EFFECT OF NUTRITION AND FERTILIZATION ON PRODUCTION OF NILE TILAPIA (*O. NILOTICUS*) FINGERLINGS IN CONCRETE PONDS.

KAMAL, S. M., S. ABDEL GHANNY AND M. M. ABD-EL ALL

Department of Aquaculture, Central Laboratory for Aquaculture Research at Abassa, Sharkia governorate.

Abstract

This study has been carried out to investigate the growth performance and economic efficiency as well as pond productivity of Nile tilapia (*Oreochromis niloticus*) fingerlings reared in monoculture concrete ponds as affected by different nutrition and fertilizing inputs. Nile tilapia fingerlings averaging 0.889 g in weight were assigned randomly to four tested different feed and fertilized inputs. Four treatments were applied in the concrete ponds. These were (T_1) was fed daily with diet 30% protein at rate of 7% of fish body weight 5 days a week (control), (T_2) was fertilized weekly with fish rigirs at a rate of 50 g / m^2, (T_3) was fertilized weekly with rigirs at a rate of 50 g / m^2 and (T_4) was fertilized with chicken layer manure (mash) 50 g / m^2 every week. Eight concrete ponds each measuring 5 x 2.5 m and 1 m in depth were used in the experiment. Each treatment was performed in duplicate. All the experimental ponds were stocked with 500 tilapia fish / pond (40 fry / cubic meter). The study extended 98 days. Results obtained can be summarized in the following: 1- The highest final body weight, average daily gain (ADG) and specific growth rate (SGR), were recorded for Nile tilapia fish group in T_1. While a reverse trend was observed with survival rate. T_2 exhibited the highest survival rate. 2- With regard to economic efficiency, the total cost of T_1 was the highest but a net return of T_2 was the highest.

In conclusion, the use of fish Rigir in fish pond culture could be recommended for Nile tilapia at a rate of 210 kg/ feddan / week with fish stocking density 168000 fingerlings/ feddan, especially with the high cost of fish diets and the problems found now for fresh poultry manure.

Key words: *Growth performance, Nile tilapia, varying fertilizing inputs, chicken manure, fish rigir, rigir, concrete ponds*

INTRODUCTION

Tilapia culture in tropical and subtropical countries is practiced at either extensive or semi- intensive levels. The semi-intensive of tilapia is particularly ideal in developing countries because it provides a wide variety of options in management and capital investments.

Management strategies in the lower levels of intensification involve the use of fertilizers to encourage natural productivity and to improve the levels of dissolved oxygen. Fish yields from such techniques have been found to be higher than those from natural unfertilized systems (Hickling, 1962, Hepher, 1963 and Green, 1992).

Artificial feed costs in aquaculture operations account for approximately 50% of total operational costs (Keenum and Waldrop 1988, Ratafia 1994) and is considered a major constraint for both small fish farms and commercial fish aquaculture ventures. Reducing amount of feed is a means of lowering costs if production is not reduced. In attempts to reduce feed costs, fish farmer provide supplemental feed for part instead of all of the grow-out operation. An on-farm trial, carried out in the Philippines, demonstrated that initiation of feeding of Nile tilapia after 75 d of stocking in ponds produced the same yield as initiation at 45 days (Brown *et al.,* 2000).

The objective of the present study aimed to evaluate the effect of rigir, fish rigir, and chicken manure fertilization without artificial feeding, and comparing with artificial feeding on the production of Nile tilapia fingerlings in the intermediate fish farming for youth project.

MATERIALS AND METHODS

The present study was carried out at outdoor concrete ponds in Central Laboratory for Aquaculture Research at Abassa, Sharkia Governorate, Egypt. Rigirs and Fish rigirs is a new product for fish farm produced by Misr El-Salam International Company for producing oraganic fertilizer, Alexandria Governorate. Rigirs consists of chicken manure but compressed and heat treated in order to be free from parasites, Salmonella, Shigella and *E. coli.* Fish rigirs consists of 60% compressed chicken manure and heat treated plus 20% yellow corn, 10% soybean and 10% rice bran plus some feed additive (Sodium Algenate, Selinium, antifungal drug and Saccharromycine). Chemical analysis of fish rigirs, rigirs and chicken manure are shown in Tables 1.

Before starting the experiment all fish ponds were drained completely and then were exposed to sunrays for 2 weeks till complete dryness. Ponds were then refilled with fresh water coming from Ismailia Nile branch through a canal to the experimental station. Nile tilapia (*Oreochromis niloticus* L.) fish with an average initial weight 0.889 g /fish were obtained at 19 August 2007 from Arabia Company Fish Hatchery, El-Abbassa, Sharkia governorate. Fish were transported in plastic bags and after arrival to the experimental station, fish were adapted to the new conditions for one hour, then distributed randomly into eight concrete ponds each measuring 5 x 2.5 m. Total water area of each pond was 12.5 m^2, water level was maintained at one-meter level throughout the whole experimental period (98 days).

Table 1. Chemical analysis of fish rigirs, rigirs and chicken manure on D.M basis.

Item	Fish Rigir	Rigir	Chicken manure
Cubic meter weight (kg/ m3)	720	730	510
Humidity %	11.6	9.6 %	16 %
pH	8.47	8.01	8.22
Electric conductivity mmhos/cm	4.22	4.2	4.19
Total nitrogen %	2.15	2.38	2.18
Ammonia nitrogen ppm	1117	1040	-
Organic matter %	59.1	59.68	56.22
Organic carbon %	34.28	29.58	29.58
Ash %	40.9	40.32	42.78
C:N ratio	15.9:1	13:1	19:1
Total phosphorus %	2.17	1.79	1.1
Total potassium %	1.48	1.91	0.96.
Iron ppm	1210	768	700
Manganese ppm	574	398	298
Copper ppm	82	40	40
Parasites	Nil	Nil	Nil

Four treatments were applied in the experimental concrete ponds. These were (T_1) fed daily with diet 30% protein at a rate of 7% of fish body weight 5 days a week (control), (T_2) fertilization weekly with fish rigirs at rate of 50 g / m^3, (T_3) fertilization weekly with rigirs at rate of 50 g / m^3 and (T_4) fertilization with chicken layer manure (mash) 50 g/ m^3 every week. Each treatment was performed in duplicate. All ponds were stocked with 500 tilapia fish / pond (168000/feddan).

Water temperature, dissolved oxygen and pH were measured daily at 6 a.m. and 12 p.m. using thermometer, dissolved oxygen meter (YSI model 57) and pH meter (model Corning 345), respectively. Determinations of the other water quality parameters (alkalinity and ammonia) were carried out every two weeks according to the methods of Boyd (1979). Phytoplankton and zooplankton communities in pond water were determined every month according to the methods described by Boyd (1990) and A.P.H.A (1985). Samples were collected from different sites of the experimental ponds randomly to represent the water of the whole pond. The chemical analyses of rigirs, fish rigirs and chicken manure on dry matter basis according to the methods of A.O.A.C. (1990) and phosphorus and potassium were determined using spectrophotometer (model LKB, Biochrom 4050 / uv / visble uttras pec П) according to the methods of A.O.A.C. (1984) are illustrated in Tables (2 and 3).. Live body weight 50 fish at start and monthly thereafter were recorded till the termination of the experiment and at the end all fish in each pond were collected, weight and counted. Specific growth rate (SGR) was calculated by using the following equation:-

$$SGR\% = 100 (Ln W_2 - LnW_1) / T$$

Where W_2 is the fish weight at the end and W_1 is the weight at the start and Ln is the natural log. as described by Bagenal and Tesch (1978).

Condition factor (K): K= weight (g) x 100 /length (cm^3) (Hopkins, 1992).

Statistical analysis

A statistical analysis for the experimental results was carried out by using SAS program (SAS Institute, 1990).

RESULTS AND DISCUSSION

Water quality parameters:

Results of water quality parameters of the experimental ponds during the experimental period (98 days) as averages of the monthly samples are summarized in Table (2). In general, averages of water temperature ranged from 23 through 29 °C during the experiment course (19 august – 25 November). Gui *et al.* (1989) found that an average temperature of 28 °C was optimal for growth of Nile tilapia fry. Dissolved oxygen ranged between 4.11 and 4.88 mg / l. Denzer (1968), AIT (1986), and Hasssan *et al.* (1997) reported that 2.3 mg DO /l is above the normal tolerance level of tilapia. pH ranged between 8.01 and 8.35. Ellis (1937) and Boyd (1998) reported that waters with a pH range of 6.5 – 9 are the most suitable for fish production. The average concentration of unionized ammonia (NH_3) was 0.45, 0.22, 0.21 and 0.19 mg/l for T_1, T_2, T_3 and T_4, respectively. Some studies showed the same trend for lower ammonia concentration, Diana and Lin (1998) reported ammonia concentration of 0.374 – 0.410 mg/l in ponds fertilized with both chicken manure and inorganic fertilizers in combination. This low concentration of total ammonia may be attributed to ammonia utilization by phytoplankton (Knud- Hansen and Pautong, 1993 and Boyd, 1998) or to oxidation of ammonia to nitrate, especially in high dissolved oxygen conditions (Boyd, 2000). Rhyne *et al.*, (1985) refer the consumption of ammonia may be due to algae. The European Inland Fisheries Advisory Commission (1993) reported that the toxic level of NH_4 to fish is 2 mg/L. The values of nitrite ranged between 0.02 and 0.03 mg/L. Diana and Lin (1998) noticed that nitrite and nitrate concentration ranging between 0.374 – 0.410 mg/l and 0.438 – 0.461 mg/l, respectively, in ponds fertilized with both chicken manure and inorganic fertilizers. The average value of seechi disk readings were 17.75, 29.50, 32.38 and 30.75 (cm) for T_1, T_2, T_3 and T_4, respectively. The significant decrease in seechi disk reading less than 20 cm for T_1 (fed diet) indicates that pond is too turbid, which may due to either phytoplankton or suspended soil particles (Boyd 1998). Since these ponds did not show low dissolved oxygen, which is usually coincident with phytoplankton blooming (Boyd, 1998), so suspended soil particles appear to be the principal factor in lowering secchi disk in this experiment. Organic material is commonly used to remove clay turbidity from water (Boyd, 1982), this explain why the other treatments (which manured) were not turbid. The values of the total alkalinity ranged between 392.50 and 434.34 mg/l, and total hardness ranged between 258.75 to 275 mg/l. The above results showed that all parameters of water quality were in the suitable range (Boyd, 1979).

Table 2. Average water quality parameters during The experimental period (98 days) in concrete ponds stocked with Nile tilapia fry.

Parameter	Treatment			
	T1	T2	T3	T4
Temperature (°C)	25.50 A ± 0.77	25.59 A ± 0.75	25.66 A ± 0.73	25.59 A ± 0.77
Dissolved oxygen (mg/l)	4.80 A ± 0.88	4.11 A ± 0.62	4.56 A ± 0.62	4.88 A ± 0.72
Secchi disk (cm)	17.75 B ± 1.19	29.50 A ± 2.35	32.38 A ± 2.96	30.75 A ± 3.20
NH3 (mg/l)	0.45 A ± 0.19	0.22 A ± 0.04	0.21 A ± 0.04	0.19 A ± 0.02
NO2 (mg/l)	0.02 A ± 0.00	0.03 A ± 0.01	0.03 A ± 0.01	0.02 A ± 0.002
PH	8.01 A ± 0.16	8.35 A ± 0.16	8.32 A ± 0.13	8.33 A ± 0.15
Salinity (ppt)	0.34 A ± 0.02	0.34 A ± 0.02	0.38 A ± 0.02	0.34 A ± 0.03
Electric conductivity (µmhos/cm)	696.00 A ± 23.74	723.50 A ± 20.28	753.88 A ± 17.99	688.63 A ± 37.87
Totai dissloved solids (ppm)	448.13 A ± 16.11	464.50 A ± 12.08	484.88 A ± 11.61	445.13 A ± 23.67
Total alkilinity (mg/l)	434.34 A ± 28.39	411.13 A ± 22.90	392.50 A ± 15.98	415.63 A ± 27.93
Total hardness (mg/l)	270.00 A ± 11.34	263.75 A ± 14.87	258.75 A ± 10.43	275.00 A ± 14.52

Values followed by A, B, etc. at the same row are significantly (P<0.05) different

Plankton

As shown in Table (3) the total phytoplankton counts for treatments T_1 , T_2 , T_3 and T_4 were on the average, 783700, 1379880, 1190600 and 775440 organisms / l, respectively. Table (1) revealed that fish rigir contain 2.15 nitrogen, 2.17 phosphorus, 1.48 (k) and C: N ratio was 15.9:1, rigir contain 2.38 nitrogen, 1.79 phosphorus, 1.91 (k) and C: N ratio was 13:1 and chicken manure contains 2.18% nitrogen and 1.1%

phosphorus, 0.96% (k) and C:N ratio was 19:1, which may reflect the better fertilization potential of fish rigir, rigir and chicken manure, respectively. From these results we noticed that a total phytoplankton count in T1 was lower than T_2 and T_3 so it confirms that high clay turbidity in this treatment resulted in high-limited phytoplankton growth (Teichert-Coddington *et al.* 1992).

Table 3. Effect of different types of organic fertilizers on Phytoplankton groups in concrete ponds.

Parameter	Treatment			
	T1	T2	T3	T4
Euglena (org./l)	472100 A ± 138525	140880 B± 31525	195900 AB ± 27049	374640 AB ± 124806
Chlorophyta (org./l)	281200 A ± 77968	1204800 A± 590711	981000 A± 459200	385920 A ± 143494
Cyanophyta (org./l)	20400 A ± 8585	20640 A ± 17527	12100 A ± 3295	6720 A ± 4703
Diatomms (org./l)	10000 A ± 10000	13560 A ±7239	1600 A ± 1600	8160 A± 8160
Total phyto. No. (org./l)	783700 A ± 167553	1379880 A ± 575007	1190600 A ± 480447	775440 A ± 257934

Values fowllwed by A, B, etc. at the same row are significantly ($P<0.05$) different.

Results from Fig. (1) Indicated that *Euglena* was the dominant group (about 60%) followed by *Chlorophyta*, (36%) *Cyanophyta* (3%) and *Diatomms* (1%) in T_1 (fed diet) but in T_2. (Fish rigir) N: P was 0.99:1 *Chlorophyta*, was the dominant group about 88% followed by Euglena (10%) *Cyanophyta* (1%) and *Diatomms* (1%). Also T_3 (rigir) N:P was 1.33:1 *Chlorophyta*, was the dominant group about 83% followed by *Euglena* 16%, *Cyanophyta*, 1% and *Diatomms* 0%. T_4 (chicken manure) N:P was 1.98:1, so *Chlorophyta* was the dominant group 50% followed by *Euglena* 48%,*Cyanophyta* 1%and *Diatomms* 1%. This results agree with those of Jensen *et al.* (1994) who found that *Chlorophytes* could be dominant in many shallow eutrophic lakes and ponds with low N:P ratios. Jensen *et al.* (1994) pointed out that one of the important reasons why C*hlorophytes* were able to out compete blue-green algae in shallow water, no stratified lakes was the continuous input of nutrient from the sediment.

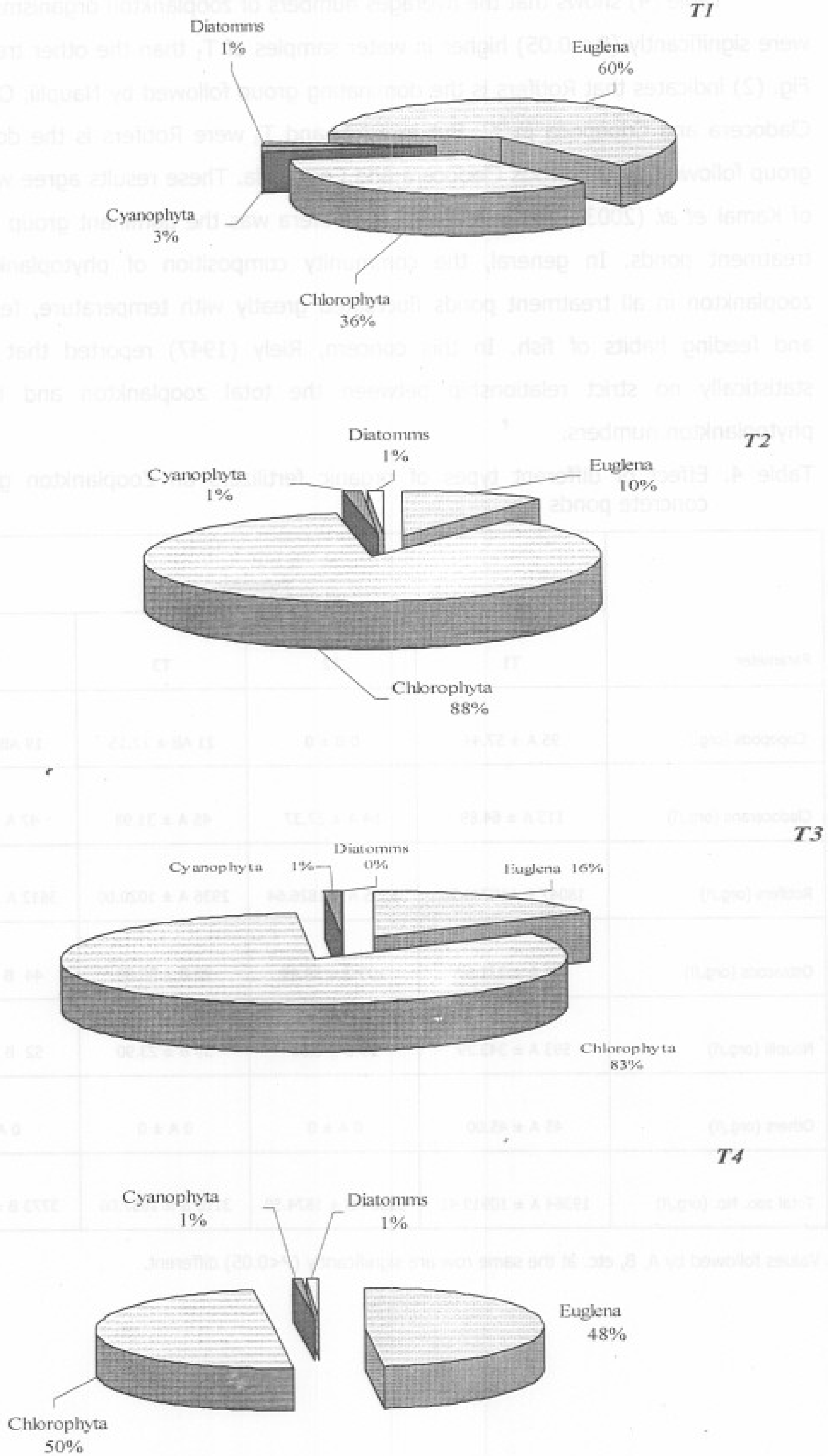

Fig.1. Phytoplankton groups (org*10/L) which counted and identificated for water of concrete ponds stocked with Nile tilapia fry (*Oreochromis niloticus)* and treated with different types of organic fertilizers.

Table (4) shows that the averages numbers of zooplankton organisms per liter were significantly ($P< 0.05$) higher in water samples of T_1 than the other treatments. Fig. (2) indicates that Rotifers is the dominating group followed by Nauplii, Ostracods, Cladocera and Copepoda in T_1. But in T_2, T_3 and T_4 were Rotifers is the dominating group followed by Ostracods Cladocera and Copepoda. These results agree with those of Kamal *et al.* (2003) who indicated that Rotifera was the dominant group in all the treatment ponds. In general, the community composition of phytoplankton and zooplankton in all treatment ponds fluctuated greatly with temperature, fertilization and feeding habits of fish. In this concern, Riely (1947) reported that there is statistically no strict relationship between the total zooplankton and the total phytoplankton numbers.

Table 4. Effect of different types of organic fertilizers on Zooplankton groups in concrete ponds

Parameter	Treatment			
	T1	T2	T3	T4
Copepods (org.,	95 A ± 57.44	0 B ± 0	21 AB ± 17.15	19 AB ± 12.21
Cladocerans (org./l)	113 A ± 64.89	64 A ± 27.37	45 A ± 31.98	47 A ± 24.59
Rotifers (org./l)	18047 A ±10749.38	5335 A ± 1826.64	2936 A ± 1020.00	3612 A ± 1451.26
Ostracods (org./l)	471 A ± 271.67	109 B ± 39.49	70 B ± 33.88	44 B ± 22.17
Nauplii (org./l)	593 A ± 343.29	29 B ± 6.67	39 B ± 23.90	52 B ± 30.02
Others (org./l)	45 A ± 45.00	0 A ± 0	0 A ± 0	0 A ± 0
Total zoo. No. (org./l)	19364 A ± 10919.41	5536 AB ± 1874.59	3110 B ± 1057.06	3773 B ± 1472.69

Values followed by A, B, etc. at the same row are significantly ($P<0.05$) different.

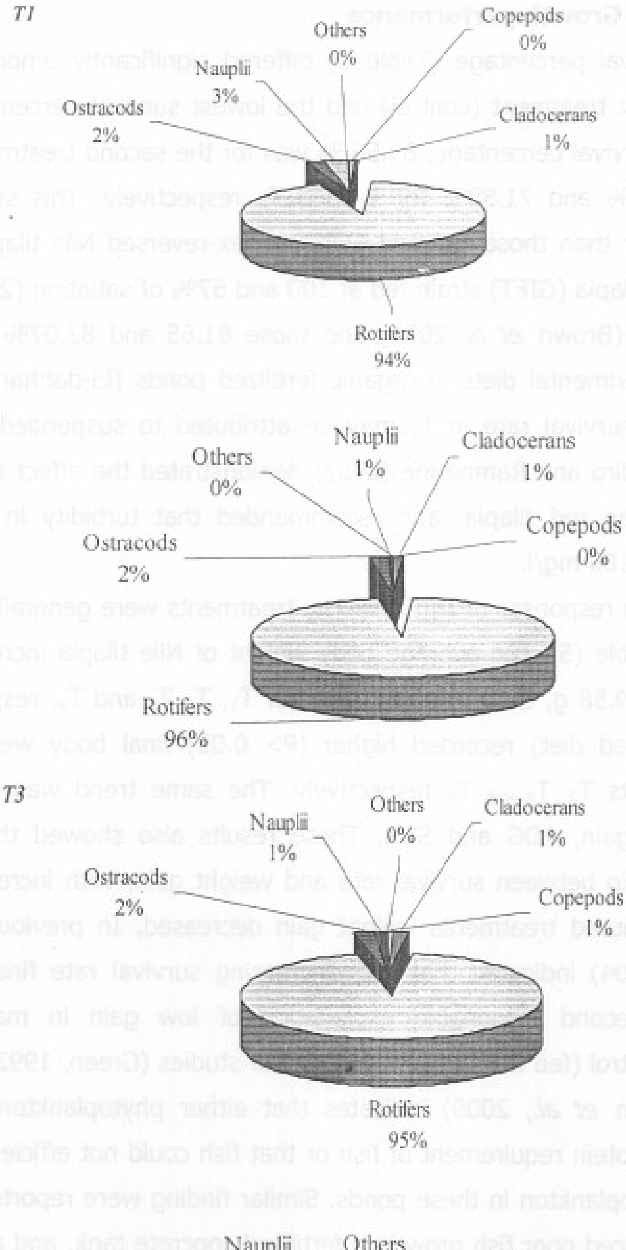

Fig.2. zooplankton groups (org*10/L) which counted and identificated for water of concrete ponds stocked with Nile tilapia fry (*Oreochromis niloticus*) and treated with different types of organic fertilizers.

Fish survival and Growth performance

Tilapia survival percentage (Table 5) differed significantly among treatments (P> 0.05). The first treatment (control) had the lowest survival percentage 50.11 % and the highest survival percentage, 89.56 % was for the second treatment (fish rigir) followed by 79.48% and 71.88% for T_3 and T_4, respectively. This survival rate is considerably higher than those (57 and 65%) of sex-reversed Nile tilapia genetically improved farmed tilapia (GIFT) strain fed at 100 and 67% of satiation (28.6% protein) in fertilized ponds (Brown *et al.* 2001) and those 81.65 and 82.07% of mixed-sex tilapia fed on experimental diets in organic fertilized ponds (El-dahhar *et al.* 2006). This reduction in survival rate in T_1 may be attributed to suspended soil particles turbidity. Ardjosoediro and Ramnarine (2002) demonstrated the effect of turbidity on survival of Jamaican red tilapia, and recommended that turbidity in tilapia ponds should not exceed 100 mg/l.

The growth responses of fish in all the treatments were generally satisfactory. As described in Table (5), the average body weight of Nile tilapia increased from 0. 889 g to 13.84 g, 9.58 g, 8.13 g, and 7.43 g for T_1, T_2, T_3 and T_4, respectively. It is obvious that T_1 (fed diet) recorded higher (P> 0.05) final body weight than the manured treatments T_2, T_3 and T_4, respectively. The same trend was obtained with regard to weight gain, ADG and SGR. These results also showed that there was negative relationship between survival rate and weight gain, with increasing survival percentage in manured treatments weight gain decreased. In previous work, Della Patrona *et al.* (2004) indicated that with increasing survival rate final weight was decreased. The second reasonable explanation of low gain in manured ponds compared with control (fed diet) reported in similar studies (Green, 1992, Diana *et al.*, 1994, 1996, Brown *et al.*, 2000) indicates that either phytoplankton may not be enough to meet protein requirement of fish or that fish could not efficiently assimilate the produced phytoplankton in these ponds. Similar finding were reported (Colman *et al.*, 1990) they noticed poor fish growth in fertilized concrete tank, and attributed it to the predomination of the green algae *Scenedesmus* and its poor assimilation. Moriarty and Moriarty (1973) and McDonald (1985) reported substantially reduced assimilation rate of green algae compared to blue –green algae by tilapia. These results are in agreement with McDonald (1987) who found that tilapia fish (*Oreochromis aureus*) fed blue green algae (*Anabaena spp.*) gained more weight than the control. Tefei *et al.* (2000) demonstrated that *O. niloticus* was found to be essentially phytoplanktivorous in Lake Chamo, the blue green algae contributed over 60% of the total food ingested. Of these, more than 50% was due to *Anabaena.* From these data, it can be concluded that fish do not need to be fed immediately after stocking but can be supported by the natural food in the pond ecosystem (Abdelghany *et al.*, 2002 and Kamal and Agouz 2006).

Table 5. Growth performance parameters of Nile tilapia fry (*Orechromis niloticus*) stocked at concrete ponds treated with different types of organic ferilizers.

Item	Treatment			
	T1	T2	T3	T4
Initial body weight (g/fish)	0.889	0.889	0.889	0.889
Final body weight (g/fish)	13.84 A ± 1.70	9.58 B ± 0.99	8.13 B ± 0.01	7.43 B ± 0.57
Total weight gain (g/fish)	12.95 A ± 1.70	8.69 B ± 0.99	7.29 B ± 0.04	6.54 B ± 0.57
Daily weight gain (mg/day/fish)	132.15 A ± 17.35	88.63 B ± 10.05	74.40 B ± 0.41	66.75 B ± 5.82
Specific growth rate (%)	2.80 A ± 0.13	2.42 B ± 0.11	2.26 B ± 0.00	2.17 B ± 0.08
Survival rate (%)	50.11 B ± 3.23	89.56 A ± 10.42	79.48 AB ± 8.65	71.88 AB ± 9.38

Values followed by a, b, etc. at the same row are significantly ($P<0.05$) different.

Economic efficiency

Table (6) shows the results of economical evaluation including the costs and returns for treatments applied in kg / feddan and income in (L.E) for 98 days. All of the treatments in this experiment generated a profit (Table 6). Total costs were 16890, 11646, 10837 and 10749 L.E / feddan for T_1 T_2 T_3 and T_4, respectively and net returns in L.E per feddan were 4998, 21455, 17203 and 13402 for T_1 T_2 T_3 and T_4, respectively. Percentages of net return to total cost were 29.6 %, 184.2 %, 158.7 and 124.7% for T_1 T_2 T_3 and T_4, respectively. These results revealed that the total cost of T_1 ((fed diet) was higher than manure treatments (T_2 T_3 and T_4), and a net return of T_2 (fish rigir) was the highest folowed by T_3 (rigir) and T_4 (chicken manure), and the lowest net return was T_1 (fed diet).

Table 6. Economic efficiency (%) of Nile tilapia (*Oreochromis niloticus*) fingerlings production as affected by the applied treatments during the experimental period for 98 days in L.E./feddan.

Item	T_1	T_2	T_3	T_4
Stocking data				
Stocking rate of tilapia (fish / feddan)	168000	168000	168000	168000
Average size at stoking of tilapia (g)	0.889	0.889	0.889	0.889
Average size at harvesting (g) of tilapia (g)	13.84	9.58	8.13	7.43
Survival rate % of tilapia	50.11	89.56	79.48	71.88
Production, No./feddan of tilapia	84185	150461	133526	120758
Operating costs (L.E)				
Tilapia fry	8400	8400	8400	8400
Commercial diet (30% protein)	7890			
Fish rigir	-	2646	-	-
Rigir	-	-	1837	
Dried poultry manure mash				1749
Labour (one / feddan)	300	300	300	300
Fixed costs, L.E/ Fedd.				
Depreciation (materials &others)	200	200	200	200
Taxes (one feddan)	100	100	100	100
Total costs/feddan (L.E)	16890	11646	10837	10749
% of the smallest value of total costs	157.1%	108.3%	100.8	100%
Returns				
Total Returns (L.E)	21888	33101	28040	24151
Net returns (L.E.)	4998	21455	17203	13402
% Net return to total cost	29.6	184.2	158.7	124.7

The economical evaluation of results was carried out according to market prices in 2008 in L.E. where:
1000 tilapia fry = 50 L.E.
1000 tilapia fingerlings (7- 8g each) = 200 L.E.
1000 tilapia fingerlings (8- 9g each) = 210 L.E.
1000 tilapia fingerlings (9- 10g each) = 220 L.E.
1000 tilapia fingerlings (13- 14g each) = 260 L.E.

RECOMMENDATION

Based on the obtained results and the high cost of fish diet now, it can say that, the use of fish rigir in concrete fish ponds culture could be recommended for producing Nile tilapia fingerlings at a rate of 50 g (fish rigir)/squire meter every week.

REFERENCES

1. Abdelghany, A. E., M. S. Ayyat and M. H. Ahmed. 2002. Appropriate timing of supplemental feeding for production of Nile tilapia, silver carp, and common carp in fertilized polyculture ponds. J. of the World Aquaculture Society, 33, (3): 307-315.
2. (AIT) Asian Institute of Technology 1986. Buffalo/ fish and duck/fish integrated systems for small – scale farmers at the family level. AIT Research Report No. 198. Bangkok, Thailand, 138 pp.
3. American Public Health Association (A.P.H.A.) 1985. Standard method for the examination of water and waste water. American Public Health Association . Washington, pp. 1268.
4. Ardjosoediro, I., and I.W. Ramnarine 2002. The influence of turbidity on growth, feed conversion and survivorship of the Jamaican red tilapia strain. Aquaculture 212: 159-165.
5. Association of Official Analytical Chemists (AOAC) 1984. Official methods of analysis. S. Williams (Ed). AOAC, Inc. Arlington, Virg. U. S. A, 1102 pp.
6. Association of Official Analysis Chemists (AOAC) 1990. Official Methods of Analysis, 15th ed, pp 1298, Virginia Association, Washington.
7. Bagenal, T. B and F.W. Tesch, 1978. Age and growth In Bagenal, T. (Ed.) Methods for Assessment of Fish Production in Fresh Waters. IBP Handbook 3. Blackwell, Oxford, U.K., 101-136.
8. Boyd, C. E. 1979. Water Quality in Warm Water Fish Ponds. Ed Claude E. Boyd. Third printing, 1984. Pub. Auburn Univ., Agri.Exp. Station, AID/Dsan- G.G.00 39.pp. 359.
9. Boyd, C. E. 1982. Water quality management for pond fish culture. Elsevier Scientific publishing Co., Amsterdam. The Netherlands.
10. Boyd, C. E. 1990. Water Quality in Ponds for Aquaculture Alabama Agriculture Experiment Station, Auburn University, Alabama, pp.462.
11. Boyed, C. E. 1998. Water quality for pond aquaculture. Research and development series No. 43. pp. 37. International Centre for aquaculture and aquatic Environments. Alabama Agricultural Experiment Station. Auburn University.
12. Boyed, C. E. 2000. Water quality – an introduction. Kluwer Academic Published Boston, Massachusetts.
13. Brown, C. L., R. B. Bolivar, E. T. Jimenez and J. Szype. 2000. Timing of the onset of supplemental feeding of Nile tilapia (*Oreochromis niloticus*) in ponds. Page 237 in K. Fitzsimmons, editor. Proceedings of the Fifth International Symposium on Tilapia Aquaculture. 3-7 September, Rio De Janeiro. Brazil.

14. Brown, C. L., R. B. Bolivar, E. B. T. Jumenez and J. P. Szyper 2001. Reduction of feed rations below satiation levels in tilapia pond production. P 21-23. In McElwee K, K, Lewis, M. Nidiffer, and P. Buitrago (Eds.) 19th Annual Technical report, Pond Dynamics/ Aquaculture CRSP, Oregon stat Unv. Corvallis, Oregon.
15. Colman, J. A., P. Edwards, M. Yomchinda and C. Pacharaprakiti 1990. Extending the limits of fish production in manured static-water ponds Aquaculture, 89: 27-41.
16. Della Patrona, L., L. Chim, S. Capo, P. Brun, P. Lemaire and J. L. M. Mortin 2004. Effect of mineral Fertilization on food web development, abundance of ingested prey, growth rate and pelleted feed conversion ratio of the shrimp (*Litopenaeus stylilostris*) reared in earthen ponds in cold season. Page 105. In: Book of abstracts, Aquaculture 2004, Honolulu, Hawaii, USA.
17. Denser, H. W. 1968. Studies on the physiology of young tilapia. FAO Fisheries Report, 44 (4): 357 – 366.
18. Diana, J. S. and C. K. Lin 1998. the effects of fertilization and water management on growth and production of Nile tilapia in deep ponds during the dry season. J. of the World Aquaculture Society. 29 (4) 405 – 413.
19. Diana, J. S., C. K. Lin and K. Jaiyen 1994. Supplemental Feeding of tilapia in fertilized ponds. J. world Aquaculture. Soc. 25 (4): 497-506.
20. Diana, J. S., C. K. Lin and Y. Yi 1996. Timing of Supplemental Feeding for tilapia in production. J. world Aquaculture Soc., 27, (4): 410-419.
21. El-dahhar, A. A., Y. T. Moustafa. M. E. A. Salama and Aida, M. Dawah, 2006.Effect of fertilization on production of Nile tilapia in earthen ponds (1) Evaluation of untraditional organic fertilizer in earten ponds. J. of the arabian aquaculture society vol. 1 (2) 91-111.
22. Ellis, M. M. 1937. Detection and measurement of stream pollution. U. S. Burea of fish, Bull. 22: 267 _ 437.
23. European Inland Fisheries Advisory Commission. 1993. Water quality criteria for European fresh water fish. Report on Ammonia and Inland Fisheries. Water Res., 7: 1011.
24. Green, B. W.1992. Substitution of organic manure for pelleted feed in Tilapia production. Aquaculture, 101: 213-222.
25. Gui,Y., Z. Wang, Y. Chen, W. Zheng and F. Li. 1989. Use of fluctuating temperature to promote growth of Tilapia nilotica. Journal of Fisheries of China. 13 (4) 326 – 331.
26. Hasssan, S., P. Edwards and D. C. Little. 1997. Comparison of tilapia monoculture and carp polyculture in fertilized earthen ponds. J. Worled Aquaculture Society, 28 (3): 268 – 274.
27. Hepher, B. 1963. Ten years of research in fish pond fertilization in Israel,11 fertilization dose and frequency of fertilization. Bamidgeh, 15: 78-92.
28. Hickling, C. F. 1962. Ed. Fish culture. First published in memlxii by Faber and Faber Limited, 24 Russell square London W.C.1., 295pp.

29. Hopkins, K. D. 1992. Reporting fish growth: review of the basic. J. World Aquacult. Soc., 23(3): 179.
30. Jensen, J. P., E. Jeppesen, K. Olrik and P. Kristensen. 1994. Impact of nutrients and physical factors on the shift from cyanobacterial to chlorophyte dominance in shallow danish lakes. Can. J. Fish Aquat. Sci., 51: 1692-1699.
31. kamal, S. M. and H. M. Agouz 2006. Production of Nile Tilapia (*Oreochromis niloticus*) and silver carp (*Hypophthalmicthys molitrix* val.) in earthen ponds fertilized by blue green algae and poultry manure. Mnsoura University Journal of Agricultural Sciences vol. 31 (6) 3389- 3398.
32. Kamal, S. M., A. A. Hassan, R. A. Abou-Seif and Faiza S. Abbas 2003. Effect of damsissa plant (*Ambrosia maritima*) on water quality and plankton communities in fish ponds stocked with grass carp (*Ctenopharyngodon idella*). J. Egypt. Acad. Soc. Environ. Develop., (B- Aquaculture) 4(2): 143-155.
33. Keenum, M. E. and J. E. Waldrop. 1988. Economic analysis of farm-raised catfish production in Mississipi. Bulletin 155. Mississipi Agriculture & Forestry Experiment Station. Mississipi State. Mississipi. USA.
34. Knud-Hansen, C.F. and A. K. Pautong 1993. On the role of urea in pond fertlization. Aquaculture, 114: 273 - 282.
35. McDonald, M. E. 1987. Interactions between a phytoplanktivorous fish, *Oreochromis aureus*, and tow unialgal forage population. Environ. Biol. Fish. 18, 3, 229-234.
36. McDonald, M. E. 1985. Carbon budgets for a phytoplanktivorours fish fed three different unialgal populations, Oecologia (Berlin). 67: 246-249.
37. Moriarty, C. W. and D. J. W. Moriarty. 1973. The assimilation of carbon from phytoplankton by two herbivorous fishes *Tilapia niloticus* and Haplochromis nigripinnus. J.Zool, 171: 41-55.
38. Ratafia, M. 1994. Feed supliers should consider aquaculture market. Feedstuffs, 66: 10- 12.
39. Rhyne, C., L. Crump and P. Jordan. 1985. Growth and protein production in selected laboratory cultures of blue green algae in tilapia wastewater: Final report, January 1984 through March 1985. Rep. Miss. ALA. Sea Grant Consort. Ocean Springs, MS USA Miss ALA. Sea Grant Consort. 35 pp.
40. Riely, G. A. 1947. Seasonal fluctuations of the phytoplankton production in New England Coastal Waters. J. Mar. Res., 6: 114 - 125.
41. SAS 1990. SAS user's guide statistics, version 6, 4^{th} Ed., SAS Institute Inc., Cary, N.C., USA.
42. Tefei, Y., D. Admassu and S. Mengistou..2000. The food and feeding habit of *Oreochromis niloticus* L. (Pisces: Cichlidae) in lake Chamo, Ethiopia. Sinet, an Ethiopian J. of Sci., 23: (1): 1-12.
43. Teichert-Coddington, D. R., B. W. Green and R. P. Phelps. 1992. Influence of site and season on water quality and tilapia producyion in Panama and Honduras. Aquaculture 105, 297-314.

تأثير التسميد و التغذية على إنتاج إصباعيات البلطى النيلى فى أحواض خرسانية

صلاح محمد كمال و صفوت عبد الغنى و محمد عبد العال

قسم الاستزراع السمكي – المعمل المركزي لبحوث الثروة السمكية بالعباسة – محافظة الشـرقية – مركز البحوث الزراعية.

أجريت هذه الدراسة بالمعمل المركزي لبحوث الأسماك بالعباسة مدينة أبـو حمـاد– محافظـة الشرقية –مصر. وكان الهدف منها دراسة تأثير التسـميد و التغذيـة علـى أداء النمـو و الكفـاءة الاقتصادية لزريعة للبلطي النيلي المرباة في أحواض خرسانية فى نظام الاستزراع السمكى وحيـد النواع ، وكان متوسط وزن الزريعة من أسماك البلطى النيلى فى البداية ٠,٨٨٩ جرام. تم إجـراء أربع معاملات مختلفة وهى كالآتي: المعاملة الأولى (T_1) التغذية على عليقة أسماك ٣٠% بـروتين بمعدل ٧% من وزن الجسم (٥ أيام / أسبوع) و المعاملة الثانية (T_2) التسميد بالفيش ريجر بمعـدل ٥٠ جم / للمتر المربع و ذلك كل أسبوع و المعاملة الثالثة (T_3) التسميد بالريجر بمعـدل ٥٠ جـم / للمتر المربع و ذلك كل أسبوع و المعاملة الرابعة (T_4) التسميد بزرق الدواجن السائب بمعدل ٥٠ جم / للمتر المربع و ذلك كل أسبوع. تم استخدام ٨ أحواض خرسانية مساحة الحوض الواحد ١٢,٥م٢ و تم تخزين الأسماك في الأحواض بمعدل ٤٠ سمكة بلطى نيلى / م٢ (١٦٨ ألـف / فـدان) ، وتـم تكرار كل معاملة مرتين والدراسة استمرت ٩٨ يوم ، و كانت النتائج المتحصل عليها على النحـو التالى:–

١– أعلى متوسط وزن نهائي و متوسط نمو يومى و معدل نمو نوعي تم تسجلها لأسماك البلطى النيلى فى المعاملة الأولى (T_1) التغذية على عليقة أسماك ٣٠% بروتين ، بينما كانت على العكس أقل معدل إعاشة.

٢– بالنسبة للكفاءة الاقتصادية كانت التكاليف الكلية للمعاملة الأولى (T_1) أعلى من كل المعاملات ، أما من حيث عائد الربح الصافى كانت المعاملة الثانية (T_2) أعلى من كل المعاملات.

وتوصى الدراسة باستخدام التسميد بالفيش ريجر بمعدل ٥٠ جم / للمتر المربع (٢١٠ كجم/فدان) و ذلك كل أسبوع وكثافة تخزين ٤٠ زريعة / م٢ (١٦٨ألف/فدان) من اسماك البلطي النيلي المرباة فـي الأحواض الخرسانية وذلك للحصول على أعلى إنتاجية و أعلى كفاءة اقتصادية خاصة مـع ارتفـاع أسعار العلف و المشاكل الموجودة الآن فى زرق الدواجن الطازج.