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RESEARCH ARTICLE

Effect of Artificial Feed and Fertilization of Ponds on Growth and Body Composition of Genetically Improved Farmed Tilapia

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ABSTRACT

The study was conducted to evaluate the effect of artificial feed and adding organic manures to the earthen ponds on the growth and body composition of genetically improved farmed tilapia (GIFT). A total of 160 fish were stocked in each of the two ponds for 90 days. Fish in both ponds were fed with supplementary feed containing 30% crude protein at 4% body weight. Pond 1 was fertilized using cow dung and poultry manure while pond 2 received no fertilizer. Fish were sampled every month for weight and length measurements. Fish were also sampled for biochemical analysis. T-test was used to compare the means between treatments. Fish from pond 1 gained significantly higher ($P<0.05$) weight compared to fish in pond 2. The specific growth rate and food conversion ratio also showed significantly higher ($P<0.05$) values for fish in pond 1 (1.52 and 2.4) compared to fish in pond 2 (1.22 and 2.1). Crude protein and lipid composition of fish were found significantly higher ($P<0.05$) in pond 1 compared to pond 2. It can be concluded that GIFT strain grow much better with the combination of organic manure (cow dung and poultry manure) and artificial feed as compared to artificial feed alone in semi-intensive system.

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INTRODUCTION

Tilapia culture in tropical countries is practiced either in extensive or semi intensive systems. The semi-intensive culture of tilapia is particularly ideal in developing countries due to certain options such as management and investments (Kamal *et al.*, 2008). Management strategies in the lower levels of intensive systems involve the use of fertilizers to encourage natural productivity of planktons and to improve the levels of dissolved oxygen. Application of organic and inorganic fertilizers in fish ponds results in higher fish production than from natural unfertilized systems (Green, 1992). Traditionally, pig and cattle manure are often used in semi-intensive systems to improve the primary productivity of the ponds and fish growth (Nwachukwu, 1997; Ezeafulukwe *et al*. 2013). The pond sediments are greatly influenced by the frequent application of organic manure and artificial feed (Chatterjee and Saha, 2000). Cattle and pig manures, which are generally plentiful worldwide, constitute a cost effective source of nutrients. Thus, in attempts to reduce feed costs, fish farmers provide supplementary feed along with organic and inorganic manures to reduce feed cost and increase fish production in South – East Nigeria.

However, feed accounts for approximately 70% of total aquaculture operational costs and is considered a major constraint for both small and large scale commercial aquaculture (Ezeafulukwe *et al.*, 2013; Ratafia, 1994). Reducing amount of feed is a means of lowering costs without reducing production. Nigeria is an agro-based country enriched with vast fisheries resources. Despite an increase in the pace of development in agriculture sector, the problems of starvation and malnutrition have persisted probably due to the low production of food, its distribution and quality. Genetically improved farmed tilapia (GIFT) is good option for aquaculture in Nigeria due to its faster growth. The objective of this study was to evaluate the use of manure along with artificial feeding on the growth and body composition of GIFT.

MATERIALS AND METHODS

Location

The experiment was conducted at Research and Training Farm of Department of Fisheries and Marine Technology, Imo State Polytechnic Umuagwo, Nigeria.

Stocking and feeding

GIFT fingerlings were stocked in earthen ponds (0.13 ha) at 160 fish/ pond in monoculture system. The average weight of fish in pond 1 (experimental) was 2.63g and in pond 2 (control) was 4.90 g. Water was filled up to 3 feet depth in the ponds two days before seed stocking. Supplementary feed having crude protein 30% (Table 1) was given to fish in both ponds at the rate of 4% body weight of fish daily. Feed was given twice a day at 8:00 a.m. and 3:30 p.m. in each pond. Organic manures were applied daily at 10 kg of dried cow dung (Nitrogen contents 1.02%) in morning and 4 kg of poultry manure (N=1.63%) in the evening to pond 1 while pond 2 received no manure. Cow dung was procured from Obinze, Cattle Abbatoir, Owerri West Local Government Area, Imo State, Nigeria and poultry manure from the Department of Animal Production and Health Technology, Imo State Polytechnic Umuagwo, Nigeria.

Growth parameters

Growth of the experimental fish was monitored on monthly basis. A sample of about 5-6 fish were taken from each pond and after taking morphometric measurements (total body weight and total body length) were released back into their respective ponds. Other growth parameters such as percent weight gain, specific growth rate (SGR) and feed conversion ratio (FCR) were calculated by following formulae:

Percent weight gain = (Final weight- initial weight) x 100/initial weight

SGR % = (log of final weight – log of initial weight) x 100/ no of days of experiment

FCR= Feed fed/weight gain

Proximate analysis

Five fishes of same size were sampled from each experimental pond. The fishes were oven dried at 70°C and grinded to obtained powder which was then analyzed for proximate composition. Proximate analysis of fishes in terms of dry matter, total ash, crude fat, crude protein and NFE (nitrogen free extract) was done to evaluate the nutritive value of fish according to AOAC (2006). Dry matter (DM) was determined by oven drying at 105°C for 18 hours and crude protein (CP) by Micro-kjeldhal analysis. Crude fat was determined by ether extraction using Soxhelt apparatus.

Water quality parameters

Water quality parameters such as temperature and DO of the pond water were determined using Dissolved Oxygen Meter (YSI -55/25 FT). Total alkalinity, carbonates, bicarbonates, total dissolved solids (TDS), total suspended solid and pH were determined daily while nitrates on weekly basis.

Total dissolved solids and EC were measured by conductivity meter (WTW Cond 330i); pH was measured by pH meter (Lutron pH-207). Nitrate ions with spectrophotometer (Model U2020) at wave length of 410 nm.

Statistical analysis

The data obtained was statistically analyzed by using Co-state version 6.3. T-test was used to compare the growth and proximate composition means among both treatments. The significant levels was ($P<0.05$).

RESULTS

Growth parameters such as final weight, gain in weight, percent weight gain, SGR% and FCR showed statistically significant differences ($P<0.05$) between two treatment groups (Table 2). Dry matter content, ash contents, moisture and nitrogen free extract (NFE) of fish from two treatments were not significantly different (Table 3). Fish from experimental group (pond 1) had significantly higher content of crude fat while fish from control (pond 2) had significantly higher level of crude protein (Table 3). There were no significant differences in physicochemical parameters between ponds except for nitrates where values of pond 2 were found significantly higher than pond 1 (Table 4). All the parameters were in acceptable range for GIFT strain in both treatments.

Table 1: Feed formulation

Feed ingredients	Percentage	Crude protein %
Fish meal	15	7.5
Soybean meal	20	8.4
Maize gluten	20	12.0
Rice polish	40	4.8
Molasses	4 -	
Vitamins	1 -	
Total	100	30.7

Table 2: Growth parameters of GIFT strain.

Parameters	P1	P2	SEM	*P(t=0)*
Initial wt (g)	2.63	4.9	0.92	0.1320
Final wt (g)	293.33	162.33	19.86	0.0222
Gain in wt (g)	290.70	157.43	18.97	0.0197
Percent wt gain (%)	11302.63	3350.80	1177.10	0.0212
SGR%	1.52	1.22	0.01	0.0006
FCR	2.4	2.1	0.02	0.0037

SEM= Standard error of mean, P1= pond 1, P2= pond 2.

Table 3: Proximate analysis of experimental fish GIFT strain

Parameters	P1	P	2 SEM	P(t=0)
Dry matter	93.85	93.25	0.4	0.3743
Moisture	6.15	6.75	0.6	0.3743
Ash	14.9	13.62	0.57	0.2697
Crude lipids	15.86	11.37	0.04	0.0057
Crude protein	61.25	65.62	0.16	0.0250
NFE	1.83	2.65	0.16	0.1227

SEM= Standard error of mean.

Table 4: Physico-chemical parameters of ponds water

Parameters	P1	P2	SEM	P(t=0)
Temperature (˚C)	31.24	31.67	0.47	0.3906
DO (mg/l)	3.56	3.31	0.16	0.1839
Salinity (ppt)	0.733	0.7	0.02	0.8476
pH	8.67	8.57	0.09	0.3215
TDS (mg/l)	900.85	892.77	15.89	0.6269
Nitrates (mg/l)	0.20	0.37	0.05	0.0279
Total alkalinity (mg/l)	394.75	323.75	38.19	0.1049

DISCUSSION

The fish during study period exhibited significantly higher growth when cultured in a fertilized pond with feed supplementation compared to fish cultured in unfertilized pond. This increase in growth parameters seems to be due

to the application of artificial feed and organic manures together in earthen ponds compared to artificial feed alone. These results are similar to Green (1992) experiment on mono-sex Nile tilapia where the pond was treated with organic fertilizer and fish were fed with supplementary feed for 150-day experimental period. In another study Green *et al.* (1989) reported that the final weight of fish was significantly higher by using poultry manure (203.9±16.1 g) than for the chemical fertilizer (150.4±17.9 g). Liti *et al.* (2001) reported that daily weight gains in mono-sex Nile tilapia were 0.68 and 1.17 g / fish/ day while using combination of chemical fertilizer plus rice bran (6.5% crude protein) and supplemental feed alone (12.5% crude protein). According to Azim *et al*. (2002) major carps showed higher growth rate in fertilized pond with the provision of supplemental feed. Results indicated that enhancing natural food through fertilization of fish pond resulted in higher contribution in fish nutrition and reduced the amount of supplemental feed requirement. McNabb *et al.* (1990) reported that fertilization of fish pond increases the production of phytoplankton in pond and more food items are available for fish. Feed conversion ratio (FCR) in present study indicated significant differences between treatments. Patrona *et al.* (2004) reported that FCR was decreased from 1.79 to 1.37 when ponds were fertilized. Abd El-All *et al*. (2001) reported that organic fertilizer with supplementary feed had higher fish yield in comparison to chemical fertilization or organic fertilization treatments alone. Li and Yakupitiyage (2003) reported that supplemental feed is required to increase fish yield in fertilized ponds. Fish from pond 2 (control group) had significantly higher crude protein content than fish from pond 1 (experimental) but the crude lipid content was higher in fish from pond 1. The higher crude protein contents in fish of pond 2 might be due to the consumption of higher amount of supplementary feed while in pond 1 the higher amount of lipid might be associated with the feeding on natural feed preferably phytoplankton and zooplankton where supplementary feed was added along with organic manure. The body composition of fish is mainly influenced by both the endogenous and exogenous factors, which operate simultaneously (Haard, 1992; Shearer, 1994). The dietary lipid content is regarded as one of the most important factor influencing the muscle and carcass lipid levels in fish (Hanley, 1991; Ali and Al-Asgah, 2001). According to Oduor-Odote *et al.* (2008) lipids in fish vary greatly due to variation in feed intake. The results of key physico-chemical parameters of water quality were found within the acceptable range for GIFT fry (Hasssan *et al.*, 1997; Boyd, 1998; Kamal *et al.*, 2008). During entire study period no mortality was observed due to limnological parameters. No significant differences were observed for temperature, pH, salinity, TDS and DO between treatments. Nitrates showed significant differences and values were higher in pond 2 than pond 1 that might be due to increased amount of pond fertilization along with the addition of supplementary feed.

Conclusions

Based on the results it can be concluded that yield of GIFT strain can be increased with combination of organic manure and artificial feed in semi-intensive system.

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