J. Agrofor. Environ. 3 (1): 183-186, 2009 ISSN 1995-6983

Effect of feeding frequency on the growth and production performance of Monosex Tilapia

M.E. Ahsan, M.R. Haque[1], M.A. Hossain[1], M.S. Islam[2], M.S. Sultana[3] and M.M. Khan[4]
Department of Fisheries Management, Bangladesh Agricultural University. [1]Department of Fisheries Management, HSTU, Dinajpur, [2]Dept. of Fisheries, DU, [3]IDE-Bangladesh, Rangpur; [4]BFRI, Freshwater station, Mymensingh.

Abstract: A field experiment was conducted to study the effect of feeding frequency on the growth and production performance of Monosex tilapia (*Oreochromis niloticus* L.) in pond condition under three treatments each with three replications for a period of 40 days. A stocking density of 200 fish per decimal was used for the experiment and three feeding frequencies i.e. once daily (T_1), twice daily (T_2) and thrice daily (T_3) were used. The fish were fed @ 8 to 5% of their body weight throughout the study period. The water quality parameters were monitored at ten days intervals and they were more or less similar in three treatments and remained within the suitable ranges for Tilapia culture. The significantly ($P<0.05$) higher mean weight gain and specific growth rate (SGR) were recorded in treatment T_3. The survival rate was high (94-95%) in each treatment. The food conversion ratio (FCR) was significantly ($P<0.05$) lower in T_3 (1.65) than that of T_1 and T_2. The highest production of fish was observed in T_3 (2669kg/acre/40 days), which was significantly higher than that of other treatments and the result of the present study indicated that feeding frequency has direct effect on the growth and production of Monosex Tilapia (*O. niloticus*) under pond condition.
Key words: FCR, Feeding Frequency, Monosex Tilapia, Production and SGR.

Introduction

Tilapia is an excellent fish for growing in the shallow and seasonal ponds in a country like Bangladesh (Gupta *et al.*, 1992; Kohinoor *et al.*, 1998), as it enjoys suitable climate and ecological conditions for culture of this warm water species. The synthetic Monosex strain was reported to show on an average 60% faster growth and 50% better survival at harvest than the most commonly farmed strain (Eknath, 1992; Sultana *et al.*, 1997). The Monosex strain has proved to be very suitable fish for aquaculture in Bangladesh and, is considered to be an important food fish (Khan, 1996).

In aquaculture, like other form of husbandry, feeding is crucial for its viability and success (Lovell, 1977). Feed cost is one of the largest operational costs in aquaculture (De Silva and Davy, 1992). The practice of feeding in an aquaculture system involves selection of appropriate ration sizes, (the amount of feed supply), determining the feeding frequency (how many times the organism should be fed in a day), and timing of meal and efficient broadcasting of the predetermined ration to the culture system (Murai and Andrews, 1976). The number of feeding per day and the time of feeding vary with species, size of fish and environmental conditions (Chiu, 1987). Sometimes excellent quality feeds do not perform satisfactorily unless correct feeding practices and proper feeding rates are used (Numenz and Donos, 1995). It is essential to recommend the optimum feeding rate for economic production of fish. In general the feeding regime and growth of fish are very much related. Thus the feeding strategy may provide clue for maximum growth because the feeding frequency contribute to feed efficiency and growth response (Jarboe and Grant, 1997). The feeding frequency is important to ensure best FCR and weight gain of cultured organism (Carlos, 1988). The present study was conducted to determine the effect of feeding frequency on the growth and production performance of Monosex Tilapia, determine the water quality, and profit margin.

Materials and Methods

The experiment was conducted in 9 earthen ponds situated in the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh for a period of 40 days commencing from 30 June to 8 August, 2008. Aquatic weeds were removed manually from the ponds. Complete eradication of all undesirable fish, insects and other aquatic live forms were done by using Phostoxin tablet. One week after this, lime was administrated @ 1 kg per decimal. Seven days after liming, the ponds were fertilized with cow dung, urea and triple super phosphate (TSP) @ 3 kg, 100g and 75g per decimal respectively. Ponds were divided into three treatments *viz.* T_1, T_2 and T_3 each having three replicates for feeding fish once a day, twice a day and thrice a day, respectively. The experimental design was conducted by Completely Randomized Design (CRD) process. The Monosex Tilapia fry were stocked @ 200/decimal for each treatment and the fish were initially fed @ 8% of their body weight and was reduced gradually to 5% of their body weight. Reducing of ration size was performed by 1% in each 10 days interval. The fish were fed thrice daily at 8 am in the morning at 12.30 pm in the noon and 5 pm in the afternoon in case of T_3. Where as in case of T_1 feed was supplied once at 8 am and in case of T_2 feed was supplied twice at 8 am and 5 pm. Pelleted feed (Starter III, Quality Feed) was broadcasted in a fixed corner of each pond.

Three major water quality parameters such as temperature, dissolved oxygen and pH were measured and recorded weekly throughout the experimental period at 9 am by using a commercial kit box (Model: FF-3, USA). Growth and production of fishes were measured by sampling at an interval of 10 days by using a digital electronic balance KERN, Model No. EMB 2000-0 and were evaluated by the following parameters.

Weight gain= mean final fish weight- mean initial weight.

Specific Growth Rate (SGR, % per day)

$$= \frac{\mathrm{Log_e} W_2 - \mathrm{Log_e} W_1}{T_2 - T_1} \times 100$$

Where,

W1= Initial live body weight (g) at time T_1 (day)

W2= Final live body weight (g) at time T_2 (day)

T_2- T_1 = Duration of the experiment (day)

$$\text{Survival rate (\%)} = \frac{\text{No. of fish harvested}}{\text{No. of fish stocked}} \times 100$$

Production = No. of fish harvested × Final weight of fish

$$\text{Food Conversion Ratio (FCR)} = \frac{\text{Food fed (dry wt.)}}{\text{Live weight gain}}$$

Analysis of the data was done by using the software SPSS version 11.5 significance was assigned at 5% level.

Results and Discussion

Water quality parameters

Water temperature (°C): The water temperature varied from 28.65 to 31.53°C in all the treatments. The mean values of water temperature in treatments T_1, T_2 and T_3 were 30.03±1.25, 30.05±1.34, 30.06±1.28°C respectively (Table 1). The maximum temperature (31.85°C) was recorded in treatment T_2 on 9 July whereas the minimum (28.65°C) was in treatment T_2 and T_3 on 19 July.

Dissolved Oxygen: Dissolved oxygen content of the water was observed 4.40 to 6.36 mg/L in all the treatments. The mean values of dissolved oxygen content of the water in treatment T_1, T_2 and T_3 were 5.34±0.76, 5.39±0.75, 5.36±0.78 mg/L respectively (Table 1). The highest value of dissolved oxygen content (6.37 mg/L) was found in treatment T_3 on 9 July whereas the lowest value (4.40 mg/L) of dissolved oxygen content was found in treatment T_1 on 19 July. No significant variation of dissolved oxygen was observed among the treatments.

pH: During the study period, the range of pH values recorded 7.13 to 9.27 in all the treatments. The highest pH obtained with the treatment T_3 on 9 July whereas the lowest value of pH (7.13) was recorded in treatment T_1 on 19 July. There was no significant variations of pH values under different treatments were found and the values were within the alkaline range during the study period.

Table 1. Average value of water quality parameters under different treatments throughout the study period

Treatment	Parameters		
	Temperature (°C)	Dissolved oxygen (mg/L)	pH
	Mean	Mean	Mean
T_1	30.03±1.25	5.34±0.76	7.99±0.82
T_2	30.05±1.34	5.39±0.75	7.90±0.80
T_3	30.06±1.28	5.36±0.78	8.04±0.89

Figures indicates mean values ± standard deviation

Growth performance of fish: For the evaluation of growth performance of fish in different treatments in terms of final weight, mean weight gain, percent weight gain, specific growth rate (SGR% per day), survival (%), food conversion ratio (FCR) and production (Kg/acre/40 days) were calculated and are shown in Table 2 and Fig. 1.

Weight gain: There was no significant ($P>0.0.5$) difference in initial weight of fish under different treatments. The mean weight gain of fish at the end of the experiment was significantly higher in T_3 (106.00 g) than those in treatments T_1 (62.66 g) and T_2 (86.66 g).

SGR (% per day): The mean specific growth rate of Monosex Tilapia in different treatments ranged between 2.55 to 3.47. The significantly ($P<0.05$) highest SGR values (3.47) was recorded in treatment T_3 while the lowest (2.55) was obtained in T_1.

Survival (%): The survivals (%) in different treatments were fairly high. The survival ranged between 94.00 to 95.33%. There was no significant difference among the treatments.

Food conversion ratio (FCR): The food conversion ratio (FCR) values among the treatments were ranged 1.65 to 2.14. The significantly lowest i.e. the best FCR (1.65) was obtained with treatment T_3 while the highest (2.14) FCR i.e. the worst was obtained with T_1.

Fish production: The production of Monosex Tilapia ranged between 1836, to 2669 kg/acre/40days in different treatments. Treatment T_3 resulted in significantly ($P<0.05$) higher production compared to T_1 and T_2. Significantly higher production was obtained in T_2 than T_1 also.

Table 2 Growth parameters of Monosex Tilapia observed in different treatments

Growth parameter	Treatment		
	T_1	T_2	T_3
Initial weight (g)	35±0.00a*	35±0.00a	35±0.00a
Final weight (g)	97.66±2.51c	121.66±2.88b	141.00±3.60a
Weight gain (g)	62.66±2.51c	86.66±2.88b	160.00±3.60a
% weight gain	179.05±7.19c	247.63±8.23b	302.86±10.30a
SGR (%/day)	2.55±0.07c	3.11±0.05b	3.47±0.06a
Survival %	94.00±1.00a	95.33±1.54a	94.66±1.52a
FCR	2.14±0.05c	1.84±0.05b	1.65±0.06a
Fish production kg/acre/40days)	1836.00±43.71c	2319.56±80.98b	2669.41±87.32a

*Values in the same row having the same superscript are not significantly different ($P>0.05$), values are given with ±standard deviation

In this study, a commercial feed (Starter-III, Quality feed) was used for Monosex Tilapia farming under field conditions by feeding fish at different feeding frequencies. During the study period, physico-chemical parameters and growth parameters have also been observed. Growth, feed efficiency and feed consumption of fish are normally governed by few environmental factors (Fry, 1971 and Brett, 1979). The water quality parameters measured during the study period were within the acceptable limit for fish culture. Temperature recorded during the experimental period is more or less similar in different treatments. The highest temperature (31.58°C) was recorded in treatment (T_2 on 9 July) was due to relative high intensity of sunlight and absence of cloud in the sky and the lowest temperature (28.65°C) was recorded in T_2 & T_3 on 19 July, might be due to low intensity of light as a result of rainfall and cloudy condition and cool air flow which agreed with the findings of Hossain *et al.* (1997), Wahab *et al.* (2001).

In this study, a commercial feed (Starter-III, Quality feed) was used for Monosex Tilapia farming under field conditions by feeding fish at different feeding frequencies. During the study period, physico-chemical parameters and growth parameters have also been observed. Growth, feed efficiency and feed consumption of fish are normally governed by few environmental factors (Fry, 1971 and Brett, 1979). The water quality parameters measured during the study period were within the acceptable limit for fish culture. Temperature recorded during the experimental period is more or less similar in different treatments. The highest temperature (31.58°C) was recorded in treatment (T_2 on 9 July) was due to relative

high intensity of sunlight and absence of cloud in the sky and the lowest temperature (28.65°C) was recorded in T_2 & T_3 on 19 July, might be due to low intensity of light as a result of rainfall and cloudy condition and cool air flow which agreed with the findings of Hossain *et al.* (1997), Wahab *et al.* (2001).

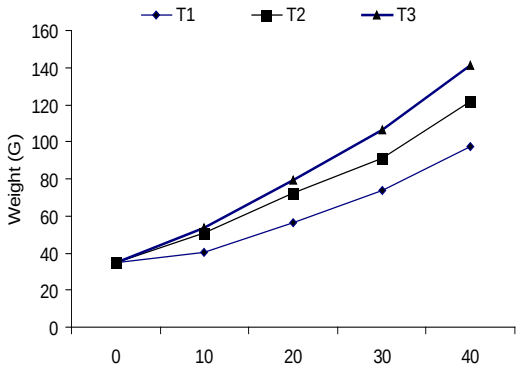

Fig. 1. Growth of Monosex Tilapia in terms of increase in weight (g) in different treatments during the study period

In the present study the DO content in water was 4.4 to 6.37 mg/L. More or less similar results were reported by Hossain (2000) and Kohinoor (2000) where they recorded DO values of fish ponds ranged from 3.8 to 6.9 mg/L and 2.04 to 7.5 mg/L respectively. The pH range in the experimental period was found to be slightly alkaline 7.1-9.3. This is within the acceptable range required for fish culture 6.5-9.0, (Boyd, 1990). Observation on the growth rate of fishes in various treatments showed that in 40 days culture period, the average weight gain (160.00g) was attained in treatment T_3 followed by T_2 (86.66g) and T_1 (62.66g). The highest weight gain in T_3 might be due to the fact that the fish had received the small amount of feed at a time and effectively utilized the applied feed effectively converted into muscle. The specific growth rate (SGR), of 2.55, 3.11 and 3.4% per day were found in T_1, T_2 and T_3, respectively. SGR progressively increased with the increase in feeding frequency. The significantly highest specific growth rate (SGR) in T_3 might be due to the fact that the fish have utilized effectively the supplied feed taking small amount at a time thrice daily. The survival (%) of fish in different treatments was fairly high ranging from 94 to 95.3% (Table 2) in all the treatments. There was no significant ($P>0.05$) variation in the survival of fish in different treatments. The survival rate recorded in present study was higher than the survival rate (82 to 90%) recorded by Hussain *et al.* (1987), which might be attributed to the relatively large size of fingerlings (35g) stocked in the present study. The lowest i.e. the best FCR (1.65) was observed in treatment T_3 with three time feeding frequency and the highest i.e. the worst FCR value (2.14) was recorded in T_1 with the feeding frequency of once a day. Chervinski (1982) reported different values of FCR for *Cyprinus carpio* with formulated diet at different feeding frequencies. The maximum fish production (2669 kg/acre) was obtained in T_3 under the three time feeding frequency and the production was found to be decreased significantly with the decrease in feeding frequency. The lowest fish production (1836 kg/acre) was observed in T_1 which might be due to ineffective feed utilization on bulk ration at a time and resulting decreased feed efficiency. Among the treatments, the highest productions were found in T_3 and consequently provide the highest net profit (Tk. 79630) with T_3, where fishes were fed three times a day. Similarly, the net profit was intermediate in treatment T_2 (Tk. 63438) and lowest in T_1 (Tk. 2669). Considering the overall production, survival rate and maximum profit the best result was obtained in treatment T_3 with three times feeding frequency in a day. Thus, the result of the present study indicated that feeding frequency has direct effect on the growth and production of Monosex Tilapia (*O. niloticus*) under pond culture.

References

Boyd, C. E. 1990. *Water quality in ponds for Aquaculture.* Birmingham Publishing Co., Birmingham, Alabama, 482 pp.

Brett, J. R., 1979. Environmental factors and growth. In: W.S. Haor, D.J. Randall and J. R. Brett (eds). *Fish Physiology. Vol. 6,* Environmental relations and behaviour. Academic Press, New York. pp. 599-677.

Carlos, M. H. 1988. Growth and survival of big head carp (*Aristichthys nobilis*) fry fed at different intake levels and feeding frequency. *Aquaculture,* 6: 267-276.

Chervinski, J. 1982. Environmental physiology of tilapias. In: R.S.V. Pullin & Lowe-McConnel (eds.). *The biology of Tilapias.* ICLARM conference proceedings 7, International Center for Living Aquatic Resources Management, Manila, Philippines, 119-128pp.

Chiu, Y. N. Sumagaysay, N. S. and Sastrillo, M. G. S. 1987. Effect of feeding frequency and feeding rate on the growth and feed efficiency of milk fish, *Chanos chanos* (Forskal) juveniles. Asian Fish. Sci., 1: 27-31.

De Silva, S. S. and Davy, F. B. 1992. Fish nutrition research for semi-intensive culture system in Asia. Asia Fisheries Science., 5: 129-144.

Eknath, A. E. 1992. Growth capacity of *Tilapia* in intensive culture. *Bamidgheh*, 32(3): 57-65.

Fry, F. E. 1971. The effect of environmental factors on the physiology of fish. In: W.S. Hoar, D.J. Randall and J.R. Brett (eds.) *Fish Physiology.* Vol. 6, Environmental relations and Behaviour. Academic Press, New York. pp 1-98.

Gupta, M. V. Ahmed M. Bimbao, M. A. and Lightfoot, C. 1992. *Socio-economic impact and farmers Assessment of Nile Tilapia (O. niloticus) culture in Bangladesh.* ICLARM technical Report No. 35. International Center for Living Aquatic Resources Management, Manila, Philippines, 50pp.

Hossain, M. A., Toyub, M. A., Islam M. N. and Hasan, M. R. 1997. Effect of species combination on the growth of major and Chinese carps in demonstration pond under Feni district. Bngladesh Agril. Sci., 21(2): 257-266.

Hossain, M. Y. 2000. *Effects of iso-phosphorus organic and inorganic fertilizer on water quality parameters and biological production.* M.S. Thesis, Department of Fisheries Management, BAU, Mymensingh. 74 pp.

Jarboe, H. H. and Grant W. J. 1997. The influence of feeding time and frequency on the growth, survival, feed conversion and body composition of channel catfish, *Ictalurus punctatus,* cultured in a three tier, close recirculating raceway, J. Appl. Aquacult., 7: 13-62.

Khan, M. S. H. 1996. *Culture of Genetically Improved Farmed Tilapia (GIFT) in cages.* M. S. Thesis, Department of aquaculture and Management, BAU, Mymensingh. 74 pp.

Kohinoor, A. H. M. 2000. *Development of culture technology of three indigenous fish mola (Amblypharyngodon mola), Punti (Puntius sophore) & Chela (Chela cachius) with notes on some aspects of their biology*. Ph. D dissertation, Department of Fisheries Management, BAU, Mymensingh, 363 pp.

Kohinoor, A. H. M. Modak P. C. and Hussain, M. G. 1998. Growth and Production performance of red Tilapia and Nile Tilapia under low input culture system. Bangladesh J. Fish Res., 3(1): 11-17.

Lovell, R. T. 1977. Feeding practices. In: *Nutrition and feeding of channel catfish*, Southern Cooperative series, 218: 50-55.

Murai, T. and Andrews, J. W. 1976. Effect of frequency of feeding on growth and food conversion of channel cat fish fry. Bull. Jap. Soc. Sci. Fish., 42: 159-161.

Nunez, J. D. and Donos, T. G. 1995. Feeding strategies of Salmonid cages and residuals assessment in lake Rupanco. Osorno, Chile. Medio. Ambiente., 12. 76-81.

Sultana, R. Kohinoor A. H. M. Islam, M. S. and Hussain, M. G. 1997. Comparative studies on growth of fry of GIFT and existing strain of Nile Tilapia (*O. niloticus* L.). Bangladesh J. Fish. Res., 1(1): 26-30.

Wahab, M. A. Ahmed Z. F. Islam, M. A. and Rahamatullah, S. M. 2001. Effect of introduction of common carp, *Cyprinus carpio* (L.), of the pond ecology and growth of fish in polyculture. Aquacult. Res., 26: 619-628.