Egypt. J. Aquat. Boil. & Fish., Vol. 11, No. 3: 230-238 (2007) ISSN 1110 - 6131

Evaluation of Nile tilapia commercial hatcheries systems in Fayoum governorate

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ABSTRACT

This experiment was carried out in thirteen tilapia commercial hatcheries at Fayoum governorate during year 2006 to evaluate the effect of 6 hatching systems, on Nile tilapia fry production. The results revealed that the laboratory hatching was better than natural hatching regarding to the number of monosex produced. Big broodstock weight gave more number and size of eggs than small broodstock weight. Good water quality improved hatching percent and increased fry production than decent water. The presence of hatchery inside the farm helps in increasing fry production and improved economic efficiency than lonely hatcheries. Broodstock feeding rate at low levels was more effective in increasing fry production than high levels. The economic efficiency was in favour of the 1st hatching system (good water quality) followed by the 3rd system (big brood) and the 6th system (inside the farm).

Key words: Nile tilapia, hatching system, water quality, feeding rate and hatchery area.

INTRODUCTION

Total aquaculture production in Egypt participates by 8.17 % agricultural national income and 33.27 % from animal production income in 2004 (AS, 2005). Aquaculture production in Egypt reached 471535 tonnes with a total market value of 4.046 milliard L.E., and Fayoum governorate production contribute by 8537 tonnes (1.81%) of the total production. Tilapias are among the most important freshwater species with the greatest production expansion in aquaculture in recent years (Fitzsimmons and Gonzalez, 2005), it was 82% of Fayoum aquaculture production (GAFRD, 2004). The area of fish farms in Fayoum was 2650 feddan (fdn) (GAFRD, 2004), it was increased to more than 3000 fdn in 2007 and there are 14 tilapia hatcheries are existing. In the traditional systems tilapia broodfish are reared in ponds with or without supplementary feed and fry are collected from the edges of ponds. Recently, spawning of broodfish in large nylon hapas suspended in ponds has been developed (Little *et al.*, 1995, 1997 and Bhujel *et al.*, 1998) and became commercialized and proven to be economically viable (Little *et al.*, 1997; Bhujel, 1997).

Regarding hapas, broodfish handling, and eggs and fry harvesting are easy (Lovshin and Ibrahim, 1988), and purity of strain can be maintained well. In addition, hapas are more flexible and cheaper than tanks. Manipulation of inter-harvest interval and conditioning of males and females have improved seed output and spawning synchrony (Little *et al.*, 1993). However, fouling of spawning hapas and the seasonality of demand for seed has been identified as major problems (Little *et al.,* 1997).

Hatchery success to achieve a high returns depends on the demand volume of the fry production or its complete marketing. Nile tilapia hatching is easy and this led to construct many hatcheries most of them are drived without experience.

This study aimed to evaluate Nile tilapia hatching systems at Fayoum governorate with regard to the best economic system.

MATERIALS AND METHODS

This experiment was carried out in thirteen tilapia commercial hatcheries on Shakshouk village, Fayoum Governorate, during year 2006. Six tilapia hatching systems (propagation) systems are used at Fayoum governorate. These systems are illustrated in Table (1). They differ in water quality, broodstock weight, feeding level, and hatching method. Some of these hatcheries are not connected to grow out pond farm and the others are included in the fish farm.

Table (1). Plan of work

Hatching system	Water quality	Brood weight, g	Feeding level, %	Hatchery situation	Hatching method
1	Good	180	0.5	Independent	Laboratory
2	Decent	180	0.5	Independent	Laboratory
3	Decent	250	0.5	Independent	Laboratory
4	Decent	180	0.5	Independent	Natural
5	Decent	180	2.0	Independent	Natural
6	Decent	180	2.0	Included in a farm	Natural

Broodstock were fed a commercial diet containing 25% CP (Joe Fid, Joe trade company). Its CP was checked according to method of AOAC (1984). Regarding water quality parameters during the experimental period; water temperature, pH, dissolved oxygen, salinity and total ammonia-N were obtained through centigrade thermometer, Orion digital pH meter model 201, Col Parmer oxygen meter model 5946 and Hanna instruments ammonia test kit (HI 4829), respectively.

Analysis of variance and LSD range test were used to compare treatment means. Data were analyzed using Statigraphic Package Software (SPSS, 1997). Also, a simple economic evaluation was conducted.

RESULTS AND DISCUSSION

Effect of water quality

Some of hatcheries obtained water of good quality from El-Wadi drain but the others obtained decent quality water from a branches drainage cannels which are more polluted.

Table (2) shows the means of water quality parameters during the hatching season. As shown in this table, water sources differ in their salinity. The other tested parameters were within the acceptable limits.

Table (2). Water quality parameter of two group of hatcheries

Item	Good quality	Decent quality
Water temperature, ^{o}C	27.0	27.0
Water oxygen, mg/l	6.5	5.7
Water pH	7.6	6.8
Water salinity, ppt	1.0	3.0

Results of Table (3) indicated that number of monosex produced per female increased significantly ($P \leq 0.05$) for females reared in good water quality (951) compared to those obtained from females kept in decent water (711). In this connection Little *et al.* (1994) reported that water quality parameters are the major factors affecting seed output.

Table (3). Effect of water quality on tilapia mono sex fry production

Hatching system	Water quality	Brood No.	Mono sex fry/female	SE
1	Good	8200	951[a]	± 26.0
2	Decent	10500	711[b]	± 41.0

Effect of feeding level

Results of Table (4) show significant differences in reproductive performance of broodfish due to feeding level. In general the lowest feeding level (0.5% of live body weight/day in system 4) resulted in better reproductive performance than the higher feeding level (system 5) in natural hatching. These results are in agreement with these obtained by Abou Zied (2006).

Table (4). Effect of feeding level on tilapia monosex fry production in natural hatching

Hatching system	Feeding level %	Brood No.	Mono sex fry/female	SE
4	0.5	4950	520 [a]	± 14.67
5	2.0	10700	469 [b]	± 12.65

Effect of brood weight

Effect of broodstock weight on fry production is shown in Table (5). It was indicated that the higher weight of broodstock produced significantly more fry than small weight despite the fact that small brood weight spawn more frequently. In the present study the 250 g female produced 741 fry, but that of 180 g produced 711 fry. These results agree with those obtained by other authors, who reported that Nile tilapia females of larger size were found to produce more and bigger eggs (Rana, 1986) and more fry per female (Guerrero and Guerrero, 1985), and smaller females spawn more frequently (Guerrero and Guerrero, 1985).

Table (5). Effect of brood weight on tilapia mono sex fry production

Hatching system	Brood weight, g	Brood No.	Mono sex fry/female	SE
3	250	16250	741	± 14.20
2	180	10500	711	± 41.00

Effect of hatching method

Results of Table (6) show the effect of hatching system on fry production. The laboratory system produced significantly ($P \leq 0.05$) more fry which can be converted to monosex than natural method because in natural method fry are incompletely harvested from hapa and are of different sizes, where big fry aren't useful for monosex reverse and these fries therefore are excluded.

Table (6). Effect of hatching methods on tilapia mono sex fry production

Hatching system	Hatching method	Brood No.	Mono sex fry/female
2	Laboratory	10500	711 [b]
4	Natural	4950	520 [b]

Effect of hatchery situation

Hatchery situation may influence fry production by saving a suitable area to contain a lot of fry number until marketing especially on stagnancy state of fry demand. Results in Table (7) show that the area of hatchery or the presence of hatchery inside the farm had better effect than independent hatcheries due to nursing the fry on stagnancy state and these will be soled as fingerlings.

Table (7). Effect of hatchery situation on tilapia mono sex fry production

Hatching system	Hatchery situation	Brood No.	Mono sex fry/female	Mixed fingerling/female
5	Independent	10700	469	50
6	Farm dependent	10450	511	175

Comparing the tested systems (Table 8) it was observed that the first system was the best which put the importance of good quality of water in the first position. In much lower extent systems 2 & 3 occupied the second position referring to hatching method. This means that laboratory method is better than the natural one as it is more organized and egg could be harvested more completely. Brood weight, feeding level, the presence of hatchery in the farm or not had lower effect than the above systems and seems to be nearly similar to each other.

Table (8). A comparison of the tested systems.

Hatchery system	Brood No.	No. of monosex fry/female	No. of mixed fingerlings/female
1	8200	951	0
2	6700	711	0
3	16250	741	0
4	4950	520	0
5	5200	469	50
6	10450	511	175

The economic evaluation of the tested systems (Table 9) cleared that water quality had the major effect (system one) on fry production. The positive effect of laboratory method with high brood weight was observed (system 3). Also, the effect of natural spawning in the farm (system 6) produced the lowest number of fry per female.

In conclusion it seems that good water quality had a positive effect followed by brood weight and the presence of the hatchery in the farm considering the economic evaluation.

Table (9). The economic evaluation of the tested systems.

Item	Hatching system					
	1	2	3	4	5	6
Costs in thousand, L.E.						
Brood	12.3	10.5	24.75	7.4	16.0	15.5
Feed	13.0	9.0	22.0	5.0	9.0	23.0
Equipments	40	38	50	20.5	33.5	40
Other	9.7	7.5	3.25	7.1	6.5	6.5
Total costs	75	65	100	40	65	85
Selling price in thousands, L.E.						
Mono sex fry	190	120	275	60	100	125
Mixed fingerlings	---	----	----	----	50	70
Total sales	190	120	275	60	150	195
Returns/hatchery in thousands, L.E	115	55	175	20	85	110
Returns/brood, L.E.	14.02	5.24	10.77	4.04	7.94	10.53

Based on the obtained results, it is to recommend for tilapia hatcheries to drive the hatchery with broodstock at higher body weights and to feed it at 0.5% daily of the total biomass in laboratory using water of good quality. It also to recommend the establishment of the hatchery inside the grow out farm for better economic efficiency.

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تقييم نظم تفريخ البلطى النيلى التجارية بمحافظة الفيوم

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أجريت هذه الدراسة فى ثلاثة عشر مفرخ تجارى فى منطقة شكشوك بمحافظة الفيوم خلال عام ٢٠٠٦ لتقييم تأثير ٦ نظم للتفريخ على إنتاج زريعة البلطى.

وقد أوضحت النتائج زيادة الزريعة الناتجة من التفريخ المعملى معنويا عن التفريخ الطبيعى وذلك عند النظر الى كمية الزريعة وحيدة الجنس التى تم الحصول عليها. الأمهات ذات الوزن الكبير اعطت عدد اكثر من البيض كبير الحجم عن الأمهات صغيرة الوزن. كما ارتفعت نسبة التفريخ فى المياه الجيدة وزادت كمية الزريعة الناتجة عن المياه قليلة الجودة كذلك وجود المفرخ داخل المزرعة ساعد فى زيادة كمية الزريعة الناتجة وحسن من الكفاءة الاقتصادية عن وجود المفرخ بمفرده. كما ادت تغذية الأمهات بمستويات منخفضة من وزن الجسم لزيادة كفاءة إنتاج الزريعة مقارنة بمستويات التغذية العالية.

و كانت الكفاءة الاقتصادية للنظام الاول (مياه جيد الصفات) هى الأفضل تلاها النظام الثالث (وزن الام الكبير) ثم النظام السادس (وجود المفرخ بالمزرعة).