EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES

http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 1
10-14
Year: 2022

EFFECT OF THREE DIFFERENT DIETS ON GROWTH AND SURVIVAL OF TILAPIA (OREOCHROMIS NILOTICUS) CULTURE IN A FIBRE GLASS TANK

***[1]Adams T. E., [2]Edokpia R. O., [3]Okonji V. A. and [1]Yakubu A. F.**

[1]Nigerian Institute for Oceanography and Marine Research. Sapele, Delta State. Nigeria.
[2]Department of Production Engineering. University of Benin, Benin City. Nigeria.
[3]Department of Fisheries. University of Benin, Benin City. Nigeria.

***Corresponding Author: Adams T. E.**
Nigerian Institute for Oceanography and Marine Research. Sapele, Delta State. Nigeria.

Article Received on 27/10/2021 **Article Revised on 17/11/2021** **Article Accepted on 07/12/2021**

ABSTRACT

The effect of three different diets on growth and survival of tilapia (*Oreochromis niloticus*) culture in a Fibre Glass Tank was examined. Nine circular Fibre Glass Tanks of 3.08m^3 capacities and depth of 60.5cm each and diameter 176.78cm were used in the experiment. The treatments were dried chicken manure only, dried chicken manure with commercial diet (coppens) and commercial diet (coppens) only as control. Random fish samples 50 from each treatment were taken to determine the final mean weight. Table 3 below further show that there were significant differences in final weight gain between the three feed types, treatment I (143.47g), treatment II (171.97g) and treatment III (272.10g). The highest final mean weight gain of 272.10g was recorded in treatment III that was fed with coppens only, followed by treatment II with final mean weight gain of 171.97 fed with chicken manure with coppens and the least final mean weight gain of 143 47 was observed in treatment I fed with chicken manure only. In general, final mean weight increased and performed better with treatment that were fed with coppens only. Survival rate exceeded 90% in all treatments. Treatment I recorded 77%; treatment II 99% and treatment III 99.33% which is the highest survival rate.

KEYNOTES: Growth, Fibre Glass Tanks, Diets.

1.0 INTRODUCTION

In Nigeria, tilapia production is predominantly an extensive land based (earthen ponds) system practiced at subsistence levels (Fagbenro, 2002) while commercial tilapia culture is yet to become popular and widespread (Afolabi *et al.*, 2000). Its current yield is 14,388tone/year (Fagbenro and Adebayo, 2005).

Tilapia ingest a wide variety of natural food organisms including plankton, some aquatic macrophytes, planktonic and benthic invertebrates, larval fish, detritus and decomposing organic matter (Popma and Masser, 1999). With heavy supplemental feeding, natural food organisms typically account for 30 to 50 percent of tilapia growth. Tilapia is often considered filter feeders because they can efficiently harvest plankton from the water. They are versatile feeder and farmed tilapia will accept prepared diet immediately after the initiation of feeding; the use of complete supplementary feeds or complete feed can accelerate growth by 5-10, thus increasing yields and shortening culture time (Harley, 1990).

The nutritional quality both of commercially manufactured fish feeds produced on- site by fish farmers, depend on the quality of feed ingredients used (Nalwanga *et al.*, 2009). Since the quality of complete feeds depends on the quality of ingredients (Glencross *et al.*, 2007; Lie *et al.*, 2006; Aksnes and Mundheim, 1997), the nutrient content of feed ingredients should be seen as a starting point for any attempt at improving feed quality at the production level (Nalwanga *et al.*, 2009).

Craig and Helfrich (2002) reported that the sustenance and expansion of tilapia production is limited by the high cost of fish feeds, which comprise over 50% of the production costs.

According to Tacon (1993), protein is usually the most expensive nutrient and its level and quality determine the cost of fish feeds. In addition, most fish feeds contain a proportion of animal protein, which is considered superior to other sources in terms of palatability and nutrient availability (Tacon, 1993). Growth of Nile tilapia (*O. niloticus*) is primarily dependent on the absolute protein intake (g protein kg^{-1} day $^{-1}$) (Tacon and Cowey, 1985; Bowen, 1987) rather than on the dietary protein level (Yakupitiyage, 1989). There have been several reviews of the nutrition and feeding of tilapia in commercial operations (Ulloa, 1995; Diana, 1997; Lim, 1997; El-Sayed, 2006). Early tilapia production systems relied on natural food organisms as the source for nutrition (Lim and Webster, 2006). These early production systems were extensive in nature. As the industry expands and the technology development continues, traditional extensive culture of tilapia is being replaced by semi intensive and intensive production systems. In semi-intensive farming systems, supplemental feeds that consist of locally available, low-cost single feedstuffs, such as rice bran, copra meal, coffee pulp, brewery by-products and/or their combination, are generally used as supplements to natural food (Lim, 1989). Several factors including fish size or age, dietary protein source, energy content, water quality and culture conditions have been reported to affect protein requirements of tilapia (NRC, 1993).

The escalating price of fish feed necessitate alternative means of feeding fish hence this study aimed at comparing the effect of two low cost diets with commercial diet on growth and survival of tilapia (Oreochromis niloticus) culture in a fibre glass tank.

2.0 MATERIALS AND METHOD

The study was conducted at the Nigerian Institute for Oceanography and Marine Research Sapele out station Sapele Local Government Area of Delta State, Nigeria (N50 54´.5´´E005^{o}39´56.4´´).

Nine circular Fibre Glass Tanks were used in the experiment. All experimental tanks were identical in shape and size. Tanks capacities were 3.08m^3 and depth of 60.5cm each and diameter 176.78cm. The tanks were washed and disinfected with salt solution before water was introduced into the tanks from treated bore hole in the station. Sex reversed Nile tilapia (*Oreochromis niloticus)* of 0.80g average size was stocked. The tanks were divided into three culture systems that is intensive culture, semi intensive culture and extensive culture in triplicates for each culture system. The treatments were dried chicken manure only, dried chicken manure plus commercial diet (coppens) and commercial diet (coppens) only as control. These treatments was used to determine the dissolved oxygen dynamics in each culture system and to predict the effect of other water quality parameters on dissolved oxygen in the treatment tanks. Three hundred (300) fish were stocked in each tank.

The fish used for this experiment were fingerlings of all male Nile tilapia (*O. niloticus*). Fish were fed at 800hr and 1600hr with dried chicken manure, chicken manure plus commercial feed (coppens) and commercial feed only (coppens). The feeding rate was 5% of the total fish biomass presented in each tank and the feed amount was adjusted every two weeks for each tank separately according to the biomass available which was determined during sampling. The adjustment was done by calculating the average weight of the fish sample, multiply by the total biomass express in percentage.

Random samples of 75 fish were taken biweekly from each treated tank during the experimental period. Fish samples were obtained in the early morning (between 7.00hr to 9.00hr) to avoid the heat of the sun and kept in Fibre Glass containers filled with water from the same tank to avoid fish stress during the different measurements.

Analysis of crude protein, crude fibre, ether extracts, ash and moisture content were done for the chicken manure and the commercial diet (Coppens) following AOAC (1990) procedures for the feed.

Seventy five (75) fish which is 25% of the fish stocked in each tank were randomly sampled biweekly from each treatment tank and weighed in a weighing balance during the experimental period.

From the measurements, the following parameters were determined:

Initial weight of Fish in gram (g):

Final weight of fish harvested (g)

$$Bi-weekly\,mean weight\,gain\,(g) = \frac{Total\,bi-weekly\,weight\,(g)}{Total\,No\,of\,fish\;\;weight\,(g)} \qquad (1)$$

$$Absolute\,growth rate\;\;(g/day) = \frac{Final\,weight - Initial\,weight\,of\,fish}{Culture\,peroid\,(days)} \qquad (2)$$

$$Specific\;growth\,rate\,(SGR\%\;day) = 100 \times \frac{(\ln Final body weight\;-\ln Initial body\,weight)}{\mathrm{Re}aring\;peroid\,in\,days\,(t)} \qquad (3)$$

Where

ln = natural log

$$Feed\;Conversion\,Ratio\;=\frac{Total\;weight\;of\;\;feed\;consumed}{Total\;weight\;of\;\;fish\;produced} \qquad (4)$$

$$Fish\,Survival\,Rate\,(SR\%)\;\;=\frac{Total\;\;fish\,number\,harvested}{Total\;\;fish\,number\,stocked}\times 100 \qquad (5)$$

$$Fish\ Yield = \frac{Total\ weight\ of\ fish\ harvested\ over\ culture}{\left(g/180\,days/3.08m^3\right)} \times 100 \quad (6)$$

At the end of the experiment (24 weeks of fish culture), tanks were drained and fish were harvested by hand picking. Total weight of the fish was taken i.e. The total biomass and total number of fish counted in each tank. Random fish samples 50 from each treatment were taken to determine the final mean weight. Harvested fish were kept in plastic containers for marketing.

3.0 RESULT AND DISCUSSION

Using equation 1, the mean weight gain in treatment I was found to be 42.49 while that of treatment II recorded was 55.77 and treatment III was 108.91. Fish in treatment III showed the highest mean weight gain of 108.91 which was significantly different from all the other treatments (Table 1). Fish in treatment I and II recorded 42.49 and 55.77 respectively, which were not significantly different from each other.

Table 1: Values of bi-weekly mean weight gain 0f All male tilapia *O niloticus* fed with three different types of feed.

	Treatment I	**Treatment II**	**Treatment III**
Weeks	**Chicken Manure Only (g)**	**Chicken Manure With Coppens (g)**	**Coppens Only (g)**
2	0.83	0.77	0.80
4	1.07	1.39	1.98
6	4.50	6.63	15.53
8	9.14	13.64	33.17
10	14.05	20.55	51.57
12	19.74	27.84	72.09
14	26.57	35.79	103.81
16	40.38	58.04	135.35
18	59.38	85.04	174.63
20	79.27	107.67	206.73
22	111.48	139.87	239.10
24	143.47	172.97	272.10
X	42.49^b	55.77^b	108.9^a

Table 2 below further show that there were significant differences in final weight gain between the three feed types, treatment I (143.47g), treatment II (171.97g) and treatment III (272.10g). The highest final mean weight gain of 272.10g was recorded in treatment III that was fed with coppens only, followed by treatment II with final mean weight gain of 171.97 fed with chicken manure with coppens and the least final mean weight gain of 143 47 was observed in treatment I fed with chicken manure only. In general, final mean weight increased and performed better with treatment that were fed with coppens only.

The average value of Specific growth rate ranges between 4.96 in treatment I, 5.14 in treatment II and 5.60 in treatment III as shown in table 3, this was estimated using equation 3. However, the differences in Specific Growth Rate values between the different experimental treatment were not far from each other hence are not significant.

Survival rate exceeded 90% in all treatments. Treatment I recorded 77%; treatment II 99% and treatment III 99.33% which is the highest survival rate. Table 3 gives the values and this was estimated using equation 5.

There was a significant difference in feed intake among the treatments. Feed intake increased progressively from a low intake of 584.5g for treatment I to 823.70g in treatment II and a high feed intake of 1596.30g for treatment III by measurement. Furthermore, the data indicated that at a similar stocking density fish fed with chicken manure only consumed significantly less feed than those fed with chicken manure with coppens and coppens only as shown in Table 3.

Table 2: Growth performance of all male Tilapia fed with chicken manure only, chicken manure with coppens and coppens only in a fibre glass tank.

Parameters	Treatments		
	I (Chicken manure only)	II (Chicken manure with coppens)	III (Coppens only)
Initial mean weight (g)	0.83	0.77	0.80
Mean weight gain (g)	42.49^{b}	55.77^{b}	108.91^{a}
Final mean weight (g)	143.47^{c}	171.97^{b}	272.10^{a}
Specific growth rate (%/day)	4.96^{a}	5.14^{a}	5.60^{a}
Survival rate (%)	77^{a}	99^{a}	99.33^{a}
Feed intake (g feed/fish)	584.50^{c}	823.70^{b}	1596.30^{a}
Feed Conversion Ratio	1.95	2.75	5.32

Mean with different superscripts in the same row are significantly different

There was a significant difference in the size of the fish at harvest among the treatments (P<0.05). Treatment III showed the largest size of 272.1g (Table 3). This was followed by treatments II (172.07g) and treatment I with 143.47g respectively. The general pattern was that at similar stocking density, Treatment that received Coppens only performed better than those that was fed with Chicken manure with coppens and Chicken manure only. There was no significant difference in mean biomass among the treatments (P>0.05). The highest mean biomass of 27.2kg was recorded in treatment III whereas the lowest mean biomass 14.3kg was observed in Treatment I and 17.207 in treatment II. Mean biomass generally increase with the feed type in the treatment that received Coppens only than treatment that received Chicken manure with coppens and Chicken manure only as diet. (Table 3).

Table 3: Number of biomass (kg) and mean size (g) of All Male Tilapia *O. niloticus* stocked and harvested in each treatment.

Treatment	Stocking			Harvest		
	Number	Mean Biomass (kg)	Mean size (g)	Number	Mean Biomass (kg)	Mean size (g)
Chicken manure only	900	0.83*	2.49	831	14.347*	143.47
Chicken manure with coppens	900	0.77	2.31	897	17.207*	172.07
Coppens only	900	0.82*	2.46	898	27.210*	272.10

CONCLUSION

The study has been able to discover that the fish in treatment III grows better than treatment II which in the normal case of earthen pond Treatment II supposed to grow better because of the fertilizer that will decompose and form phytoplankton and zooplankton as extra food for the fish to grow.

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