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Growth and Production Performance of Monosex Tilapia (*Oreochromis niloticus*) Fed with Homemade Feed in Earthen Mini Ponds

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Abstract: Field experiment was conducted to evaluate the growth performance of monosex tilapia using homemade feed with Peninsula Group fish meal and commercially available feed with local fish meal in earthen mini ponds from June-September 2010. Three ponds (T_1) were supplied with prepared feed and the other three ponds (T_2) with commercially available fish feed. Fish were fed at the rate of 10% of their body weight for the first thirty days then gradually reduced to 6% for the next ten days, 2% for the next ten days and 3% for remaining days. The temperature were ranged from 31.5-33.0°C, DO from 5.5-15 mg L^{-1} in T_1 and 6.5-14 mg L^{-1} in T_2, pH from 7.1-8.0 in T_1 and 7.1-7.7 in T_2, alkalinity from 105-160 mg L^{-1} in T_1 and 100-145 mg L^{-1} in T_2, nitrate was 0.06 mg L^{-1} in both treatments and ammonia from 0.02 and 0.04 mg L^{-1} in T_1 and T_2, respectively. The results of the present study showed that the best weight gain was observed as 123.48 g in T_1 than T_2 (111.82 g). The Specific Growth Rate (SGR) was recorded 3.09 and 2.97 and the Food Conversion Ratio (FCR) was 1.51 and 1.40 in T_1 and T_2, respectively. There was significant ($p<0.05$) variation among the survival rate (%) of fishes which were 75.55 and 90.37% in T_1 and T_2, respectively. The fish productions were 19076 and 16312.11 kg ha^{-1} in T_1 and T_2. The highest net profit (Taka/ha/70 days) of Tk. 15, 83,213 was obtained with T_1. So, the prepared feed showed better performance with monosex tilapia in compared with commercial fish feed with local fish meal.

Key words: Genetically improved farmed tilapia, peninsula group fish meal, homemade feed, monosex tilapia

INTRODUCTION

Monosex tilapia (*Oreochromis niloticus*) is a fast growing popular cultivable fish (Chowdhury *et al*., 1991; Shamsuddin *et al*., 2012). It can easily survive in derelict water bodies at minimum oxygen level and wide range of temperature and eat all types of feed (Hussain *et al*., 1989). They may be cultured with low inputs which are locally available. Monosex tilapia is high yielding, excellent breeder and efficient converter to organic and agricultural wastes in to high quality protein, very hardy and resistant to disease, tolerant to over crowding conditions and able to grow in either fresh or brackish water. Tilapia, an omnivore, is assumed to be reared on number of cheaply available foodstuffs containing sizeable amount of carbohydrate. Monosex tilapia growers generally use different supplemental feeds in culture. Only natural food cannot afford high production in commercial monoculture system. Traditionally, fish meal is the preferred dietary protein source for many farmed fish species and is appreciated for its amino acid balance, vitamin content, palatability and un-identified growth factors (Azim *et al*., 2012; Soltan *et al*., 2008). Fish meal is considered the most desirable animal protein ingredient in aquaculture diets (Al Mahmud *et al*., 2012) because of its high protein content, balanced amino acid profiles, high digestibility and palatability and as a source of essential omega-3 polyenoic fatty acids. Among the Southeast Asian countries, Bangladesh in particular abounds with hundreds and thousands of seasonal water bodies in the form of ditches, shallow ponds, road side canals and borrow pits which retain water for 4-6 months, where carp species can not be cultured. No doubt, these water bodies have tremendous potential for aquaculture of fish species with short life cycle and characteristics of faster growth rate and require low input support (Hussain *et al*., 2000a). Though tilapia is not yet a widely cultured species in South Asian countries, however, its culture practices is

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increasing rapidly in Bangladesh. There are many homestead derelict mini ponds; proper use of those ponds with any short time culture fish like tilapia can open a new avenue for the poor farmers of Bangladesh.

Thus the aim of the present investigation was to observe the growth performance of monosex tilapia in mini earthen mini ponds using homemade feed and commercial feed.

MATERIALS AND METHODS

The experiment was conducted in 6 experimental ponds each of 0.60 decimal, located in the northern side of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. The study was carried out for 70 days from 26 June to 03 September 2010. The water depth was maintained at a level of 1.0-1.3 m.

To eradicate all undesirable fish, insect and other aquatic organism ponds were drained out completely. Aquatic weeds were removed manually. Lime was applied at a rate of 1 kg/decimal. Lime was soaked for overnight in a metallic container and then applied by spreading homogeneously in the ponds.

Two treatments were considered having 3 replicates in each, treatment 1 conducted with prepared feed (having Peninsula Group supplied fish meal) and treatment 2 conducted with commercially available fish feed named Quality Fish Feed (nursery-2, starter). The fries of monosex tilapia were supplied by Agro-3 Fish Hatchery and Culture farm, Bailor, Mymensingh and transported to the pond site with polythene bags having oxygenation facilities. The proximate compositions of feed ingredients were determined by using standard methods. A prepared feed (55.24% protein) composed of 37.24% fish meal, 15.00% mustard oil cake, 18.38% rice bran, 18.38% maize, 10% wheat flower and 1% vitamin premix was used in T_1. Fish were fed at a rate of 10% of their body weight for the first thirty days then was gradually reduced to 6% for the next ten days, 2% for the next ten days (because, during the period water temperature was suddenly increased between 35-38°C) and 3% till the termination of the experiment. The water quality parameters were recorded throughout the experimental period. Water samples were collected between 9:00-10:00 a.m. at fortnightly interval. The physico-chemical parameters like temperature (°C), dissolved oxygen (mg L^{-1}), pH, alkalinity (mg L^{-1}), nitrate (mg L^{-1}) and ammonia (mg L^{-1}) were determined at fortnightly interval.

RESULTS AND DISCUSSION

The mean initial weight of fish in both the treatments was 15.96 g. The mean weight gains of fish at the end of the experiment were 123.48 and 111.82 g in T_1 and T_2, respectively. In first 30 days of culture period (stage 1), tilapia grew from 15.96 g to an average weight of 103.6 and 99.69 g in T_1 and T_2, respectively (Table 1). Average survival rates were 75.55 and 90.37% in T_1 and T_2, respectively (Table 1). Average Food Conversion Ratio (FCR) for tilapia with the prepared pellet feed and commercial pellet feed in stage 1 was 2.30 and 2.33 (Table 1). The gross production was 14174 and 12726.99 kg ha^{-1} in T_1 and T_2, respectively in the stage 1 (Table 1).

After 30 days (stage 2) of feeding, tilapia grew from 103.6 and 99.69 g to an average weight of 139.44 and 127.78 g in T_1 and T_2, respectively (Table 2). During the period average survival rates were 75.55 and 90.37% in T_1 and T_2, respectively. Average Food Conversion Ratio (FCR) for tilapia with the prepared pellet feed and commercial pellet feed were 1.51 and 1.40. Gross production averaged 19076 and 16312.11 kg ha^{-1} in T_1 and T_2, respectively during total experimental period of 70 days (Table 2).

The results of the water quality parameters such as temperature (°C), dissolved oxygen (mg L^{-1}), pH, alkalinity (mg L^{-1}), nitrate (mg L^{-1}) and ammonia (mg L^{-1}) during the experimental period are presented in (Table 3).

Table 1: Growth parameters of monosex tilapia in different treatments during the first 30 days of culture period

	Treatments	
Growth parameters	T_1	T_2
Initial mean weight (g)	15.960	15.960
Final mean weight (g)	103.610	99.690
Mean weight gain (g)	87.650	83.730
Average daily weight gain (g)	2.922	2.791
Weight gain (%)	7765.111	6373.444
SGR (%/day)	6.233	6.105
Food conversion ratio (FCR)	2.300	2.330
Survival (%)	75.550	90.370
Fish production (kg ha^{-1}/first 30 days)	14174.000	12726.990

Table 2: Growth parameters of monosex tilapia in treatments during the study period

	Treatments	
Growth parameters	T_1	T_2
Initial mean weight (g)	15.96±0.00[a]	15.96±0.00[a]
Final mean weight (g)	139.44±5.91[a]	127.78±7.82[b]
Mean weight gain (g)	123.48±5.91[a]	111.82±7.82[b]
Average daily weight gain (g)	1.76 ±0.08[a]	1.60±0.11[a]
Weight gain (%)	12348.44±591.38[a]	11181.78±782.23[b]
SGR (%/day)	3.09±0.06[a]	2.97±0.09[b]
Food conversion ratio (FCR)	1.51± 0.07[a]	1.40± 0.10[a]
Survival (%)	75.55±9.30[b]	90.37±4.55[a]
Fish production (kg ha^{-1}/first 30 days)	14174.00±7.69[a]	12726.99±6.91[b]
Fish production (kg ha^{-1}/next 40 days)	4902.00±801.32[a]	3585.12±991.68[b]
Total fish production (kg ha^{-1}/70 days)	19076.00±809.01[a]	16312.11±998.59[b]

[a,b]: Significant variation between treatments

Table 3: Fortnightly fluctuations of water quality parameters of the ponds under different treatments during the study period

		Sampling date				
Parameters	Treatments	10/07/10	25/07/10	09/08/10	25/08/10	Mean±SE
Temperature (°C)	T_1	32.500	31.800	34.000	33.500	33.16±0.29
	T_2	32.500	31.800	34.000	33.500	33.16±0.29
DO (mg L^{-1})	T_1	15.000	5.500	9.500	11.500	11.00±1.44
	T_2	14.000	6.500	9.300	14.000	11.45±1.26
pH	T_1	7.100	7.100	8.000	7.600	7.55±0.14
	T_2	7.600	7.600	7.100	7.700	7.71±0.07
Alkalinity (mg L^{-1})	T_1	130.000	115.000	160.000	105.000	128.00±6.63
	T_2	145.000	130.000	135.000	100.000	128.00±5.54
Nitrate (mg L^{-1})	T_1	0.060	0.060	0.060	0.060	0.06±0.00
	T_2	0.060	0.060	0.060	0.060	0.06±0.00
Ammonia (mg L^{-1})	T_1	0.003	0.007	0.080	0.040	0.04±0.01
	T_2	0.005	0.006	0.024	0.025	0.02±0.00

Among all the treatments, the highest growth rate of *Oreochromis niloticus* was recorded in T_1. This might be associated with higher percentage of protein and lipid content of feed. Cruz and Laudencia (1998) indicated that the tilapia fingerlings need 20-30% crude protein in ration to give optimum results in ponds. The feed in T_1 of the present study also contained crude protein within similar range.

In the present study weight gains of tilapia in the first 30 days were 87.65 and 83.73 g and at the end of the experiment weight gains were varied between 123.48 and 111.82 g in T_1 and T_2, respectively. The highest weight gain of tilapia was observed in T_1 which a prepared pelleted diet with Peninsula fishing group supplied Fish Meal (FM). Supplemental feeding with formulated prepared feed resulted highest growth of *Oreochromis niloticus* than supplemental feeding with commercial pellet feed. Cao *et al.* (1998) also found similar results in case of *Oreochromis niloticus* fed formulated diet. Hussain *et al.* (2000b) and Hasan *et al.* (1992) reported a weight gain of about 128 g for GIFT tilapia in on-farm ponds for a culture period of 6 months fed rice bran at 5-6% of their body weight. Considering the 70 days culture period in the present study, compared to 6 months period by Hussain *et al.* (2000b), tilapia in the present study performed better in respect of weight gain. In the present study Specific Growth Rate (SGR) of fish in the first 30 days were 6.23 and 6.10 and at the end of the experiment specific growth rates were varied from 3.09 and 2.97 in T_1 and T_2, respectively. According to De Silva and Davy (1992) fish feed on supplemental feeds could show SGR value between 3-4% day^{-1} which is similar to the result of the present study. Diana *et al.* (1996) obtained SGR value of 3.10 with *Oreochromis niloticus* in Thailand using feed and fertilizer. On the other hand, Green (1992) obtained a slightly lower SGR value of 2.03 with tilapia in Honduras using feed and fertilizer. Hossain *et al.* (2004) also observed SGR value of GIFT strain ranged from 2.04-2.30 fed on formulated diet which are lower than the present value. The differences of SGR values of the species *O. niloticus* in the present study are due to the temperature difference during the culture period of the ponds.

In the present study, FCR value varied between 1.40 and 1.51. Lower FCR value (1.40) was obtained in T_2 receiving commercial tilapia diet (31.91% protein). Hossain *et al.* (2004) found FCR value for GIFT strain fed on formulated diet (30.09% protein) was 1.71-1.77. The FCR values in other treatments were higher than that of T_2 which could be due to the fact that rice bran, wheat bran usually contain higher crude fiber are not easily digestible.

In the present study higher survival was achieved as the fish can survive under adverse conditions like low oxygen, high temperature and high pH value. The survival rate of monosex tilapia was recorded 75.55 and 90.37% in T_1 and T_2, respectively during the harvesting time. During the 1st week of August, temperature increased up to 35-38°C. As a result plankton bloom occurred and then most of the mortalities were recorded during this period in both the treatments. This result does not agree with Akhteruzzaman (1998) who reported that the survival rates of *Oreochromis niloticus* varied from 60-80%. But the results of present study was close to the research findings of Kohinoor *et al.* (2007) who observed that the survival rates of monosex tilapia were varied from 79-92%.

Significantly higher production was obtained from T_1 than T_2. Both the treatments had similar stocking density but obtained reduced production in T_2 than T_1 due to produced stress in fish which lead to reduced growth and production. In first 30 days, temperature was within favorable range (31.5-33.0°C), when growth of fish in both the treatments were excellent. In the next 10 days, when temperature was increased up to 35-38°C, plankton bloom occurred which continued for 10 days, feed supply was stopped for 2 days and then reduced to 1-2% body weight. As a result fish became stressed. This is the reason of growth in the last 40 days i.e., in those days

production did not achieved at the expected level. Moreover, most of the mortalities were recorded during this period in both the treatments.

In the present study, the production of fishes in first 30 days were 14174 (kg ha^{-1}) and 12726.99 (kg ha^{-1}) and then next 40 days were 4902 and 3585.12 kg ha^{-1} and total fish production were 19076 and 16312.11 kg ha^{-1} in T_1 and T_2, respectively whereas i.e., in 70 days. Thakur and Das (1996) and Akhteruzzaman (1998) mentioned that the average yield was 1800 and 150-500 kg ha^{-1}, respectively in 5-6 months. These results are much lower than the findings of the present experiment.

A simple economic analysis of the growth performance of fish showed that highest net profit (Tk/ha/70 days) of Tk. 15, 83,213 was obtained with T_1. The highest profit in T_1 is due to good proximate composition of feed prepared with Peninsula group supplied fish meal than commercial tilapia feed. On the other hand, fish fed prepared feed supplied by Peninsula Fishing Group also showed more profit than fish fed commercial tilapia diet (T_2).

In the present study, when we consider growth, SGR, production, FCR and economic value in the treatment 1 which yield significantly better results. In the diet of prepared feed, the fish meal was specially supplied to Agro-3, Fish Hatchery, to compare growth performance with local fish meal. It was observed that feed prepared from Peninsula Group supplied fish meal yielded better performance with monosex tilapia. Thus during feed formulation quality ingredients is a must for improved fish growth and production. It can be mentioned here that the supplied fish meal from Chittagong area possesses higher protein percentages in comparison with local one and thus yielded higher production compared with local fish feed.

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