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Effect of initial weight and stocking density on growth performance of mono sex nile tilapia reared in semi intensive system

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ABSTRACT

The present investigation was carried out at Wady El Raian, Fayoum Governorate, Egypt in order to test the effects of initial weight and stocking density on growth performance and pond productivity of Nile tilapia (*Oreochromis niloticus*) in semi intensive system. The experiment was carried out in 12 earthen ponds each of a total area of one feddan (4200 m^2) to represent six treatment groups in replicates each. The first; second and third two ponds (T1; T2 and T3) were stocked with Nile tilapia fingerlings of an average initial weight of 9.6 g and stocking density 30; 40 and 50 thousands respectively. The second; fourth and sixth tow ponds (T4; T5 and T6) were stocked with Nile tilapia fries of 0.3g and stocking density 30; 40 and 50 thousands respectively. The fish were fed three times daily on a commercial diet containing 27% protein at a rate of 3% of fish biomass. The experiment lasted for 26 weeks from the start. Results obtained are summarized in the following:

1- Water quality (physical and chemical) lied within the permissible levels required for optimum growth and development of Nile tilapia.

2- The highest final weight was obtained by T4; T1; T2; followed in a significant decreasing order by T5; T4 and T6 respectively.

3- Averages of gain in weight; daily gain; specific growth rate and condition factor were influenced significantly with tilapia initial weight and stocking density.

4- Total fish production/feddan was the highest for 50 thousand fingerlings/feddan, stocking density followed by 40 and 30 thousand fingerlings/feddan.

5- The highest net returns were by the 30 thousand fingerlings/feddan stocking density (T1) and 40 thousand fingerlings/feddan stocking density (T2) due to the high contribution of super size and grade 1 fish in the harvest, compared to other densities and initial weights.

Keywords: Nile tilapia; initial stocking size; stocking density; earthen ponds; monoculture; semi-intensive; Growing period; Growth performance.

INTRODUCTION

On a global basis, tilapia has become the second most commonly consumed farmed fish after the carps. Pond tilapia (*Oreochromis niloticus*) has been cultured for more than 3000 years and is one of the first fish species to be cultured. All tilapia are native to Africa and the Middle East, even though there has been a worldwide distribution within the past sixty years due to aquaculture demands (Popma and Masser, 1999). Culture can be practiced at many levels of production intensity based on the quantity and quality of nutrients added to enhance, supplement or replace natural pond productivity (Bardach et al. 1972).

There are basically three systems of culturing tilapia: extensive, semi-intensive and intensive systems. Extensive systems require low capital and greatly influenced by environmental conditions. At this system earthen ponds or natural water bodies are used and low stocking densities are employed. Little or no feeding is practiced. Semi-intensive systems are generally conducted in earthen ponds using hatchery produced fingerlings and supplemental feeding is practiced and the natural productivity of the pond is harnessed. Supplemental aeration is normally done. Intensive systems usually employ circular tanks, and raceways. Intensive systems generally require high capital inputs, continuous aeration and the feed used is nutritionally complete.

According to Guerrero (2002), identified “best practices” is important in any industry for providing good and exact examples for a successful operation. For tilapia farming to develop on a sustainable way there is a need in knowing the best practice to guide those who want to start up businesses and to allow those already into tilapia farming to find out how they can improve their present practice. Semi-intensive culture of Nile tilapia *Oreochromis niloticus* commonly utilizes organic and inorganic fertilizers to increase primary production of natural food in ponds.

The present study was carried out to investigate the effect of fish size upon the high stocking density (semi-intensive system) on earthen pond productivity and the economic returns in staged increment of pond inputs in the tilapia culture under practical condition.

MATERIAL AND METHODS

The present experiment was carried out at a private fish farm at Wady El-Rayan Fayoum Governorate during the fish culture season form 10/04 to 09/10 year 2008 and the experiment lasted 26 weeks after start. The study aimed to test the feasibility of Nile tilapia culture at different initial sizes and stocking densities and its effects of fish growth performance, total yield and the economic returns.

Experimental ponds:

A total number of 12 earthen ponds, each of one feddan total area with a water depth of one and half- meter were used in the present study. The experimental ponds represented two tilapia initial weight 9.6g (fingerlings) and 0.3g (fry) within each initial weight three stocking densities 30; 40 and 50 thousand fish/feddan were tested. The treatments tested were carried out in replicates. The following experimental groups were performed T1; T2 and T3 were stocked with tilapia fingerlings with higher initial weight 9.6g and stocked at densities 30; 40 and 50 thousand fish/fed respectively, while T4; T5 and T6 were stocked with tilapia fry (0.3g initial weight) at the same rates cited above respectively. After that all experimental ponds were filled with water (drainage water) coming from the first El Wadi drainage canal. Ponds water was changed to keep water quality suitable for fish growth.

Experimental fish:

Nile tilapia monosex produced by hormone treatment was purchased from a privet tilapia hatchery; Experimental fish were transported from the hatchery to the experimental ponds at the early morning, in plastic bags filled with water and supplied with oxygen. The experimental fish was exposed to an adaptation period for 30 minutes, to be adapted to new water temperature. The tilapia fingerlings used in the present study were over wintered fries grown at the experimental site. At the start of the experiment, weights of fish (gram) were estimated in a sample 50 fish of each pond. At every 14 days intervals, the weights and lengths were recorded in a sample of 50 fish from each pond. At experimental termination the pond fish were harvested by seining and total yield were recorded.

Ponds water:

The fish experimental ponds were filled to a level of 1.5m with water and water losses due to evaporation or seepage were compensated every two days and during the last 12 weeks about 5% of the pond water was exchanged daily and replaced by fresh water. Two HP paddle wheels supplied to each pond. Water samples were collected every month from the ponds outlet for determinations of water pH using digital pH meter model 68 engineered systems and Designs. Salinity (g/l); hardness (mg/l); alkalinity (mg/l) and ammonia NO3 (mg/l) were determined according to the methods described by APHA (1992). Seccki disck reading (cm) and water temperature (^{o}C) 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 (1).

Experimental diet:

All experimental fish were fed on a commercial diet containing 27% crude protein and 3750 kcal/gross energy/kg., with a calorie to protein ratio (C/P) 138.3 kcal to 100g protein. The diet was fed at a rate of 3% of the fish biomass divided into three equal portions daily i.e. 8^{00}; 12^{00} and 16^{00} o'clock.

Growth performance parameters:

1- Live body weight:

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

2- Weight gain:

Weight gain (WG) = final weight – initial weight

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)

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.

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.

Table (1) Average of physical and chemical properties of pond water during experimental period through intervals (month) (mean ± SE)* from 10th of April to 9th of October (2008).

ITEMS	Periods					
	10/4/08 to 09/5/08	10/5/08 to 09/6/06	10/6/08 to 09/7/08	10/7/08 to 09/8/08	10/8/08 to 09/9/08	10/9/08 to 09/10/08
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
Seccki Disk (cm) reading	>50 ±0.28	>40 ±0.28	>35 ±0.3	20 ±0.4	20 ±0.42	20 ±0.35
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
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
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
Hardness (mg/L)	400 ±48	400 ±48	650 ±42	800 ±60	650 ±50	450 ±30
Alkalinity (mg/l)	200 ±35	200 ±35	270 ±25	160 ±35	200 ±30	220±15
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
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
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

RESULTS AND DISCUSION

Water quality parameters

As presented in table (2) water temperature averaged between 25.8 Co in April and 30.2 Co 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 development of tilapia. These results are in complete agreement with the findings of Abdel-Hakim and Ammar (2005).

Growth performance:

Body weight (BW): As presented in table (2) averages of initial body weights at the experimental start were found to be 9.6g for fingerlings groups (T1; T2 and T3) while that of fries groups (T; T5 and T6) was found to be 0.3g, with insignificant differences among the experimental fish of the treatments ponds. At periods 2; 4; 6 and 8 weeks after experimental start, differences in body weights among the fingerlings groups were insignificant the same trend was observed within fries groups. These results may be explained by the fact that till the 8th week after experimental start, fish of both trend had still enough space to move and to feed, especially for the smaller average body weight of fish (i.e. 0.3g/fry) at the start of the trial. At 10 weeks interval after start the fingerling at stocking densities of 30; 40 and 50 thousand fish/feddan (T1; T2 and T3), showed average BW sampling between 59.0 and 61.8g with insignificant differences among the stocking densities within this size. Similar trend was observed after 12; 14 and 16 weeks of experimental start. The fries at stocking densities of 30; 40 thousand fish/feddan (T4 and T5) showed significantly ($p<0.05$) heavier body weights, compared to the highest stocking density (50 fish/feddan) at 10 weeks interval after start. Similar trend was observed after 12; 14; 16; 18; and 20 weeks of experimental start. At 18 weeks interval after start the fingerling at stocking densities of 30 and 40 thousand fish/feddan (T1 and T2) showed significantly ($p<0.05$) heavier body weights, compared to the highest stocking density (T3). During the 20 week after experimental start both T1 and T2 showed significantly ($P<0.05$) heavier bodies compared to T4; T3; T5 and T6 respectively. During the 22 weeks after experimental start T1; T4 and T2 showed significantly ($P<0.05$) heavier bodies weights compared to T3; T5 and T6 respectively. The same trend was observed during the period 24 weeks after stocking, But during 26 weeks after experimental start T1; T4 and T2 showed significantly ($P<0.05$) heavier bodies compared to T5; T3 and T6 respectively. 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 T1; T4 and T2 averages of final weights (table 2) were 208.3; 211.8 and 204.8g compared to 176.1; 166.8 and 134.8g for T5; T3 and T6 respectively. These results are in accordance with the findings of Abdel-Hakim *et al* (1995), who reported that growth performance of Nile tilapia cultured in earthen ponds decreased as the stocking density increased from 3000 to 45000 or 6000 fish/feddan. In this connection, Pagan

(1970), Suwanasart (1971) and Coche (1976) showed that growth rate of fish in general decreased with increasing stocking rate. Furthermore Moav *et al*. (1977) and Barlin (1979) showed that body weight and growth rate of fish were depressed when the fish were stocked at higher rates and the growth depression may be attributed to crowding, social interaction and aggression. Also results in table (2) are in agreement with the findings of Abdel-Hakim and Ammar A. (2005) who reported that lower stocking densities (14 or 16 thousand fish/feddan) resulted in significantly higher final weights and lengths of fish compared with the 18 thousand fish/feddan densities. Also, Abdel-Hakim *et al* (2008) indicated in general that the highest initial weights influence the BW during the growth period give the highest final weight, the highest SGR and RGR. Also results of Abdel-Hakim *et al* (2001) revealed that increasing tilapia stocking density from 50 to 100 or 150 fish/m^3 of tank water decreased significantly final body weight and length of fish.

Table (2) Average of body weight (W) of *O.niloticus* during experimental period as affected with stoking density and initial weight

Intervals	weeks	Fingerlings			Fries		
		T1	T2	T3	T4	T5	T6
10/4/08	0	9.6a±0.7	9.6a±0.7	9.6a±0.7	0.3b±0.0	0.3b±0.0	0.3b±0.0
24/4/08	2	18.5a±1.1	18.7a±1.1	18.8a±1.1	2.1b±0.2	2.2b±0.2	2.0b±0.2
08/5/08	4	29.0a±1.7	29.2a±1.7	29.0a±1.6	6.3b±0.5	6.3b±0.5	6.2b±0.5
22/5/08	6	37.5a±2.4	38.0a±2.3	37.9a±2.3	12.0b±0.7	10.5b±0.7	10.5b±0.7
05/6/08	8	49.0a±3.4	49.0a±3.6	48.0a±3.6	19.0b±1.0	20.0b±1.1	18.0b±1.0
19/6/08	10	61.8a±4.6	61.0a±4.4	59.0a±4.5	32.0b±1.3	31.0b±1.2	27.0c±1.2
03/7/08	12	73.0a±5.4	73.0a±5.4	69.0a±5.2	44.0b±2.4	45.0b±2.3	39.0c±2.1
17/7/08	14	85.5a±6.1	85.0a±6.0	80.0a±5.9	60.0b±3.9	61.0b±3.9	52.0c±3.4
31/7/08	16	98.0a±5.7	98.0a±5.7	90.0a±5.4	81.0b±4.8	81.0b±4.4	63.0c±3.3
14/8/08	18	113.0a±5.6	112.0a±5.4	102.0b±5.1	101.0b±5.7	99.0b±5.4	78.0c±4.7
28/8/08	20	131.4a±5.9	130.0a±6.0	117.0b±5.2	126.0b±6.5	115.0b±6.3	90.0c±4.5
11/9/08	22	150.8a±6.2	149.0a±6.1	134.0b±5.2	158.0a±6.0	124.0b±6.0	102.0c±4.2
25/9/08	24	177.0a±5.8	176.0a±5.7	153.0b±5.9	180.6a±7.1	145.0c±6.9	118.0c±6.2
09/10/08	26	208.3a±6.9	204.8a±6.4	166.8b±5.9	211.8a±9.8	176.1b±8.1	134.8c±6.3

Growth parameters:

Effect of tilapia initial weight and stocking density on production of ponds:

Growth parameters of Nile tilapia cultured in earthen ponds as affected with initial weight and stocking density are presented in table (3). Results revealed that the average initial body weight for T1; T2 and T3 was 9.6g. and T4; T5 and T6 was 0.3g/fish and the initial biomass (kg) stocked in pond (one feddan area) were found to be 288; 384; 480; 9; 12; and 15 kg for stocking densities per treatment of 30; 40 and 50 thousands/fingerling and fries/pond (T1; ; T2; T3; T4; T5 and T6), respectively. As presented in the same table, averages of final body weight were 208.3; 204.8; 166.8; 211.8; 176.1; and 134.8g for T1; T2; T3; T4; T5 and T6 respectively and the statistical evaluation of results revealed that fish at lower stocking densities (T1, T2 and T4) showed significantly ($p < 0.05$) higher final weights compared to those at the highest stocking density (T3; T5 and T6). The same trend was observed for total gain in weight where fish of T6 (the highest stocking density) had significantly ($p < 0.05$) the lowest total gain in weight, however differences in total gain in weight among the lower stocking densities (T1; T2 and T4) were insignificant. These results are in accordance with the findings of Abdel-Hakim *et al* (2001). Abdel-Hakim and Ammar (2005) and Abdel-Hakim *et al* (2008).

Averages of daily weight gain for T1; T2; T3; T4; T5 and T6 were found to be 1.1; 1.1; 0.9; 1.2; 1.0 and 0.7g/day respectively. The analysis of variance for this trait showed that averages of daily gain in weight of the lower stocking densities (T1, T2 and T4) were significantly ($p < 0.05$) higher than fish stocked at higher rates (T3; T5 and T6). At harvesting of T1; T2 and T3 (26 weeks after start) showed higher SGR values ($P < 0.05$) compared to T4; T5 and T6.

Concerning fish grades at harvesting T1 had the highest % of super tilapia (300g. and more), followed in a decreasing order by the total harvest of T2; T3; T4; T5 and T6 respectively. On the other hand T6 produced the highest percentage of small fish (grade 3) (125g/fish) followed in a decreasing order by T5; T4; T3; T2 and T1 respectively. These results may indicate that starting with tilapia fingerlings of initial weight 9.6g and stocking density 30 thousand/feddan for 26 weeks fattening season produced fish of higher grades than using fry (0.3) tilapia at higher stocking densities 50 thousand/feddan.

Concerning total fish production per experimental pond (one feddan) average weights were 6249; 8192; 8342.4; 6354; 7044; and 6740 kg/feddan per experimental pond for T1; T2; T3; T4; T5 and T6 respectively (table 3). Total pond production calculated as percentages of the lowest pond production (T1; 100%) were 131.0; 131.9; 106.4; 118.0 and 112.8% for T2; T3; T4; T5 and T6 respectively. These results indicate in general that the highest experimental pond productivity was obtained by T3, followed in a decreasing order by T2; T5; T4; T6 and T1 respectively. These results also indicate that a stocking density of 50 thousand fingerlings (T3) per experimental pond produced the highest final fish mass, which corresponds to the maximum standing crop per unit area. In this connection, Van der Lingen (1959) proved that total fish yield per unit area is dependent upon stocking mass per unit area.

In this connection Sweillum (2005) reported that the maximum total production of Nile tilapia (7.6 tons feddan) was achieved with small sized fish (22.9g) with dietary high protein 30% and low energy 10.5 K. Cal/g, while the large initial weight fish (38.8g) had the highest production when fed the 25% protein and 12.6 K. Cal/g 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 (3) Final body weight, final weight gain, consumed feed and total production per pond (4200m2) of *O.niloticus* cultured under different initial body weight and stocking densities for 26 weeks

Parameter	Unit	T1	T2	T3	T4	T5	T6
Pond surface area	Fed.	1	1	1	1	1	1
No. of stocked fish at start of exp.	Fish/ Fed.	30000	40000	50000	30000	40000	50000
Mean initial weight	g/fish	9.6	9.6	9.6	0.3	0.3	0.3
Total initial weight	Kg/fed.	288	384	480	9	12	15
Specific growth rate	SGR	36.47a	36.39a	36.16a	5.22b	4.73b	4.71b
Average final body weight	g/fish	208.3a	204.8a	166.8b	211.8a	176.1b	134.8c
Total production/pond	Kg/pond	6249	8192	8342.4	6354	7044	6740
Fish grade	%						
Grade super (1 to 3fish/kg)		65.8	63.9	52.6	47.8	41.6	19.9
Grade 1(4 to 5 fish/kg)		9.8	11.5	10.8	12.2	11.1	9.7
Grade 2 (to 7 fish/kg)		6.3	4.0	6.2	9.2	7.0	6.3
Grade 3 (10 fish/kg)		18.1	20.6	30.5	30.8	40.3	64.1
Gain in weight	g/fish	198.7	195.2	157.2	211.5	175.8	134.5
Average of daily weight gain	g/fish	1.1	1.1	0.9	1.2	1.0	0.7
Total gain in weight/pond	Kg/pond	5961	7808	7862.4	6345	7032	6725
% of the lowest value	%	100	131.0	131.9	106.4	118.0	112.8
Total of consumed food	Kg	10002.5	13195	12941	11490	12917.5	12505
Food conversion ratio	FCR	1.7	1.7	1.6	1.8	1.8	1.9

Economical efficiency:

Results of costs including variable costs (LE) and fixed costs are illustrated in (table 4). This table revealed that cost of fish fingerlings were increased from 6000 to 8000 and 10000 LE as the stocking densities increased from 30 to 40 and 50 thousand fingerlings/ feddan. The same trend was observed with fries thus the price increased from 3000; 4000 and 5000 LE as the stocking densities increased from 30 to 40 and 50 thousand fry/ feddan.

The same trend was observed with fish feeds costs required for one feddan which were 32008; 42224; 41411.2; 36768; 41336 and 40016 LE for T1; T2; T3; T4; T5 and T6 respectively. Also, the fuel costs were 3600, 4800; 6000, 3600; 4800 and 6000 LE for T1; T2; T3; T4; T5 and T6 respectively due to increased aeration costs. Labor costs were 1200 LE/feddan; fertilizer 400 LE/feddan and this cost were constant for all treatments. Total fixed costs were found to be the same per feddan (800LE) for all experimental ponds. Meanwhile the total variable costs per/feddan were 43208; 56624; 590112; 44968; 51736 and 52616 LE for the T1; T2; T3; T4; T5 and T6 respectively. The differences among treatments in total variable costs were due to the differences in fingerling and fry costs, feed and fuel costs though other costs were almost the same for all treatments.

As presented in table (4) averages of fish sales (LE) of super size fish (1-3 fish kg) were the highest for stocking density 40 thousand fingerling/feddan (T2) followed in a decrasing order by T3; T1; T4; T5 and T6 respectively. Meanwhile the total return per pond was 57678.2; 75241.3; 74669.8; 55730.1; 60140.5 and 52933.7 LE for T1; T2; T3; T4; T5 and T6 respectively.

Net returns calculated as returns over costs for stocking densities of T1; T2; T3; T4; T5 and T6 were 14470.2; 18617.3; 15658.6; 10762.1; 8404.5and 317.7 LE, respectively. The highest net returns were obtained by medium stocking densities of fingerling (40 thousand) compared to the lowers and highest (30 and 50 thousand) stocking densities. Meanwhile the highest stocking density produced more fish of grade 3, which has a very low sell price which reflected negatively on the net returns.

Table (4) Effect of different initial body weight and stocking density on economical efficiency.

Parameter	T1	T2	T3	T4	T5	T6
1- Variable costs LE per pond						
a-Fries or fingerlings/pond	6000	8000	10000	3000	4000	5000
b-Artificial food 27% protein	32008	42224	41411.2	36768	41336	40016
c-Fertilizers:						
chicken manure	200	200	200	200	200	200
superphosphate	200	200	200	200	200	200
d-Fuel	3600	4800	6000	3600	4800	6000
e- Labor	1200	1200	1200	1200	1200	1200
Total variable costs, LE	**43208**	**56624**	**59011.2**	**44968**	**51736**	**52616**
3- RETURN						
a- Fish sales, LE						
Super (1 to 3fish/kg)	41095.5	52305	43856	30367.5	29267	13398
Grade 1(4 to 5 fish/kg)	5494.5	8474.4	8909.5	6992.1	7034.85	5890.5
Grade 2(6 to 7 fish/kg)	3165.2	2622.4	4112	4670.4	3965.6	3388
Grade 3(10 fish/kg)	7922.95	11839.5	17792.3	13700.1	19873	30257.2
Total return/pond, LE	**57678.2**	**75241.3**	**74669.8**	**55730.1**	**60140.5**	**52933.7**
Net returns (total returns-costs)	14470.2	18617.3	15658.6	10762.1	8404.5	317.7
% Returns relative to costs	33.5	32.9	26.5	23.9	16.2	0.6

Concerning percent of returns relative to total costs, the averages were found to be 33.5; 32.9; 26.5; 23.9; 16.2 and 0.6% for T1; T2; T3; T4; T5 and T6 respectively, indicating that the lowest fingerling stocking density (30 fingerling thousand/feddan) was the most feasible and profitable for the fish farmer followed by the density of 40 fingerling thousand/feddan, while the highest density 50 fry thousand/feddan seemed to be infeasible.

Based on the present results, a stocking density of 30 and 40 (T1 and T2) thousand tilapia monosex fingerling is recommended for culture in earthen ponds due to its higher total production, total weight gain, better feed conversion ratios, better and higher production of fish of super grade and higher relative returns.

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