EFFECT OF INITIAL STOCKING SIZE AND PRODUCTION CYCLE ON GROWTH PERFORMANCE OF MONO SEX TILAPIA REARED IN EARTHEN PONDS

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Abstract

The present investigation was carried out at Wady El-Rayan, Fayoum Governorate, Egypt in order to test the effects of initial weight and production cycle on growth performance and pond productivity of Nile tilapia (*Oreochromis niloticus*). The experiment was carried out in 6 earthen ponds each of a total area of two feddan (8400 m^2) where 2 ponds have been randomly allocated to each of the three treatments. The first two ponds (T_1) were stocked with Nile tilapia fry of an average initial weight of 1.3±0.0 g and cultured for 28 weeks. The second two ponds (T_2) were stocked with Nile tilapia fingerlings of 4.1±0.1 g cultured for 28 weeks, while the third two ponds (T_3C_1) were cultured with Nile tilapia fingerlings of an initial weight of 11.6±0.15 g for 14 weeks. Then all fish of the last two ponds were harvested and there after the same ponds were restocked with Nile tilapia fingerlings of an initial weight (T_3C_2) of 31.2±0.4 g and cultured for another cycle of 14 weeks i.e. from 8/07 to 14/10/2006.

Results obtained are summarized in the following:

1- The highest initial weights were recorded by T_3C_2 followed in a decreasing order by T_3C_1; T_2 and T_1 respectively.
2- The highest final weight was obtained by T_2 then T_1 then significantly followed by T_3C_2 and T_3C_1.
3- The highest SGR and RGR values were recorded by groups T_3C_2 followed in a decreasing order by T_3C_1; T_1 and T_2 respectively with significant differences among groups.
4- Averages of daily weight gain (DWG) ranged between 1.3 g (T_2) and 2.91 g (T_3C_2) with significant differences among groups and averages condition factor (K) ranged between 1.3 to 2.91% (T_3C_2) with significant differences among groups.
5- Averages of final yield were found to be 6340.8; 6470.4; (4425.6 + 4790.4) kg for T_1; T_2 and for both (T_3C_1+ T_3C_2) during the whole culture season respectively.
6- Net returns recorded by T1; T2 and (T3C1 + T3C2) were 19543.4; 27488.5 and 35886.3 LE respectively, and net returns as percent of the lowest one (T1 100) were 140.65 and 183.62 for T2 and T3C1 + T3C2 together respectively.

Keywords: Nile tilapia; initial stocking size; earthen ponds; monoculture system; Growing period; Growth performance.

INTRODUCTION

There is a great need to increase fish production via aquaculture in Egypt to fill the gab in animal protein in the country. In 2006, fish production from aquaculture activities contributed by 61.28% of the total fish production which amounted 970.923 metric tons in the same year (GAFRD 2006). There is a significant potential to increase aquaculture production in Egypt via applying the proper feeding methods, fertilization, water quality management and the suitable production strategy, in the light of freshwater limitation for aquaculture are limited in Egypt. Tilapia is the leading species in Egyptian aquaculture as this species is well adapted to Egyptian conditions, easy to propagate, grows fast, converts the artificial food very efficiently, and tolerates the changes in water quality as well as diseases compared to other cultured fresh water species. It is of great interest to find out a culture strategy of Nile tilapia in earthen ponds which achieves the highest yield with the lowest costs which will be reflected on the market price of tilapia. The present study was carried out to investigate the effect of fish size upon stocking and the length of culture period on pond productivity and economics of Nile tilapia under practical condition.

MATERIALS AND METHODS

The present experiment was carried out in 2006 on a private fish farm at Wady El-Rayan, Fayoum Governorate during fish farming season 1/4 to 14/10. The experiment lasted 28 weeks from the start. The study aimed to investigate the effect of initial tilapia sizes on growth performance, total yield and economic returns.

Experimental ponds

Six 2-feddan (water surface) earthen ponds have been randomly allocated to the three treatments. Average water depth was about 1.5m in the experimental ponds. The first two ponds were stocked with Nile tilapia fry of an initial body weight of 1.3g at a stocking density of 24 thousand fry /pond. The second two ponds were stocked at a density of 24 thousand Nile tilapia fingerlings (4.1g. initial weight). The previous four ponds followed the single production cycle for 28 weeks. The last two ponds which have been allocated to the third treatment investigated the two production cycles. The two ponds were stocked with Nile tilapia fingerlings at a rate of 24 thousand/pond. After 14 weeks, ponds were harvested and restocked again with equal number of fingerlings for another 14 weeks. Average initial weights of tilapia fingerlings in the last experiment were 11.6 and 31.2g in the first and second production cycles, respectively. Table (1) shows the experimental design and the initial weights as well as the length of culture periods.

Table 1. Initial weights and growing periods in the present study

ITEMS	Initial weight (g)	Culture duration (week)	Period
Young fry	1.3	28	1/4 : 16/10
Medium fingerling	4.1	28	1/4 : 16/10
Large fingerling	11.6	14	1/4 : 8/7
Large fingerling	31.2	14	8/7 : 16/10

Experimental fish

All-male Nile tilapia (*Oreochromis niloticus*) fry produced through hormonal treatment was purchased from the commercial tilapia hatchery that belongs to Arab Fisheries Co. at Abbasa, Sharkiya Governorate. Tilapia fry were transported in plastic bags filled with hatchery pond water and filled with air and transported to the experimental location. The batch of tilapia fingerlings stocked in April has been over-wintered. For the second cycle of the third treatment, fingerlings used were the nursing products of fry produced on the farm in the same year. In order to avoid thermal shocks, all experimental fish were adapted for experimental pond conditions for 30 minutes before being released from transportation bags.

Ponds water

Experimental Ponds were filled to a level of 1.5m and water losses due to evaporation or seepage were compensated every two days and during the last 8 weeks about 5% of the pond water was exchanged daily and replaced by fresh water and this water exchange was performed during night hours for the one cycle production ponds. For the two-cycle production ponds, water loss was compensated every two days during the first 6 weeks and during the last 8 weeks 5% of pond water was exchanged by fresh water daily. This was applied during the two production cycles. Water sampling for essential water quality parameters was carried out monthly whereas water samples were taken from ponds outlets. Water pH values were determined using digital pH meter model 68 engineered systems and Designs. Salinity (g/l); hardness (mg/l); alkalinity (mg/l) and ammonia NO_3 (mg/l) were determined according to the methods described by APHA (1992). Seccki disck reading (cm) and water temperature (^oC) were measured daily at 11:00am, while water oxygen concentration was measured at 6:00 am daily using a digital oxygen meter model WPA 20 Scientific Instruments. Averages of the determined physical and chemical properties of the experimental ponds water are illustrated in table (2).

Table 2. Averages of physical and chemical properties of pond water during experimental period on 2-week intervals. (Mean ± SE)* From 20th of April to 6th of September (2006).

ITEMS	Periods						
	10/4/06 to 29/4/06	30/4/06 to 27/5/06	28/5/06 to 24/6/06	25/6/06 to 22/7/06	23/7/06 to 19/8/06	20/8/06 to 16/9/06	17/9/06 to 14/10/06
Temp. (C^0)	19.8 ±0.4	23.4 ±0.4	27.4 ±0.45	30.2 ±0.5	32.9 ±0.05	28.5 ±0.3	26.4 ±0.29
Seccki Disk (cm)	>70 ±0.28	>70 ±0.28	>55 ±0.3	32 ±0.4	30 ±0.42	35 ±0.35	>40 ±0.14
pH values (Unit)	9.0 ±0.1	9.0 ±0.1	8.6 ±0.11	8.8 ±0.15	8.0 ±0.16	8.7 ±0.2	8.6 ±0.07
D. Oxygen (mg/L)	9.2 ±0.2	9.2 ±0.2	9.6 ±0.25	6.6 ±0.24	6.0 ±0.27	7.3 ±0.3	9.2 ±0.35
Salinity (g/L)	1.0 ±0.1	1.0 ±0.1	1.5 ±0.1	1.5 ±0.1	1.5 ±0.11	1.5 ±0.15	1.0 ±0.13
Hardness (mg/L)	400 ±48	400 ±48	650 ±42	800 ±60	650 ±50	450 ±30	360 ±45
Alkalinity (mg/l)	200 ±35	200 ±35	270 ±25	160 ±35	200 ±30	220 ±15	245 ±20
NO_3 (mg/L)	0.01 ±0.03	0.01 ±0.03	0.15 ±0.05	0.01 ±0.04	0.04 ±0.06	0.01 ±0.05	0.01 ±0.06
NH_4 (mg/L)	0.4 ±0.04	0.4 ±0.04	0.4 ±0.04	0.8 ±0.05	0.6 ±0.03	0.06 ±0.04	0.04 ±0.04
NH_3 (mg/L)	0.123438± 0.05	0.122636 ±0.05	0.122736 ±0.03	0.182624 ±0.05	0.294528 ±0.06	0.1 ±0.04	0.178536 ±0.03

Experimental diet

Experimental fish were fed on a commercial diet containing 25% crude protein and 3750 kcal/gross energy/kg., with a calorie to protein ratio of 150 kcal to 100g protein. The diet was fed at a rate of 3% of the fish biomass divided its three equal portions daily i.e. 8^{00}; 12^{00} and 16^{00} o'clock.

Growth performance parameters

1-Live body weight and body length

Live body weight (LBW) in g and body length (BL) in cm of individual fish of each experimental treatment was recorded every 2 weeks (14 days) based on a random sample of 50 fish each. After weighting the sample all fish were returned back to its ponds. Individual fish weight in the sample was recorded.

2- Weight gain

Weight gain (WG) = final weight – initial weight

3-Condition factor (K)

The condition factor (K) represents the relationship between LBW and BL of the fish. It was calculated as follows:

$K = LBW \times 100 / (BL)^3$

Where: LBW= fish weight "grams"

BL = fish length "cm

4-Specific growth rate (SGR)

Specific growth rate (SGR) = (LnW2-LnW1)/t X 100

Where: Ln = the natural log

W2= Final weight at certain period (g)

W1= Initial weight at the same period (g)

T = Period (d)

5-Daily weight gain (DWG):

(W_2-W_1) /t., where W_2 is the final weight, W_1 initial weight and t is the time in days.

6-Relative growth rate (RGR %)

(W_2-W_1/W_1) X100 where W_2 and W_1 is the final and initial weight respectively.

Statistical analysis

The statistical evaluation of results was performed according to the methods described by Snedecor and Cochran (1976) and Duncan's multiple range test (Duncan 1955) was carried out to detect the significant differences among means.

RESULTS AND DISCUSSION

Water quality parameters

As presented in table (2) water temperature averaged between 25.8 ^oC in April and 30.2 ^oC in July; Seccki Disk reading ranged between 15.3cm. (June) and 20.7 cm. (October); water pH values ranged between 8.3 (April) and 9.2 (October); dissolved oxygen (mg/L) fluctuated between 4.2mg/L (October) and 5.8mg/L (April), while salinity (g/L); hardness (mg/L) alkalinity (mg/L) and ammonia (mg/L) ranged between 2.0 to 2.1; 1240 to 1625; 220 to 370 and 0.28 to 0.69respectively. All the tested physical and chemical water properties were within the permissible levels required for the optimal growth and well being of tilapia. These results are in complete agreement with the findings of Abdel-Hakim *et al.*, (2001) and Abdel-Hakim and Ammar (2005).

Growth performance

Body weight (BW)

Averages of initial body weight upon stocking for experimental groups T_1; T_2: $T3C_1$ and $T3C_2$ were 1.3; 4.1; 11.6 and 31.2g/fish respectively, and the statistical evaluation of results reveled that $T3C_2$ showed the highest ($P<0.05$) initial weights followed in a significant decreasing order by $T3C_1$; T_2 and T_1 respectively. The same trend was observed during the period 2 weeks after stocking where $T3C_2$ showed the highest ($P<0.05$) body weight followed in a significant decreasing order by $T3C_1$; T_2 and T_1 respectively. After 4 weeks of the experimental start group $T3C_2$ showed the highest BW with insignificant differences among this group and group $T3C_1$ followed in a significant ($P<0.05$) decreasing order by T_2 and T_1 respectively. Similar trend was observed after 6 weeks of experimental start. During periods 6; 10; 12 and 14 weeks of start, both groups T3C1 and T3C2 showed heavier bodies ($P<0.05$) compared to T_2 and T_1 where differences in BW among the first two groups were insignificant. Similarly, the difference in BW among the later two groups T_2 and T_1 during these periods were insignificant. These results may indicate in general that the initial weight influence the BW during the growth period even when differences are insignificant. At the harvest of $T3C_1$ and $T3C_2$ averages of final weights (Table 3) were 184.4 and 199.6g compared to 108.1 and 98.5g for T_1 and T_2 which have to grow 14 weeks further till harvesting. For the remaining period i.e. 14 weeks further culture of T_1 and T_2 results of (Table 3) reveled that, during the periods 16; 18; 22; 24; 26 and 28 weeks after stocking differences in BW among T_1 and T_2 were insignificant. However, T_2 showed relatively higher body weights compared to T_1. As presented in the same table, averages of final weights of T_1 and T_2 were 264.2 and 269.6g respectively. In general these results may indicate that expanding the growing season to 28 weeks with smaller fish may result in heavier individual weight at harvesting compared to applying shorter season (14 weeks) starting with heavier fingerlings, however the limiting factor in this hence is the profit of applying two runs with heavier individuals or using smaller fish for one run during the season.

Table 3. Average of body weight (W in grams) of *O.niloticus* during experimental period (14 and 28 weeks)

Intervals in weeks	T1	T2	T3C1	T3C2
0	1.3 d ±0.0	4.1 c ±0.10	11.6 b ±0.1	31.2 a ±0.4
2	6.3 d ±0.81	14.6 c ±0.32	33.4 b ±0.5	44.5 a ±0.5
4	15.6 d ±0.33	29.4 b ±0.65	57.2 a ±0.7	60.3 a ±0.7
6	30.3 c ±0.63	42.6 b ±0.94	82.7 a ±0.9	78.3 a ±0.9
8	49.1 b ±1.06	58.8 b ±1.30	111.3 a ±1.4	105.3 a ±1.3
10	63.1 b ±1.38	71.7 b ±1.56	138.9 a ±1.7	136.7 a ±1.7
12	81.9 b ±1.79	90.1 b ±1.9	162.5 a ±2.0	161.7 a ±1.9
14	98.5 b ±2.00	108.1 b ±2.4	184.4 a ±2.6	199.6 a ±2.4
16	117.6 a ±2.36	131.2 a ±2.90	-	-
18	133.0 a ±2.68	152.0 a ±3.40	-	-
20	157.1 a ±3.09	181.6 a ±4.01	-	-
22	178.4 a ±3.49	201.4 a ±4.47	-	-
24	206.6 a ±4.17	228.7 a ±5.10	-	-
26	233.2 a ±4.46	251.6 a ±5.60	-	-
28	264.2 a ±4.65	269.6 a ±5.86	-	-

- a, b, c within each row show the same superscripts that do not differ significantly ($P<0.05$) otherwise they do

Body length (BL)

At the experimental start group $T3C_2$ showed the highest body length records (10.0cm) followed significantly by $T3C_1$; T_2 and T_1 respectively (Table 4). Results of the same table revealed that after two weeks of the experimental start the highest BL records were obtained by the group $T3C_1$ followed in a significant decrease by $T3C_1$; T_2 and T_1 respectively. During this period differences in BL among T_1 and T_2 were insignificant. These results may indicate that fish of T_1 was able to compensate the differences in initial BL within two weeks to achieve the same BL as T_2 which showed longer bodies at the start. During the periods 4; 6; 8; 10 and 12 weeks after experimental start both $T3C_1$ and $T3C_2$ showed significantly ($P<0.05$) longer bodies compared to T_2 and T_1 among both differences in this trait were insignificant. At the period 14 weeks after start averages of BL of groups T_1; T_2; $T3C_1$ and $T3C_2$ were 13.7; 14.1; 18.4 and 18.4cm respectively and the analyses of variance for BL indicate that differences in this trait among T_1 and T_2 were insignificant also among $T3C_1$ and $T3C_2$ differences in BL were insignificant, however at this period $T3C_1$ and $T3C_2$ showed significantly ($P<0.05$) longer bodies compared to T_1 and T_2. These results may indicate that Nile tilapia could partially compensate the differences in BL after 14 weeks when the differences in initial BL are not to drastic. As presented in Table (4) both groups $T3C_1$ and $T3C_2$ were harvested after 14 weeks where $T3C_1$ was early stocked and early harvested while $T3C_2$ was later stocked and later harvested with final length of 20.0 and 20.2cm respectively. On the other hand both T_1 and T_2 continued to grow till the end of the season i.e. to 28 weeks after stocking. Result of Table (4) show that differences in BL among T_1 and T_2 were significant during periods 18; 20; 24; 26 and 28 weeks after start except the periods 16 and 22 weeks after start thus differences in BL among both groups were insignificant (Table 4). These results may reflect the effect of initial length at stocking on the final length of fish, thus shorter fish can grow in length but not as those of longer bodies at stocking.

Growth parameters

Averages of condition factor (K); daily weight gain (DWG); specific growth rate (SGR) and relative growth rate (RGR) are presented in Table (5). Results of this table show that the highest ($P<0.05$) k values were recorded by T_1 (13.65%) followed in a significant decreasing order by T_2; $T3C_1$ and $T3C_2$ respectively. These results indicate that as smaller the fish in weight and size as greater the K value at the experimental start. After 14 weeks after start, K values of T_1; T_2; $T3C_1$ and $T3C_2$ were 2.84; 3.10; 2.49 and 2.47% respectively where T_2 recorded the highest value and differences among T_1 and T_2 were insignificant also differences in K value among T_1; $T3C_1$ and $T3C_2$ were insignificant. These results may indicate that starting with tilapia fingerlings of weight over 4g may decrease the K values which indicate that the fish grow faster in length than in weight. At 28 weeks after start (harvest of T_1 and T_2) group T_1 showed higher K value ($P<0.05$) than T_2.

Table 4. Average of body length (L in cm.) of *O. niloticus* during experimental period (14 and 28 weeks)

intervals	weeks	T1	T2	T3C1	T3C2
1/04/2006	0	2.0 d ±0.7	3.4 c ±0.1	6.1 b ±0.1	10.0 a ±0.2
15/04	2	4.1 c ±0.14	5.0 c ±0.16	9.90 b ±0.2	11.86 a ±0.24
29/04	4	6.4 b ±0.27	6.90 b ±0.28	13.1 a ±0.2	13.1 a ±0.2
13/05	6	7.6 b ±0.34	8.4 b ±0.31	14.3 a ±0.2	14.4 a ±0.2
27/05	8	10.4 b ±0.45	10.8 b ±0.41	15.9 a ±0.3	15.8 a ±0.3
10/06	10	12.0 b ±0.52	12.7 b ±0.36	17.4 a ±0.3	17.1 a ±0.3
24/06	12	13.7 b ±0.36	14.1 b ±0.37	18.4 a ±0.3	18.4 a ±0.3
08/07	14	15.2 b ±0.27	15.7 b ±0.29	20.0 a ±0.4	20.2 a ±0.3
22/08	16	16.6 a ±0.29	17.7 a ±0.28	-	-
05/08	18	17.9 b ±0.25	19.1 a ±0.21	-	-
19/08	20	19.1 b ±0.24	20.7 a ±0.23	-	-
02/09	22	20.0 a ±0.27	21.1 a ±0.26	-	-
16/09	24	20.3 b ±0.25	21.9 a ±0.28	-	-
30/09	26	20.8 b ±0.29	22.6 a ±0.20	-	-
14/10	28	21.7 b ±0.29	23.1 a ±0.24		

a, b, c within each row show the same superscripts that do not differ significantly (P<0.05) otherwise they do .

Concerning results of DWG, the group $T3C_2$ showed at harvest (14 weeks after start) the highest (P<0.05) DWG values compared to the other group and the lowest value was recorded by T_1. At the harvest of T_1 and T_2 (28 weeks after start) T_2 showed significantly (P<0.05) higher DWG records compared to T_1.

After 14 weeks of the start $T3C_2$ showed the highest (P<0.05) SGR value with insignificant difference with T_2 and significant (P<0.05) differences in SGR compared to T_1 and $T3C_1$ (table 5).

At harvesting of T_1 and T_2 (28 weeks after start) T_1 showed higher SGR value (P<0.05) compared to T_2.

As presented in Table (5), RGR values after 14 weeks (harvest of ($T3C_1$ and $T3C_2$) were found to be 7476.9; 2536.6; 1489.6 and 539.7 percent for T_1; T_2; $T3C_1$ and $T3C_2$ respectively. The analysis of variance indicates that the highest RGR records were obtained by T_1 followed in a significant decreasing order by T_2; $T3C_1$ and $T3C_2$ respectively. At harvesting of T_1 and T_2 RGR (28 weeks after start)

Table 5. Effect of tilapia initial weight at stocking on condition factor

Period	Unit	T1	T2	T3C1	T3C2
Start 14 weeks 28 weeks	K	13.65 a 2.84a b 2.60 a	10.59 b 3.10 a 2.17 b	5.80 c 2.49 b -	2.90 d 2.47 b -
Start 14 weeks 28 weeks	DWG	0.00 1.19 c 2.21 b	0.00 1.28b c 1.2911 a	0.00 1.56 b -	0.00 2.70 a -
Start 14 weeks 28 weeks	SGR	0.00 1.35 b 0.98 a	0.00 1.47 ab 0.46 b	0.00 0.918 c -	0.00 1.53 a -
Start 14 weeks 28 weeks	RGR	0.00 7476.9 a 20223.1	0.00 2536.6 b 6475.6	0.00 1489.6 c -	0.00 539.7 d -

- a, b, c within each column show the same superscripts that do not differ significantly (P<0.05) otherwise they do

Recorded RGR values of 20223 and 6475.6 percent respectively where T_1 showed significantly ($P<0.05$) higher RGR results than T_2.

Effect of tilapia initial weight and culture cycles on production of ponds

As presented in Table (6) averages of initial biomass per pond for T_1; T_2; $T3C_1$ and $T3C_2$ were found to be 31.2; 98.4 and 298.4 and 748.8kg, respectively and differences were due to the differences in initial weights. At harvesting total pond productions for T_1 and T_2 (harvested after 28 weeks) were 6340.8 and 6470.4kg respectively, while that for $T3C_1$ and $T3C_2$ (harvested after 14 weeks each) were 4425.6 and 4790.4kg respectively with a total production for the two cycles within the same season was 9216kg. On the other hand, total gain per pond was 6309.6; 6372.0 for T_1 and T_2 (28 weeks) and 4147.2 and 4041.6kg for $T3C_1$ and $T3C_2$ (14 weeks) growth period respectively. These results indicate that prolonging in the growth period with lower initial weight may result in better total gain but considering $T3C_1$ and $T3C_2$ as weeks of growth period the total gain was higher (8188.8kg) when the production cycle started with higher initial weights for starter period. The total production as percentage of the lowest value (T_1 100%) was 101.1 for T2 and 129.98% for both $T3C_1$ and $T3C_2$ together. Total amounts of feed consumed were 10332; 9940 (for 28 weeks) and 6806 and 6830.3 (for 14 weeks) for T_1; T_2; $T3C_1$ and $T3C_2$ respectively and that for both cycles was 12636.3. The corresponding feed conversion ratios were 1.64; 1.56; 1.40 and 1.69 kg feed for each kg gain in weight for T_1; T_2; $T3C_1$ and $T3C_2$ respectively.

In general, results revealed that culture of tilapia in two cycles/season/year improved that total pond production by about 29.98% with no reverse effects on feed conversion ratio when culture started with fingerlings.

Table 6. Final body weight, final weight gain, consumed feed and total production per pond (8400m2) of *O.niloticus* cultured under different initial body weight and one or two cycle culture system for 28 weeks

Items	Unit	Treat 1	Treat 2	Treat 3		
		Fries	Fingerlings	Cycle 1	Cycle 2	Total average of two cycles
No. of stocked fish at start of exp.	Fish/ pond	24000	24000	24000	24000	
Average initial body weight	g/fish	1.3	4.1	11.6	31.2	
Initial biomass	Kg/pond	31.2	98.4	278.4	748.8	
Cultured period	week	28	28	14	14	28
Average final body weight	g/fish	264.2	269.6	184.4	199.6	
Total production/pond	Kg/pond	6340.8	6470.4	4425.6	4790.4	9216
Fish grade						
Super	%	32.1	70.4	39.6	46.6	43.2
Grade 1	%	15.6	12.0	17.1	19.8	18.5
Grade 2	%	8.6	5.0	14.8	11.8	13.2
Grade 3	%	43.7	12.6	28.5	21.8	25.1
Gain in weight	g/fish	262.9	265.5	172.8	168.4	
Average of daily weight gain	g/fish	1.34	1.35	1.76	1.72	
Total gain in weight/pond	Kg/pond	6309.6	6372.0	4147.2	4041.6	8188.8
Total gain in weight / feddan	Kg/fed.	3154.8	3186.0	2073.6	2020.8	4094.4
% of the lowest value	%	100	101.1	-	-	129.98
Total of consumed food	Kg	10332	9940.3	5806	6830.3	12636.3
Feed conversion ratio	FCR	1.64	1.56	1.40	1.69	

Concerning grades during harvesting, T_2 had the highest percentage of super tilapia (> 250g) followed in a decreasing order by the total harvest of $T3C_1$ + $T3C_2$ and T_1 respectively. On the other hand, T_1 produced the highest percentage of small fish (grade 3) (125g/fish) followed by both $T3C_1$ and $T3C_2$ together and the lowest percentage of small fish was recorded by T_2. These results may indicate that starting with tilapia fingerlings of initial weight 4g for 28 weeks fattening season produced fish of higher grades than using bigger tilapia with higher initial weights with shorter fattening period.

Economically efficiency

Results of Table (7) show that total variable costs (LE) for T1; T2 and both T3C1+T3C2 (during the 28 weeks period) were 22557.6; 24252.5 and 36305.3 LE respectively. The differences in variable costs were due to differences in fry prices, feed costs and fertilizer costs. Total fixed cists were almost the same for the whole period; however total costs (variable + fixed) varied among treatments due to the differences in variable costs mainly. As presented in table (7) net returns recorded by T1; T2 and T3C1 + T3C2 were 19543.4; 27488.5 and 35886.3 LE and net returns as percent of the lowest one (T1 100) were 140.65 and 183.62 for T2 and T3C1 + T3C2 together respectively. From the economical point of view it is too recommended to culture tilapia in two cycles/year under the condition of starting with fingerlings of average initial weight not less 10 to 15g.

In general, results of the present study indicate that shortening of the culture period with fish of higher initial weights to 14 weeks instead of 28 weeks in order to culture tilapia two cycles yearly in the same pond could result in lower final weights compared to fish cultured for 28 weeks with smaller initial weights. However, the total pond production of two cycles culture was obtain 29.98% higher than the culture one cycle for 28 weeks with smaller initial fish weights. On the other hand, the net returns of two cycle's culture with higher initial weights were about 83.62% higher than the one cycle culture starting with 1.3g fry. It is to recommended tilapia culture for two cycles/year starting with fish of higher initial weights. These results are not in accordance with the findings of El-Naggar (2006) who studied the culture of mono sex tilapia as young-of-the year (0.4g initial weight) or over wintered fingerlings (6g initial weight) for three months period followed by the other three months culture period or for 6 month period. He reported that the net returns of young-of-the year size were higher than the over wintered fingerlings size. In this connection Sweillum (2005) reported that the maximum total production of Nile tilapia (7.6 tons feddan) was achieved with small size fish (22.9g), while the large initial weight fish (38.8g) had the highest production when fed the 25% protein and 12.6J^{-1g} diet energy. They added that starting with 27.9g fish was more advantageous than the initial size of 39.8g for rearing Nile tilapia. Small fish required a high protein and low energy diet, where the large fish required a low protein and high energy diet to achieve highest production.

Table 7. Effect of different initial weight and one or two cycle culture system on economical efficiency/pond during experimental period (28 weeks)

Items	T1	T2	T3		
	Fries	Fingerlings	Cycle 1	Cycle 2	Total of two cycle
1- Variable costs LE per pond					
a-Fry or fingerlings/pond	2400	4800	6000	6000	12000
b-Artificial food	18597.6	17892.5	10450.8	12294.5	22745.3
c-Fertilizers: organic inorganic	300 460	300 460	150 230	150 230	300 460
d- Labor	800	800	400	400	800
Total variable costs, LE	22557.6	24252.5	17230.8	19074.5	36305.3
2-Fixed costs, LE a-Depreciation b- Taxes	 1600 200	 1600 200	 800 100	 800 100	 1600 200
Total fixed costs, LE	1800	1800	900	900	1800
Total operating costs (variable and fixed)	24357.6	26052.5	18130.8	19974.5	38105.3
3- RETURN (Fish sales, LE):					
Super	18315	40986	17510	20088	37598
Grade 1	7912	6200	6804	7584	14388
Grade 2	3815	2268	5240	3962	9202
Grade 3	13859	4087	7581.6	5222	12803.6
Total return/pond, LE	43901	53541	37135.6	36856	73991.6
Net returns (total returns-costs)	19543.4	27488.5	19004.8	16884.5	35886.3
% of lowest return value	100	140.65	-	-	183.62

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تأثير الوزن الأولى للاستزراع ودورة الإنتاج على مظاهر النمو لأسماك البلطى وحيد الجنس المرباه فى الأحواض الترابية

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تم إجراء هذا البحث بمنطقة وادى الريان بمحافظة الفيوم، جمهورية مصر العربية، بغرض دراسة تأثير الوزن الأولى ودورة الإنتاج على مظاهر النمو والإنتاجية الكلية لأسماك البلطى النيلى. تمت التجربة فى ٦ أحواض ترابية، مساحة كل منها ٢ فدان، وذلك لتمثيل ثلاثة مجموعات تكرارية من المعاملات. تم استزراع الأسماك فى أول حوضين (المعاملة الأولى) بزريعة البلطى النيلى بمتوسط وزن ١,٣ جرام لمدة ٢٨ أسبوع. وتم إستزراع أصبعيات البلطى النيلى فى ثانى حوضين (المعاملةالثانية) بمتوسط وزن ٤,١ جرام جرام لمدة ٢٨ أسبوع. أما فى المعاملة الثالثة فقد تم استزراع أصبعيات البلطى بالحوضين بمعدل وزن ١١,٦ جرام لمدة ١٤ أسبوع فقط (دورة أولى)، وبعد الحصاد تم إعادة استزراع نفس الحوضين بأصبعيات البلطى النيلى بمعدل وزن ٣١,٢ جرام(المعاملة الثالثة) لمدة ١٤ أسبوع أخرى (دورة ثانية) من تاريخ ٨ يوليو وحتى ١٤ أكتوبر ٢٠٠٦ . وقد تم تلخيص النتائج كالتالى:

١- أعلى وزن إبتدائى تم تسجيله كان بالمعاملة الثالثة -الدورة الثانية ثم بالمعاملة الثلثة -الدورة الأولى تليها المعاملةالثانية وأخيرا المعاملة الأولى على التوالى.

٢- أعلى وزن نهائى كان بالمعاملةالثانية ثم المعاملة الأولى يليه بفرق معنوى المعاملة الثالثة -الدورة الثانية ثم بالمعاملة الثالثة -الدورة الأولى على التوالى.

٣- أعلى معدل نمو خاص ومعدل نمو نسبى سجل كان معنوى المعاملة الثالثة -الدورة الثانية ثم بالمعاملة الثالثة -الدورة الأولى ثم المعاملة الأولى ثم بالمعاملة الثانية على التوالى بفرق معنوى.

٤- تراوح معدل النمو اليومى بين ١,٣ (المعاملةالثانية) إلى ٢,٩١ (المعاملة الثالثة -الدورة الثانية) بفرق معنوى بين المعاملات. وتراوح معامل الحالة بين ١,٣(المعاملةالثانية) إلى ٢,٩١ (المعاملة الثالثة + الدورة الثانية) بفرق معنوى بين المعاملات.

٥- كان متوسط الإنتاج الكلى ٦٣٤٠,٨ ، ٦٤٧٠,٤ ، (٤٤٢٥,٦ + ٤٧٩٠,٤) كجم لكل من المعاملة الأولى والمعاملةالثانية ثم (المعاملة الثالثة - الدورة الأولى + المعاملة الثالثة - الدورة الثانية) لكل موسم التربية على التوالى.

٦- أوضحت النتائج أن الأرباح الصافية للمعاملات للأولى والثانية و المعاملة الثالثة (الدورة الأولى + الدورة الثانية) كانت ١٩٥٤٣,٤، ٢٧٤٨٨,٥، و٣٥٨٨٦,٣ جنيها مصريا وكانت النسبة المئوية لصافى الربح منسوبة لأقل معاملة المعاملة الأولى ١٠٠%) هى ١٤٠,٦٥ و ١٨٣,٦٢ % لكل من المعاملة الثانية ثم المعاملة الثالثة (الدورة الأولى + الدورة الثانية مجتمعتين) على التوالى.