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Comparative growth performance of monosex and mixed sex red tilapia (*O. niloticus* L.)

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Abstract

In the present study, the growth performance of mono and mixed sex red tilapia was evaluated under controlled conditions. Two groups of red tilapia (*Oreochromis niloticus*) fry (i.e. monosex and mixed sex) in triplicate were stocked in cemented cisterns (3X3X1 m). One hundred fry were stocked in each tanks and fed with commercial tilapia diet having 28% protein @ 10% of their body weight per day. After a rearing period of 28 days, the growth (Length and weight) and SGR was compared among both the groups. The highest weight gain (1.21 ± 0.009 g), (0.95 ± 0.020 g) and SGR (5.77) was noticed for monosex red tilapia. These growth parameters were statistically significant as compared to mixed sex. Thus on the basis of better growth performance of monosex red tilapia it is recommend to adopt this farming technique for better returns.

Keywords: Growth, monosex, tilapia, aquaculture, farming system

Introduction

Tilapia, popularly known as the aquatic chicken, are fast growing, hardly fish tolerating a wide range of environmental conditions and hence assumes great importance in world aquaculture. The Nile tilapia (*Oreochromis niloticus*) is one of the most important species of fish in tropical and sub-tropical aquaculture. It provides one of the major sources of animal protein and income throughout the world. Tilapia is the generic name of a group of cichlids endemic to Africa. The group consists of three aquaculturally important genera - *Oreochromis*, *Sarotherodon* and *Tilapia*. Several characteristics distinguish these three genera, but possibly the most critical relates to reproductive behavior. All *tilapia* species are nest builders; fertilized eggs are guarded in the nest by a brood parent. Species of both *Sarotherodon* and *Oreochromis* are mouth brooders; eggs are fertilized in the nest but parents immediately pick up the eggs in their mouths and hold them through incubation and for several days after hatching. In *Oreochromis* species only females practice mouth brooding, while in *Sarotherodon* species either the male or both male and female are mouth brooders^[1]. Have suggested that the grow-out of monosex male population prevents or minimizes recruitment and thereby competition between recruits and stocked fish which, in mixed sex populations, can significantly reduce harvested yields. Energy expenditure on male-male and male-female behavioural interactions and on gamete production is also minimized thereby maximizing growth potential. Several approaches have been developed to achieve monosex male populations, direct hormonal sex reversal being the most commonly applied in the industry today, although monosex hybrids and even manual sexing are also produced in many hatcheries. Manual sexing is labour intensive and susceptible to errors such that sex ratios greater than 90% male are rarely achieved. Hybridization can produce consistently high percentages of males, especially if *Oreochromis urolepis hornorum* is used as the paternal parent. However, for most freshwater aquaculture, *O. niloticus* is usually the species of choice due to its high growth potential and any dilution through hybridization usually results in loss of performance which is only partially compensated by the enhanced growth in mono sex populations. In view of the above the study was conducted to evaluate the comparative growth performance of mono and mixed sex red tilapia.

Materials and Methods

Experimental Fish: For conducting this study, the fish Red Tilapia (*Oreochromis niloticus*) was chosen as experiment fish. The fish belongs to family Cichlidae, which is basically originated from Africa. The original red tilapia is genetic mutants.

The first red tilapia was produced in Taiwan in the late 1960s, by a cross between a mutant reddish-orange female Mozambique tilapia and a normal male Nile tilapia. The seed (just yolk sac absorbed fry) of this fish was procured from the fish farm of MPUAT Udaipur. In this study 30 post-hatch larvae were stocked in each cemented cisterns.

Experimental Setup: The comparative growth performance of sex reversed seed (monosex) and mixed sex (both male and female) was evaluated. For this purpose both the groups (monosex and mixed sex) were reared in cemented cisterns (3X3X1 m) under similar conditions for a period of 28 days one human fry was stocked in each tank the feeding was done @ 10% body weight daily until the end of the experiment. At the end of rearing period following growth parameters (Net weight gain, Per cent weight gain and Specific growth rate) were compared to evaluate the performance of monosex and mixed sex culture. The selected water quality parameters such as temperature, pH, dissolved oxygen, EC, total dissolved solids and nitrate-nitrogen in experimental systems were analyzed following standard methods [2].

Growth Parameters: The mean length, weight and survival of the fish in each treatment were recorded on 28th days as per the following formula:

$$\text{Net weight gain (g)} = \text{Final weight (g)} - \text{Initial weight (g)}$$

$$\text{Per cent weight gain (\%)} = \left[\frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \right] \times 100$$

$$\text{SGR (\%)} = \left[\frac{\text{Ln final weight} - \text{Ln initial weight}}{\text{time (days)}} \right] \times 100$$

Statistical Analysis

The data recorded for evaluation of different treatments were statistically analyzed using standard procedure for analysis of variance (ANOVA) in complete randomized design (CRD) and factorial design in order to test the significance of experimental results. Beside this, standard error and CD were also calculated. For the analysis of Statistical parameters, the standard methods [3].

Results and Discussion

Water Quality

Water quality parameters studied during the experiment under all the treatment conditions were found to be within the optimum range suitable for the rearing of red tilapia. The water temperature ranged between 19.5 °C to 25.65 °C under monosex and mixed sex treatments. The mean temperature ranged between 23.18°C to 23.31 °C. The dissolved oxygen ranged between 5.78 mg/l to 7.48 mg/l in monosex culture and 6.03 mg/l to 7.26 mg/l in mixed sex culture. Total dissolved solids ranged from 994.3-1038.5 mg/l in monosex and 983.1011 mg/l in mixed sex cultures. The variations in electrical conductivity were 2.07-2.16 µs/cm to 2.00-2.12 µs/cm in mono and mixed sex. The mean pH ranged between 7.70 to 7.69 in both the groups (Table 1). These results are in accordance with the findings of who reported that in the

Indian subcontinent, most of the water bodies had their temperature lying between 7.8 °C and 38.5 °C [4]. Dissolved oxygen had an inverse relationship with water temperature in fish ponds [5]. In general, no significant input of water quality on fish growth was noticed and water quality remained congenial for the growth of experimental fish [6, 7]. Thus, the significant variations in growth rate of both the treatment groups (i.e., monosex and mixed sex) could be due to the sex and hormone treatment.

Growth Parameters: Data on the growth performance of male (monosex) and mixed sex *O. niloticus* are presented in Table 2. Significant variations were observed in growth among monosex (males) and mixed sex reared under the same culture conditions ($p < 0.05$). After 28 days rearing the fish attained an average weight of 1.51 ± 0.012 g and 1.27 ± 0.029 g for monosex male and mixed sex groups respectively. The highest net weight and length were 1.21 g and 0.95 cm for monosex. Whereas, in mixed sex weight gain (0.97 g) and length (0.69 cm) were lesser. Further, the respective SGR values for mono-sex and mixed sex groups were 5.77 and 5.14% (Table 2). The results of the present study on comparative growth performance of monosex and mixed sex show a better growth of monosex compared to mixed sex tilapia. The net weight gain, length gain and SGR were highest (1.21 g, 0.95 cm and 5.77%) in monosex as compared to while observing the culture performance of monosex and mixed sex culture of three strains of Nile tilapia reported that among the three tilapia strains, the GIFT attained a significantly ($p < 0.01$) higher weight (387.7 g) compared to the Thai strain (351.6 g) and Veit strains (359.5 g) [8]. They further narrated that overall, monosex fish of three strains grew significantly faster than mixed-sex fish. Hormone treated monosex tilapia achieved greater mean individual weight (290.4 g) than mixed-sex fish (85.9 g) in pond [9]. Increase in individual growth of Nile tilapia during monosex culture was also observed in different studies [10, 8].

The growth performance of tilapia is generally influenced by genetics, quality and quantity of feed, brood stock management and environmental conditions [11]. Further, sex specific differences in the growth of Nile tilapia and in the other species is apparent [12]. The results of the present study revealed that the growth performance of mono-sex and mixed sex tilapia reared for 28 days under the same culture conditions was significantly different. The monosex fish attained higher individual growth (both weight and length) as compared to mixed sex. The sex specific growth differences were also reported [11, 9, 13]. Thus, the findings of this study are in conformity of these researchers.

Conclusion

The data obtained on growth parameters (i.e. weight gain, length gain and SGR) of monosex (all male) and mixed sex of red tilapia clearly indicated better performance of all male. Thus for the sustainable and higher growth/yield, the culture of all male red tilapia in recommend.

Table 1: Range and average values (\pm Standard error) of selected water quality parameters during experimental period

Treatment	Temperature (°C)	DO (mg/l)	TDS (mg/l)	EC (mMoh)	pH	Nitrate-nitrogen (mg/l)	Temperature (°C)
Mono-sex	19.5-25.65 (23.18 \pm 0.80)	5.78-7.48 (6.76 \pm 0.020)	994.3-1038.5 (1026.16 \pm 5.76)	2.07-2.16 (2.11 \pm 0.01)	7.23-8.19 (7.70 \pm 0.015)	0.016-0.030 (0.023 \pm 0.001)	19.5-25.65 (23.18 \pm 0.80)
Mixed-sex	19.5-25.5 (23.31 \pm 0.77)	6.03-7.26 (6.84 \pm 0.016)	983-1011 (999.9 \pm 3.69)	2.00-2.12 (2.04 \pm 0.02)	7.25-8.21 (7.69 \pm 0.014)	0.016-0.028 (0.022 \pm 0.001)	19.5-25.5 (23.31 \pm 0.77)

Table 2: Comparative growth performance of monosex and mixed sex red tilapia

Treatment	Initial weight (g)	Final weight (g)	Net weight gain (g)	Initial length (cm)	Final length (cm)	Gain in Length (cm)	SGR (%)
Mono-sex	0.3±0.0	1.51±0.012	1.21±0.009 ^a	0.4±0.0	1.35±0.020	0.95±0.020 ^a	5.77±0.022 ^a
Mixed-sex	0.3±0.0	1.27±0.009	0.97±0.012 ^b	0.4±0.0	1.09±0.003	0.69±0.015 ^b	5.14±0.006 ^b

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