of Different Densities on the Survival and Growth of Tilapia (Oreochromis niloticus) in Recirculation Systems with Bioball Filters. Journal of Aquaculture Management and Technology. 2(3): 86-93.

Amri. 2003. Intensive Tilapia Cultivation. Agromedia Library. Jakarta.

Amri, K., Khairuman. 2002. Making Fish Feed Consumption. Central Agro Media, Jakarta.

Arafat M.Y., N. Abdulgani, R.D. Devianto. 2015. The effect of adding enzymes to fish feed on the growth of tilapia (Oreochromis niloticus). Journal of Science and Arts ITS, 4(1): 2337 –3520.

Arief, M., T. Irmaya, P.L. Widya. 2009. Effect of natural feed and artificial feed on the growth of betutu fish (Oxyeleotris marmorata Bleeker). Fisheries and Maritime Scientific Journal, 1(1): 51–57.

Arifin, M., S. Hastuti., D. Rachmawati. 2018. The Effect of Fasting Period on Feed Utilization Efficiency, Growth and Survival of Carp (Cyprinus carpio). Journal of Aquaculture Management and Technology, 7(1): 18-27.

Arifin, M.Y. 2016. Growth and Survival Rate of Tilapia (Oreochromis. Sp) Red Strain and Black Strain Raised on Salinity Media. Scientific Journal of Batanghari University Jambi, 16 (1).

Carman, O., A. Sucipto. 2011. Secrets of Successful Tilapia Cultivation. Power spreader, Jakarta.

Caroline, L., L. Lahindah. 2017. Analysis and Proposed Marketing Strategy with QSPM Method (Case Study on MSMEs in Bandung: Bandung Waringin Fish Feed). Indonesian Journal Of Marketing Science, 16(2): 86-102.

Cholik, F. 2005. Aquaculture. Archipelago Fisheries Society. Freshwater Aquarium Park. Jakarta. Global Aquaculture. Advocate, 5(3): 36-37.

Devani, V., S. Basriati. 2015. Optimization of the nutritional content of artificial fish feed using a multi objective (Goal) programming model. Journal of Science, Technology and Industry, 12(2): 255–261.

Dewi, R.R.S.P., E. Stageari. 2017. Utilization of Commercial Probiotics on Catfish (*Clarias gariepinus*) Raising. Journal of Aquaculture Research, 12(3): 275-281.

Djarijah, A.S. 2001. Cultivation of catfish. Canisius, Yogyakarta.

Effendi, H. 2014. The Study of Water Quality: For Management of Aquatic Resources and Environment. Canisius, Yogyakarta.

Fadilah, R. 2021. Effect of Giving Viterna with Different Doses to Fish on Growth and Survival of Tilapia (Oreocromis niloticus) Seeds. Thesis. Muhammadiyah University of Makassar.

Ghufran, 2013. Superior Tilapia Cultivation. Agro Media Library, Jakarta

Ghufron, M., K. Kordi. 2010. Cultivation of catfish in tarpaulin ponds, Lily Publisher. Yogyakarta.

Haeruddin, S. Supriharyono, Febrianto. 2018. Water Quality Improvement of Media Culture for Tilapia (*Oreochromis*

niloticus) with Cleaner Production Method. International Conference on Tropical and Coastal Region Eco Development 2017 2–4 October 2017, Yogyakarta, Indonesia, 116, 012080

Halver, J. E. 1989. Fish Nutrition. Ed. 2nd. Academic Prees. INC. New York.

Harmia. 2022. Application of Commercial Feeding with Different Doses in the Maintenance of Tilapia Seed (Oreochromis niloticus Linnaeus 1758). Thesis. Pangkajene Islands State Agricultural Polytechnic. Pangkep.

Hutabarat, J. 2018. Substitution of Fish Meal with Maggot. Trobos Aqua Barometer Agri Marine and Fisheries Business.

Jannah, M. 2001. Manual of Tilapia Parent Production. BBAT Jambi. Jambi.

Ministry of Maritime Affairs and Fisheries. 2020. KKP Performance Report. https://kkp.go.id/article/28333-laporan-kinerja-kkp-2020

Kordi, M.G.H.K. 2010. A Complete Guide to Keeping Freshwater Fish in Tarpaulin Ponds. ANDY: Yogyakarta. 280 pp.

Linnaeus, C. 1758. System Nature per Regna tria Naturae, secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis Synonymis, Locis, (ed. 10)

Mahendra. 2018. Different Commercial Feeds on Growth and Survival of Tawes Fish Seed (barbonymus gonionotus). Journal of Integrated Fisheries Volume 1 and 2.

Mas'ud, F. 2014. Effect of water quality on the growth of tilapia (Oreochromis sp.) in concrete and tarpaulin ponds. Grouper Scientific Journal of the Faculty of Fisheries, Lamongan Islamic University, 5(1): 1-6.

Millamena, O.M., M.C. Relicado., P.P. Felicitas. 2002. Nutrions in Tropocal Aquaculture. Southeast Asian Fisheries Development Center. Tigbauan, Iloilo, Philippines.

Mudjiman. 2001. Food, right? Print IX. Spreader Swadya. Jakarta.

Mulqan, M., S.A. El Rahimi, I. Dewiyanti. 2017. Growth and Survival of Nile Tilapia (Oreochromis niloticus) Seeds in Aquaponic Systems with Different Plant Types. Unsyiah Marine and Fisheries Student Scientific Journal. 2(1): 183-193.

Mulyani, Y.S. 2014. Growth and Feed Efficiency of Tilapia Feeding Periodically Fasted. Indonesian Journal of Swamp Aquaculture, 2(1): 01-12.

Nurhayati., T. Azwar, A. Muhammad. 2018. Application of unfermented and fermented cassava peel waste as a constituent of feed rations on the growth of tilapia (Oreochromis niloticus). Proceedings of the Asahan University Multidisciplinary National Seminar.

Perius, Y. 2011. Fish Nutrition. http://yulfiperius.files.wordpress.com/2011/07/1 introduction.pdf. [Accessed April 10, 2022].

Prabu, E., S. Felix., N. Felix., B. Ahilan, P. Ruby. 2017. An overview on significance of fish nutrition in aquaculture industry. International Journal of Fisheries and Aquatic Studies, 5(6): 349-355.

Putrianti, G.P., Subandiyono, Pinandoyo. 2015. The Effect of Different Protein and Energy on Artificial Feed on Feed Utilization Efficiency and Growth of Carp (Cyprinus carpio). Journal of Aquaculture Management and Technology, 4(3): 38-45.

Rasyid, A. 2003. Omega-3 Fatty Acids from Fish Oil. Oceana, 28(3): 11-16.

Rosyana, G., N. Limiyati., R. Romansyah. 2016. The Effect of Feeding Azolla Pinnata on Tilapia Growth. Journal of Biology Education, 4(1): 50-55.

SNI 7550. 2009. Production of Black Tilapia (*Bleeker*) Enlargement Class in Calm Water Ponds. National Standardization Body. Jakarta. Farmer's Editorial Staff. 2014. Complete Guide to Tilapia Cultivation. https://alamtani.com/budidaya-ikan-nila.

SNI 7550. 2009. Production of Black Tilapia (*Oreochromis niloticus Bleeker*) Enlargement Class in Calm Water Ponds. National Standardization Body. Jakarta. Farmer's Editorial Staff. 2014. Complete Guide to Tilapia Cultivation. https://alamtani.com/budidaya-ikan-nila/

Soedibya, P.H.T. 2013. Protein retention in GIFT tilapia (*Oreochromis niloticus*) fed Azola pinnata diet enriched with probiotic microbes. Indonesian Journal of Aquaculture, 12 (2): 109–113.

Sukadi, M.F. 2003. Strategy and policy for developing feed in aquaculture. Proceedings of the semi-workshop on the application of feed technology and its role in the development of aquaculture business. Aquaculture Research Center. Marine and Fisheries Research Agency. pp 11-21.

Suryanto. 2003. Seedling and Enlargement of Tilapia. Self-Help Spreader. Jakarta.

Wahyudi, P. 2017. Application of Rumen Fluid in Commercial Feed with Different Doses on Protein Retention and Fat Retention in Black Tilapia Seeds. Thesis. Muhammadiyah University of Makassar.

Wahyuningsih, S. 2009. Effect of feed composition on growth rate of tilapia [thesis]. Semarang: Faculty of Mathematics and Natural Sciences IKIP PGRI Semarang.

Webster, C.D., C.E. Lim. 2002. Nutrien Requirements and Feeding of Finish for Aquaculture. CABI Publishing, New York.

Yildirim Y.B., F. Turan. 2010. Effect of suppl ementation in diet on growth and feed utilization in African Catfish Clarias garipenius. Journal of Animal and Veterinary Advances 9: 327–331.

Yolanda, S., L. Santoso, E. Harpeni. (2013). The Effect of Fish Meal Substitution with Trash Fish Meal on the Growth of Nile Tilapia (Oreochromis niloticus). Journal of Aquaculture Technology and Engineering, 1(2): 96-100.

Zulkhasyni., Adriyeni., R. Utami. 2017. The Effect of Different Feed Pellet Doses on the Growth of Red Tilapia (Oreochromis Sp). Agroqua Journal Effect of Feed Dosage, 15 (2)

How to cite this paper:
Wamnebo, M.I., S. Hadijah, A. Hamdillah. 2020. Effect of different feed pellet on growth rate and survival levels of tilapia seeds (*Oreochromis niloticus*). Depik Jurnal Ilmu-Ilmu Perairan, Pesisir dan Perikanan, 12(2): 125-130.