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Research Article

Determination of the Growth Performance, Feed Conversion Efficiency and Yield of Catfish (Clarias Gariepinus) Fed With Floating (Foriegn) Feed and Sinking (Local) Feed At Various Life Stages

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ABSTRACT

The need to identify and recommend the right type of feed to be fed to catfish under culture conditions became necessary since fish feed accounts for over 60% of the total cost of production. The fact that most farmers are unaware of the right type of feed to be fed to catfish also makes them vulnerable to avoidable losses. And also, the dependence on floating diets limits the development of African catfish, C. gariepinus farming because they are more expensive, require specialized facilities to produce, and arguably may be inappropriate based on the bottom-feeding behaviour of the species. Determination of the effect of floating and sinking diets on the growth performance, feed conversion efficiency, and yield of C. gariepinus were observed for 10 weeks at the experimental tank of the Department of Aquaculture and Fisheries Management, University of Benin, Nigeria. The experiment was designed as two feed type X4 life stage factorial in a complete randomized design. The proximate compositions, growth performance of the feed, and water quality of the cultured tanks were assessed.

Fish fed with skretting (floating feed) showed significant ($P<0.05$) higher mean weight gain (44.9 g) compare to the local feed with a lower weight gain (18.4 g), Fish fed with foreign feed had a higher absolute growth rate (1.06 g) compare to local feed with (0.95). Fish fed with foreign feed had low feed conversion ratio (0.6) compare to local feed (1.06). Significant ($P<0.05$) higher mortality rate was recorded in fish fed with the local feed (83.61%) compared to fish fed foreign feed (88.67%). The growth performance was a reflection of the proximate composition of the feeds with, local feed having low crude protein when compared to skretting feed. Mortality was attributed to stress resulting from the poor quality of the feed.

Keywords: Foreign feed; local feed; C. gariepinus; Growth

INTRODUCTION

Fish is an important food source to man and due to the rapid increase in the population of the world, the demand for fish and fish products as the cheapest source of animal protein have been on the increase (FAO, 2000). Aquaculture is playing a crucial role not only in meeting the protein need of a significant proportion of the world population but, also in boosting the economy of most developing nations. Aquaculture techniques were developed in an attempt to bridge the gap between fish demand and fish supply. Aquaculture has remained the most sustainable source of fish production and supply.

The main challenge faced by the Nigerian Aquaculture industry is the high cost of feed ingredients which constitutes about 60% of the total production. Indirect devaluation of the naira has also resulted in the hike of raw material prices, particularly fishmeal, maize, and soybean. These have resulted in a sudden jump in the prices of aquafeeds.

Commercial AquaFeeds are feeds that are formulated to meet the nutritional requirements of a distinctive fish species and their different life stages. Two forms of commercial aquafeeds have been identified viz. locally manufactured (mostly sinking pellets) and imported commercial feeds (mostly floating pellets) [1].

Despite the remarkable growth in aquaculture, many fish farms continue to stop production due to the non-profitability of the operations as a result of the high cost of inputs especially feeds. Like any other economic activity in life, balancing investment cost and yield is very important as this will ensure positive returns to the farmer. It is always useful for fish farmers to know the profitability of fish culture to guide their decision-making [2]. Fish farmers can make more profit when they are aware of the possible ways to minimize costs without affecting the growth of the fish. This can be achieved through proper feeding of the fish.

Limited studies have been carried out to explore the bottom-feeding habit of Clarias gariepinus to recommend a suitable diet

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between floating and sinking diets [3] at various life stages. Consequently, farmers do not know which diet to choose for their Clarias gariepinus due to insufficient published scientific information on growth, nutrient utilization, and yield for the various life stages of the fish. This has been costly to Clarias gariepinus farmers because they tend to use the costly floating diets only, without exploring the option of the cheaper sinking pellets at the early stage.

Therefore this study is focused on the determination of the maximum growth and productivity of Africa catfish (Clarias gariepinus) fed with local (sinking) and foreign feed (floating) at various life stages.

MATERIALS AND METHODS

The study was carried out in the Department of Aquaculture and Fishery Management Experimental Farm, Faculty of Agriculture, University of Benin. It is located in Ovia North East Local Government, Benin City, Edo State, Nigeria.

A total of one thousand two hundred fry of Clarias gariepinus was used for the study. The fish was acclimatized for two weeks before stocking. The experiment was made up of two feed types (local and foreign) and was fed for a 10 weeks period. The experiment was designed a complete randomised design. Each treatment was replicated three times.

The experiment was conducted on two types of feed treatments which are the foreign feed treatment (Trt1) and the local feed treatment (Trt2). Each treatment was replicated three times with a total of 6 experimental plastic tanks of 2000 L capacity. The tanks were washed and allowed to dry. Clean water was impounded into each tank and then stocked with 200 fry of Clarias gariepinus. i.e a stocking rate of 50 fish/L of water for a maximum water depth of 1000 L. The source of water was a borehole. Water depth will be maintained at 1 m (1000 L) level daily. Water quality was maintained by occasional flushing of the ponds to remove excess organic particles of algae and feeds [4]. When Sacchi disc reading falls below 30 cm, occasional flushing was carried out at least twice a week.

Growth parameters monitored

(i) Survival rate (%),

$$\text{Survival rate (\%)} = \frac{\text{Number of surviving fish}}{\text{Total number of fish stocked}}$$

(ii) Mean Weight Gain (g) (MWG):

$$\text{MWG (g)} = \text{Wt2} - \text{Wt1}$$

Where Wt1=Initial mean weight of fish at time T1 in gram (g)

Wt2=final mean weight of fish at time T2 in gram (g)

(iii) Absolute growth rate (g/day)

$$\text{Absolute growth rate (g/day)} = \frac{\text{Final weight (g)} - \text{Initial weight (g)}}{\text{Culture period (days)}}$$

The growth parameters monitored included;

(iv) Fish yield (kg/m3)

$$\text{FCR} = \frac{\text{Weight of feed given (g)}}{\text{Fish weight gain (g)}} \quad 5$$

(v) Feed conversion ratio (FCR):

$$\text{FCR} = \frac{\text{Total fish weight harvested over culture period (kg)}}{\text{Volume of culture facility (m}^3\text{)}} \quad 4$$

Statistical analyses

Data collected were analyzed using Genstat Statistical Package 2005 version. Means were separated using Duncan analyses multiple range test. The test was carried out at 5% profitability level.

RESULTS AND DISCUSSION

Table 1 shows that there was a significant difference in bi-weekly weight gain, survival rate, absolute growth rate, feed intake, and feed conversion ratio among the two treatments ($p<0.5$) over the culture period, foreign feed (Trt1) had the highest bi-weekly mean weight gain, survival rate, absolute growth rate, feed intake and feed conversion ratio which was significantly higher than that of local feed (Trt2). Also, bi-weekly mean weight gain, survival rate, absolute growth rate, feed intake and feed conversion ratio increase significantly from week 2 to week 10 among the treatments.

Table 2 shows that the results of water quality parameters ob-

Table 1: Growth performance of C. gariepinus fed various feeding rates.

Parameter	Foreign(Trt1)	Local(Trt2)
mean weight gain	44.9a	18.4b
Survival rate	88.67a	83.61b
Absolute growth rate (g/day)	1.06a	0.95b
Feed Intake (kg)	2.48a	1.1b
Feed Conversion Ratio	0.6a	1.0b

tained during the study. The result in the Table 2 indicates that there was a significant difference in dissolved oxygen concentration, pH concentration, water turbidity, and water temperature among the two treatments ($P<0.05$) the foreign feed (Trt1) tank had the highest dissolved oxygen concentration and pH concentration which was significantly higher than that of local feed (Trt2) tank. While the local feed (Trt2) tank had the highest transparency and temperature reading which is higher than that of the foreign feed (Trt1) tank?

Table 2: Average water quality parameters measured during the experimental analysis.

Parameters	Trt1	Trt2
Dissolved oxygen (mg/l)	4.10a	3.72b
pH	6.03a	5.96b
Transparency (cm)	41.80a	58.60b
Temperature (°C)	29.65a	30.4b

Growth parameters

The result of the bi-weekly weight gain in Figure 1 shows that treatment 1 (Trt1) was better than treatment 2 (Trt2). Therefore, indicating that the local feed used in the experiment (like most other local feed sold and used in Nigeria) produced a poor growth response in C. gariepinus as compared to the imported foreign commercial feed of skretting.

The absolute growth rate was higher for Trt1 than Trt2. The poor growth response is a result of the proximate composition of the local feed. According to [5], the quality of a feed is a function

of how well that feed meets the nutrient requirement of a fish. The good growth performance of fish fed with skretting is an indication that the feed contains well-balanced nutrients as seen in the proximate composition of the feed as well as its high digestibility and nutrient utilization. The absolute growth is the visible expression of the net outcome of energy gains and losses with a framework of abiotic and biotic conditions [6].

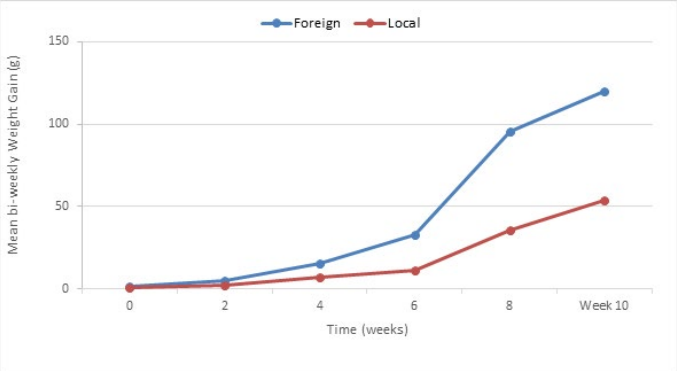

Figure 1: Mean bi-weekly weight gain of clarias gariepinus fed local and foreign feed.

Feed conversion ratio

Trt1 has a lower feed conversion ratio than Trt2. The low protein content in the local feed was responsible for the high FCR record in the table size fish, thereby making the production of the feed more expensive than foreign feed which requires less feed for fish attain table size. [7] Reported low food conversion efficiency in the local feed not eaten and that the tank also recorded the highest water quality deterioration compared to the other tanks throughout the experiment. A similar scenario has been reported by [8].

Survival rate

Fish survival was higher in Trt1 than Trt2. The high mortality recorded in Trt2 was attributed to the poor quality of the feed and high FCR. The lack of a balanced ratio in the feed gave rise to a large amount of uneaten feed which subsequently decomposed leading to the deteriorating water quality in the poor growth and mortality. [9] Stressed that lack of essential and balanced nutrients in feed could lead to poor growth and mortality, while [3] observe that stressful conditions in culture tanks of C. garipienus always lead to their mortality.

Water quality parameter

The result of the water quality parameter was not affected by the diet forms and was within the range recommended for African catfish culture [10,11] except for the slightly acidic pH. This highlighted that feeding C. gariepinus with a commercial and locally formulated diet does not cause significant deterioration of water quality parameters provided the diets are formulated correctly, the fish are fed optimally and there is occasional flushing of the tank water often.

Trt1 had a higher dissolved oxygen level than Trt2. But both treatments were within the tolerable range for C. gariepinus fish culture. As C. gariepinus is known to survive under extremely low dissolved oxygen (0-3 mg/l) [12], especially with fully absorbent organs (aid in air-breathing). Such a condition makes C. gariepinus survive in extremely poor conditions than any other fish species [13]. Nevertheless, farmers are advised to maintain water quality parameters including dissolved oxygen in the recommended level (>5.00 mg/l) for optimum C. gariepinus growth and survival [14]. Dissolve oxygen is needed for the aerobic generation of energy for body maintenance, growth, survival, behaviour, and physiology of aquatic organisms.

For water pH, the result shows that the Trt1 had a higher pH value than Trt2 tank which is not within the desirable limit for catfish culture. According to [15] the ideal pH for biological productivity is 7.0 to 8.5; fish become stressed in water with a pH ranging from 4.0-6.5 and 9.0-11.0. This means the pH obtains from this Experiment for both Treatments would be assumed to have affected the fish growth since they fall below the desirable limit. The result disagrees with the result of [16,17].

Transparency results showed that Trt1 recorded a higher turbidity level than Trt2. The high turbidity found in Trt1 was a result of a higher level of nutrients found in the skretting fish feed. This agrees with the finding of [18] who reported that the higher turbidity of the Trt1 tank was due to suspended materials in form of unconsumed feed particles, Animal waste, and organic fertilizer. This is similar to the finding of [19].

The water temperature value of Trt2 (30.4°C) was higher than that of Trt1 (29.65°C). These readings were within the optimal ranges (<40°C) described for aquaculture [20-24]. The body temperature of fish changes according to that of its environment affecting its metabolism, physiology and ultimately affecting production [20]. The temperature results agree with the earlier work of [3,21].

RECOMMENDATIONS

1. It is recommended that feeding trial of the local feed on fish should be carried out before the feed is allowed to be sold in the market to determine their efficiency and performance which should be compared well with the imported feeds, while routine samplings and quality control of the feeds should also be carried out regularly.
2. For medium-scale commercial farmers, it is recommended that foreign feed be fed to the fry, fingerlings, juvenile, and even until the adult stage. The local feed can subsequently be fed to get the adult to table size. This feed programme ensures the fish get the high crude protein level required for fast growth be fed to get the adult to table size. This feed programme ensures the fish get the high crude protein level required for fast growth.
3. For large-scale commercial farmers, it is recommended that they adopt foreign feed because it provides a fast growth rate.
4. Frequent monitoring of the water quality parameter is recommended for higher survival and a higher growth rate.

CONCLUSION

This study investigated the effects of foreign and local feed on growth performance, feed conversion efficiency, and survival rate of C. gariepinus culture in plastic tanks. The findings confirmed the fact that the use of Trt2 (local feed) is not good enough to enhance the growth of fish species. This is due to the unguided use of plants and animal ingredients in the formulation, without recourse to the nutrients composition of the ingredients, the fish requirements, lack of balanced ratio most especially protein in the proximate composition of the feed, bad formulation, and in-

adequate processing. The use of this kind of local feed will make the culture of species such as C. gariepinus to be more expensive in the long run because it will take more time, more feed, more production costs for the fish to attain table or market size thereby making aquaculture unprofitable and unattractive to people. Although producing local feed by the use of locally available ingredients is good and helpful to the growing aquaculture industry in Nigeria as it will reduce the cost of production of which feed takes about 60%.

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