Journal of Agriculture and Environment Vol. 8 No. 1 and 2, 2012: 71-77
ISSN 1595465X

GROWTH PERFORMANCE OF *Clarias gariepinus* AND *Oreochromis niloticus* UNDER DIFFERENT STOCKING COMBINATIONS IN CONCRETE TANKS.

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ABSTRACT

The experiment was conducted to determine the growth performance of *Clarias gariepinus* and *Oreochromis niloticus* in five different stocking combinations at 30 fish/m^3 in clarias : tilapia ratios of 0:1, 1:0, 1:2, 1:4, and 1:6. Feed rate was at 3% body weight per day over a period of 84 days. The final weights recorded were 261.00±3.24g and 130.64±97g for clarias and tilapia respectively; both for Treatment 5 (1:6) which also had the highest percentage weight gain ($p<0.05$) of 952.57±17 for clarias while the lowest 278.88±5.92 was recorded in Treatment 1 (0:1) for tilapia. Highest specific growth rate (%/day) of 0.028±0.00 and 0.019±0.00 were recorded in Treatment 5 (1:6) for clarias and tilapia, respectively. The least fish growth indices (WG, %WG and SGR) were recorded in Treatments 1 and 2. For clarias, Treatment 5 (1:6) had the maximum length (17.92±0.37cm) while the monoculture recorded the minimum of 16.60±0.29. The monoculture of tilapia gave the lowest length gain (4.83±0.41cm) while the highest (11.60±0.51cm) for tilapia was recorded in Treatment 4 (1:4). Stocking ratio of 1:6 should be encouraged for better growth performance.

Keywords: Polyculture; Monoculture; *Clarias gariepinus; Oreochromis niloticus*; Growth indices

INTRODUCTION

The art of artificial fish farming may perhaps encourage research and studies on the various species of fishes with the aim of improving growth and yield (Bard *et al*., 1976). The introduction of concrete tanks allows for manageable pond size and modification of the environment through a water flow-through system and supplementary feeding, thus allowing for higher fish yield.

The two main aquaculture species in Nigeria, the African catfish (*Clarias gariepinus*) and the Nile Tilapia (*Oreochromis niloticus*), have high tolerance levels to various environmental characteristics which favour their culture in different culture systems. These include an ability to tolerate poor water quality, and withstand high diurnal temperature fluctuations as well as tolerance to low dissolved oxygen and rapid growth (De Kimpe and Micha, 1974; Clay, 1979; Hepher and Pruginin, 1982; Henken *et al*., 1986;

Huisman and Richter, 1987; Hecht *et al*., 1996). It is a source of management problem in the culture of tilapia where early maturation often leads to dense population of small individuals below marketable size (Fitzsimmons, 2000). The stunted tilapia population in confined ponds is an obvious problem and hence, there is a need for alternative culture approaches (Lovshin *et al*., 1990 and Abdel, 2005).

The combined production of tilapia and clariid catfishes has attracted considerable attention particularly in West Africa (Fagbenro and Sydenham, 1990; Lazard and Oswald, 1995). The aim of catfish/tilapia polyculture systems is to increase productivity (Lazard and Oswald, 1995). Dunseth and Bayne (1978) observed that, the highest stocking ratio (*C. managuense* : *T. aurea* 1: 4 and 1:8) had a huge yield but lower individual weight gain. Viveen *et al*., (1985) recommended an initial stocking weight of 1-3g for catfish and 5-15g for *Tilapia*. Cruz and Laudenica, (1980) stated that the Nile *Tilapia* (*Oreochromis niloticus*) generally is ideal for polyculture trials, because it does not affect the growth and production of other species. Observation shows that, the highest stocking ratio of *clarias*:tilapia (1:4 and 1:8) had higher weight gains (Van der waal, 1978). The production in a tilapia monoculture system was lower than in polyculture (Guerrero and Guerrero, 1979). Ita *et al*. (1986) recommended a stocking density of 40,000/hectare for tilapia and 6,000/hectare for clarias at a ratio of 6:1 in a polyculture system. However, Ngugi and Wangila (1996) tested tilapia:catfish ratios of 2:1, 6:1 and 19:1; and recorded a significant difference in mean daily growth rates, final weight and yield in the 2:1 stocking ratio.

With the growing demand for table size tilapia and increasing proliferation in the use of concrete tanks for fish culture as well as the high cost of fish feed, there is the need for more research on the polyculture of *Oreochromis niloticus* and *Clarias gariepinus*, with a view to obtaining the best stocking ratio that could provide enhanced growth performance and improved feed utilization of both species. Therefore this study was aimed at determining the appropriate stocking ratio for optimum production of the two species.

MATERIALS AND METHODS

The Study Area

The study was conducted at Khasu integrated farm located at 15km along Kano – Madobi Road in Kumbotso Local Government Area of Kano State. The study area lies between latitudes 11^0 20’ and 11^0 45’ North and longitudes 8^0 15’ and 8^0 30’ East.

Experimental Fish

A total of 1,509 juveniles of *C. gariepinus* (average body weight 24.88g and average body length of 14.52cm) were obtained from A4 Global Fisheries, Kano. Also 2,991 juveniles of *O. niloticus* (average body weight of 24.90g and average body length of 10.93cm) were obtained from Bagauda Fish Seed Multiplication Centre, Kano, Nigeria. A total of 4,500 experimental fish were used for the study.

Pond Preparation and Water Supply

The study was conducted using fifteen concrete tanks of 2x5x1.2 m sizes. Prior to stocking, ponds were drained, washed and filled with water from the reservoir to a depth of

1.0m. Both the inlet and outlet were screened to prevent incoming of unwanted organisms and escape of fish, respectively. Water levels in all the treatments were maintained by changing the water weekly. The water quality parameters maintained included dissolved oxygen (DO), hydrogen ion concentration (pH) and temperature (^{0}C).

Experimental Design and Layout

After acclimation period of 14 days, treatments were randomly allocated to the tanks and were replicated twice. The experiment was laid out in a Completely Randomised Block Design (RCBD). Fifteen tanks were stocked at 30 fish/m^3. The treatments comprised of the following clarias:tilapia stocking ratios ; (T1) 300 Tilapia only, (T2) 300 Clarias only, (T3) 100:200, (T4) 60:240 and (T5) 43:257. The experiment lasted for 84 days.

Feeding Rate and Frequency

Fish in all the treatments were fed experimental diet (Multifeed, 2mm) containing 45% crude protein, at 3% body weight per day (BWD). Feeding rate was adjusted weekly based on weight gain and the feeding frequency was twice daily. The total feed fed per day was divided into two; one part was fed in the morning around 9:00am and the second part in the evening at 5:00pm.

Data Collection

All fishes were weighed individually at the beginning and end of the experiment, while one third of the population was sampled weekly to monitor growth performance. Length measurement was carried out to the nearest centimeters using a measuring board graduated in centimeters. Total length (TL cm) was measured from the anterior most extremity of the fish to the end of the caudal fin. The total weight was measured using Ohaus electric balance of 310g capacity.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) to test the effect of different stocking ratios on growth performance and feed conversion of clarias and tilapia. Where there was significant difference, the means were separated using Duncan's Multiple Range Test at 0.05 probability level. Regression analysis was used to establish the length-weight relationships with the aid of Statistical Package for Social Sciences (SPSS) version 18.

RESULTS

In all the treatments, clarias outweighed tilapia in terms of weight gain. At the initial weight, the two species weighed 24.80±0.31g – 24.98±0.30g, while final weight recorded at the end of the experiment reveals that clarias had the maximum value of 261.00±3.24. For tilapia, the maximum weight of fish recorded was 130.64±3.97 and a minimum of 94.13±0.78 (Table 1). In terms of the percentage weight gain, Treatment 5 (1:6) recorded the highest ($P<0.05$) value of 952.57±17.90 for clarias within 12 weeks and the lowest percentage weight gain of 278.88±5.92 was recorded in Treatment 1(0:1) for tilapia (Table 1).

Specific growth rate (SGR%) of 0.028±0.00 and 0.019±0.00 were the highest values recorded in Treatment 5 (1:6) for clarias and tilapia, respectively. The lowest values of 0.024±0.00 and 0.015±0.00 were recorded in Treatments 2 (1:0) and 1 (0:1) for clarias and tilapia, respectively (Table 1).

The least fish growth indices (WG, %WG, and SGR) were recorded in monoculture of the two species (Treatments 1 and 2). The growth indices of clarias were higher than those of tilapia at each of the three polyculture levels. The results revealed increased weight of the tilapia with increased ratio of clarias to be significant ($P<0.05$) at higher level of clarias:tilapia (1:6) than the lower ratios and their monocultures.

Table 1: Growth parameters of *C. gariepinus* and *O. niloticus* in a polyculture system

Parameter	Trt 1(0:1)	Trt 2(1:0)	Trt 3 (1:2)		Trt 4 (1:4)		Trt 5 (1:6)	
			Clarias	Tilapia	Clarias	Tilapia	Clarias	Tilapia
IMW (g)	24.85±0.33 (1500)	24.91±0.39 (1500)	24.85±0.29 (496)	24.83±0.35 (997)	24.80±0.29 (300)	24.99±0.30 (1200)	24.80±0.33 (211)	24.98±0.31 (1287)
FMW(g)	94.13±0.78^{h}	200.29±1.27^{d}	211.19±1.16^{c}	105.4±0.57^{g}	241.12±1.12^{b}	121.17±1.09^{f}	261.00±3.24^{a}	130.64±3.97^{e}
WG(g)	69.28±0.85^{h}	175.38±1.28^{d}	186.34±1.28^{c}	80.56±0.69^{g}	216.32±1.26^{b}	96.18±1.17^{f}	236.20±3.21^{a}	105.65±3.95^{e}
%WG	278.88±5.92^{h}	704.24±12.91^{d}	750.03±12.16^{c}	324.41±6.55^{g}	872.36±13.98^{b}	384.91±7.73^{f}	952.57±17.90^{a}	422.86±16.66^{e}
SGR%	0.015±0.00^{h}	0.024±0.00^{d}	0.025±0.00^{c}	0.017±0.00^{g}	0.027±0.00^{b}	0.018±0.00^{f}	0.028±0.00^{a}	0.019±0.00^{e}
K	1.60	2.11	2.30	0.52	2.37	1.70	1.87	1.40

*IMW = initial mean weight; FMW = final mean weight; WG = weight gain; %WG= % weight gain; SGR = specific growth rate; K = Condition factor.
*Means in row with same letter are not significantly different ($P>0.05$)

Mean weight gain is presented in Table 2. Treatment 5 (1:6) favored higher weight gain of 99.35±82.24 and 58.39±29.99, for clarias and tilapia, respectively. As such that ratio gave the best performance, while monoculture of both species yielded the lowest weight gain of 69.40±56.67 and 50.36±22.56 for clarias and tilapia, respectively. For clarias, Treatment 5 (1:6) had the maximum length growth performance (21.72±6.56cm) while the monoculture recorded the minimum (19.48±5.67cm) with more than 2cm less than the highest value. The monoculture of tilapia gave the lowest length gain (12.58±1.68) and was statistically ($P>0.05$) similar to Treatment 3 (1:2); while the highest length gain (13.67±3.62) for tilapia was recorded in Treatment 5 (1:6).

Table 2: Growth variation in weight and length during the experiment

Treatment	Weight (g)	Length (cm)
O. niloticus		
Trt 1(0:1)	50.36±22.56^{d}	12.58±1.68^{c}
Trt 3(1:2)	52.20±22.26^{c}	13.10±1.80^{bc}
Trt 4(1:4)	55.36±27.82^{b}	13.17±4.11^{b}
Trt 5(1:6)	58.39±29.99^{a}	13.67±3.62^{a}
C. gariepinus		
Trt 2(1:0)	69.40±56.67^{d}	19.48±5.67^{d}
Trt 3(1:2)	75.22±59.79^{c}	19.23±6.74^{c}
Trt 4(1:4)	83.58±69.14^{b}	20.99±6.29^{b}
Trt 5(1:6)	99.35±82.24^{a}	21.72±6.56^{a}

*Means followed by the same superscript along the column are statistically the same (P>0.05)

DISCUSSION

At the end of twelve weeks of study, values of various growth parameters in all the three different stocking ratios of clarias/tilapia showed that both final weight and percentage weight gain increased progressively with increase in the stocking ratios (1:2, 1:4 and 1:6). The result obtained in the present study might be related to the lower stocking density of 30 fish/m^2 and availability of feed that led to decrease in competition for both space and feed.

In the present study, *Clarias gariepinus* was not able to thin down the population of *Oreochromis niloticus* as no evidence of predation was recorded in Treatments 3 (1:2), 4 (1:4), and 5 (1:6). This was because there was no size differential between the sizes of predator and prey, and there was no reproduction by the tilapia throughout the study period. This is in accordance with the findings of Hetcht and Appelbaun (1988) that *Clarias gariepinus* do practice cannibalism which depends on variation in size. Boughey (1978) also observed a close relationship between sizes of predator and prey. The zero predation recorded in all the treatments was also attributed to the fact that the proposed predator (*C. gariepinus*) had a relatively smaller mouth size that could not predate on the almost similar size prey (*O. niloticus*). This is in agreement with the finding of Weatherly (1972). The ability of *C. gariepinus* to practise cannibalism depends on variance in size and differential growth rate of the fish in the population (Dimitrov, 1987).

The findings in this study demonstrate the effect of stocking combinations on the growth performance of *C. gariepinus* and *O. niloticus*. The final weight of each tilapia group was positively affected by stocking combinations when compared with tilapia in monoculture.

CONCLUSION

The results obtained in this study revealed better growth performance in terms of percentage weight gain (%WG), specific growth rate (SGR%), and weight gain (WG) is achievable with higher stocking ratio. Higher stocking combination of (1:6) should be encouraged to achieve better growth performance for polyculture practice of clarias and tilapia. Further research could focus on prey-predator relationship of this stocking ratio (1:6).

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