

A ONE-HUNDRED-DAY CULTURE TRIAL OF THREE DIFFERENT FAMILIES OF GIFT TILPIA, *OREOCHROMIS NILOTICUS*

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Abstract

Three families of GIFT strain Nile tilapia, *Oreochromis niloticus* were respectively stocked into three earthen ponds and a one-hundred-day trial was performed from July 13, 2007 to October 21, 2007 in order to compare their growth, survival, feed conversion ratio and seinability. The area of each pond was 1333 m² and water depth in each pond was 2 m. The stocking density was 1800 individuals in one pond. Water temperature, dissolved oxygen content and feeds quantity applied were recorded during the culture. 50 individuals were sampled from each pond at the 30th, 60th day and some indices concerning growth were measured including body weight, body length, body width and body depth. All fish were harvested at the 100th day. When harvest, the fish were first caught with two trawls, and the remainder were captured after the pond was drained. The numbers of male fish and female fish were counted and the yields of male and female fish were measured, respectively. The results showed that in Family A, the absolute growth rate (AGR) within 30 days, 60 days and 100 days was 1.349 g·d⁻¹, 2.699 g·d⁻¹, 3.206 g·d⁻¹, respectively. The ratio of female to male was 51:49, the survival rate was 78.72%, the FCR was 1.41 and the seinability was 35.4%. In Family B, the AGR within 30 days, 60 days and 100 days was 1.013 g·d⁻¹, 2.682 g·d⁻¹, 3.030 g·d⁻¹, respectively. The ratio of female to male was 53.7:46.3, the survival rate was 42.44%, the FCR was 2.58 and the seinability was 63.7%. In Family C, the AGR within 30 days, 60 days and 100 days was 1.390 g·d⁻¹, 2.477 g·d⁻¹, 3.009 g·d⁻¹, respectively. The ratio of female to male was 58.5:41.5, the survival rate was 94.33%, the FCR was 2.27 and the seinability was 78.57%. The results indicated variations in different GIFT families and potentials for further selection to meet different aquaculture purposes.

INTRODUCTION

Tilapia is one kind of global cultured fish species, which has more than 4000 years history of aquaculture (McAndrew, 2000). Tilapia is the common name of several kinds of fish belonging to the Family Cichlidae, including three major genera, i.e. *Tilapia*, *Sarotherodon* and *Oreochromis*. Tilapia has high adaptability to the environment such as tolerance to high salinity, lower dissolved oxygen and high density, fast growth even fed on natural food or cheap formula feeds, short reproduction cycle and natural spawning in the culture condition. Out of more than 100 species of tilapia, only 8 or 9 species have great potential for aquaculture, of which, 2 species belonging to genus *Tilapia* (*T. zillii* and *T. rendalli*) and 4 species belonging to genus *Oreochromis* (*O. niloticus*, *O. aureus*, *O. mossambicus* and *O. andersonii*) are widely cultured in the world (Edwards, 2000). At present, Nile tilapia (*O. niloticus*) is the most important cultured species in freshwater while all-male hybrid tilapia is popular in China due to its high growth rate. The genetically improved farmed tilapia project was conducted by ICLARM cooperated with research institutions of Norway and Philippines. After 5-generation combined selection, the growth rate increased by 85% compared to the base population (Bentsen, 1998; Eknath and Acosta, 1998). In every selection generation of the GIFT strain Nile tilapia, 120-200 families are maintained and 20 thousands fish from these families are selected as the population for the next generation selection (WorldFish Center, 2004). In our paper, 3 different families of GIFT strain tilapia were selected and cultured in three earthen ponds. Some of productive indices including growth rate, survival rate, feed conversion ratio and seinability were compared among these three families in order to select best families for dissemination.

MATERIALS AND METHODS

Experimental fish

60 families of GIFT tilapia were introduced to Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences from the WorldFish Center in August, 2006. Based on the estimated breeding value and family background, mating list was designed and a 98-family new generation was produced in 2007. Three families from them were selected into a productive trial by culturing in outdoor earthen ponds.

Stocking

1800 pieces of fries from each family were stocked in a 1333m² earthen ponds on July 13, 2007. The average body weight of fry is 2 mg.

Feeding

The fish were fed with commercial feed twice a day. The first feeding was carried out between 7:00-8:00 am; the second feeding was given between 4:00-5:00 pm. The amount of applied feed was recorded everyday.

Harvest

After 100-day culture, the fish were harvested on October 21, 2007. The fish were firstly harvested with two trawls, and then the remainders were captured after the pond was drained.

Data collection and analysis

50 fish were sampled and the body weight, standard length, body depth and body width of each fish were measured after 30-day and 60-day culture, respectively. After harvest, the amount, weight and sex of all fish were recorded by group of trawling and capture.

The absolute growth rate (AGR) within 30 days, 60 days and 100 days of each family was calculated based on the following formula

$$\text{AGR (g}\cdot\text{d}^{-1}) = (W - W_0) / (t - t_0)$$

Where, W_0 represents the initial body weight of GIFT tilapia fry, W represents the body weight of GIFT tilapia at the 30th day, the 60th day or the 100th day, respectively.

The food conversion ratio (FCR) was obtained by calculating the ratio of total feed amount applied during the culture period to the yield of fish.

RESULTS AND DISCUSSION

The growth rate of three families of GIFT strain tilapia

The three families displayed different growth rate in different growth stages (Table 1). The Family C exhibited the highest absolute growth rate while the Family B had the lowest absolute growth rate in the first 30 days of culture. But after that, the Family A increased growth rate and kept top growth till the end of the trial, and Family B grew faster than the Family C as well.

Table 1. The average body weight and absolute growth rate of each family

Family	30 days		60 days		100 days	
	Body weight (g)	AGR (g·d ⁻¹)	Body weight (g)	AGR (g·d ⁻¹)	Body weight (g)	AGR (g·d ⁻¹)
A	40.47±6.49	1.349	161.97±16.29	2.699	320.52±43.02	3.206
B	30.40±7.88	1.013	160.94±26.15	2.682	303.04±58.40	3.030
C	41.71±5.05	1.390	148.62±26.18	2.477	300.93±40.78	3.009

The growth rate of tilapia is one of the most important productive performances considered by aquaculturists. Farmers prefer male tilapia due to its fast growth in the aquaculture. All male (or high percentage male) tilapia production was adopted by

hormone treatment and hybridization between some varieties in tilapia. Hormone treatment brings food security problem and hybridization needs more complicated selection and maintenance operation of parental fish. Both of methods produce various male percentages and could affect the growth rate and yield of cultured tilapia. Due to the different growth rate existing in GIFT tilapia families showed by our experiment result, some best families for growth rate could be obtained by selection and applied in farmers' production. Our unpublished data and some other experiment indicated certain family of GIFT strain tilapia grew better than the all-male hybrid of Nile tilapia and blue tilapia (Chen, 2008; Huang and Luo, 1998).

The survival, sex ratio and seinability in three families

After 100 days culture, 1417, 764 and 1698 fish were harvested in Family A, B and C, respectively (Table 2). The survival rate of each family was 78.72%, 42.44% and 94.33% while the sex ratios of female to male in three families were 51:49, 53.7:46.3 and 58.5:41.5, respectively. After twice trawls, 501 fish were harvested in Family A, 487 fish in Family B and 1333 fish in Family C (Table 2). The result showed the highest seinability (78.57%) was observed in Family C and lowest seinability (35.4%) was observed in Family A. The seinability was 63.7% in Family B.

Seinability is another important characteristic in the tilapia culture for the harvest. Li *et al.* (1999) compared seinabilities among four different strains of Nile tilapia and found the GIFT strain had highest value which ranged between 67%-81.5%. In our experiment, Family C had the similar seinability value to their results.

Table 2. The number of harvest fish in each family

Family	By trawl			Capture after drainage			Total	
	Female	Male	Subtotal	Female	Male	Subtotal	Female	Male
A	261	240	501	462	454	916	723	694
B	243	244	487	167	110	277	410	354
C	771	562	1333	223	142	365	994	704

The yield and FCR of three families

If the survival rate is different, the growth rate of is not as important as yield for the pond culture. Considering this, we calculated the yield and FCR of each family in the pond. In Family A, the yield was 454.2 kg and the FCR was 1.41. In Family B and C, the values were 231.5 kg, 2.58 and 511.0 kg, 2.27, respectively.

In general, the three different GIFT strain tilapia families we selected in the experiment displayed different productive characteristics. For instance, Family A showed highest growth rate, lowest FCR and most balanced sex ratio, Family C showed

highest survival, yield and seinability. The results indicated large genetic varieties and selection potentials in GIFT strain tilapia. By combined family selection, we can improve the GIFT strain tilapia characteristics for culture production to meet various demands such as growth, seinability, FCR and so on. We can also make multiple index selection to integrate several good characteristics in one family such as combine growth with FCR or/and seinability.

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