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Studies on fertilization sources with artificial feeds on productivity of earthen ponds stocked with different fish species.

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ABSTRACT

The present study was carried out at a private fish farm at Tolombat 7 site Kafr El-Sheikh Governorate, Egypt. The study was performed for 140 days during the period from 5Th July to 27Th November 2010. The study aimed to investigate the effect of different fertilization and feeding systems on growth performance; feed and Nitrogen utilization; whole body chemical composition; water quality; plankton abundance; some blood parameters and economic evaluation of earthen ponds cultured with different fish species in polyculture system. The experimental ponds were stocked with 4000 Nile tilapia (*O. niloticus*) fingerlings with an average initial weight of 17.18g; 500 Common carp (*C. carpio*) fingerlings initial weight of 16.50g; 750 Bouri (*Mugil cephalus*) fingerlings initial weight of 21.43 g; and 750 Tobara (*Liza ramada)* fingerlings with initial weight of 15.9 g in ten earthen ponds with dimentions of 21 x 100 m. each i.e. 1/2 fadden. Five treatments with two replicates each, were applied as follows: The 1st treatment (T1) was fed only on a commercial fish feed (25% protein), where the daily allowance of the fish was calculated as 3 % of fish biomass/day for 6 days a week. The 2nd treatment (T2) ponds were fed on the same artificial feed and fertilized with poultry manure at a rate of 32.5 kg /pond weekly. The 3rd treatment (T3) was fed on the artificial feed and fertilized with poultry manure (32.5 kg /pond weekly) and 1 kg urea plus 4 kg triple super phosphate /pond weekly. The 4th treatment (T4) received the artificial feed and fertilized with 1 kg urea plus 4 kg triple super phosphate/pond weekly. The 5th treatment (T5) was fertilized by poultry manure 32.5 kg and 1 kg urea plus 4 kg triple super phosphate /pond weekly without artificial feeds.

Results revealed that the highest ($P<0.05$) final weights and length, weight gain, length gain, daily weight gain, specific growth rate, relative growth rate and gross yield were recorded with T3 in all tested fish species compared to the other treatments, while T5 recorded the highest ($P<0.05$) condition factor in Nile tilapia, Common carp and Tobara and T2 recorded the highest ($P<0.05$) condition factor in Bouri. The best (lowest) feed conversion ratio was recorded with T4 followed by T3; T1 and T2, respectively, while T5 recorded no results of FCR, thus it received no artificial feed. Nitrogen utilization (N output/ N input) averages were 35.56; 32.18; 33.81; 35.90 and 116.40 for T1; T2; T3; T4 and T5, respectively. The applied treatments showed significant effects on whole fish body composition (protein, ether extracts, ash, NFE and gross body energy contents in all fish species tested. The treatment T3 recorded the highest total phytoplankton counts (org /ml) followed in a decreasing order by T2; T4; T5 and T1, respectively. The same trend was observed with total zooplankton and total plankton counts. The highest ($P<0.05$) total fish yield per pond was recorded by T3, followed in a significant decreasing order by T 2; T4 ; T1 and T5, respectively. The economical study showed that treatment T3 resulted in the highest return to cost followed in a decreasing order by treatments (4,2, 1and 5), respectively. The applied treatments showed significant effects on blood Hematological parameters (Hemoglobin-Hb g/d; RBC x10^6/ml; WBC x10^3/ml; Hematocrit Ht %) and Serum components (Total protein g/dl; Albumin g/dl; Globulin g/l; Glucose mg/l; Cholesterol mg %; Triglycerides mg/l; ALT u/ml and AST u/ml) in all fish species tested.

Based on the results obtained in the present study applying the earthen ponds polyculture system (Nile tilapia, Common carp and Mullet species) could be recommended using artificial feeding and fertilizing with poultry manure plus urea and triple super phosphate for the highest net returns under Egyptian conditions.

Keywords: Organic and inorganic fertilizers, Artificial feed, polyculture, plankton, Nitrogen utilization, Blood constituents.

INTRODUCTION

Fisheries and aquaculture in Egypt are important components of the agricultural sector and a significant source of animal protein (El-Naggar *et al.,* 2008). Fish production from all Egyption resources contributed by 6.15 % of agricultural production and 16.58% of total livestock and poultry production by value in 2005 (CAPMAS, 2008). The total National fish production amounted 1.304794 million tons in 2010 (GAFRD, 2010) where the fish production from aquaculture activities reached 919585 tons in the same year, representing 70.48 % of the total country production.

Egypt is facing a sharp shortage in animal protein production. The need for increasing fish production is necessary in view of the high demand for fish to cover the shortage in animal proteins. The decline of fish availability from the natural sources during the past few years, and the high fish price have supported the development of the fish culture. Due to limited sources of fresh water in Egypt, the development and increase of the aquaculture production can be achieved through higher fish stocking density and the application of artificial feeding with fertilization to cover the nutrients demand of the cultured fish.

A number of studies have been done on feed and fertilizer combinations, which may be very effective, where fertilization rates can be reduced due to enrichment gained from excreta and exhibited rapid growth rate of tilapia, since larger size could be attained in shorter time than fertilizer alone (Milstein *et al*., 1991; Mostafa, 2005) and also the production cost may be reduced (Eroldogan *et al*., 2006 and Abdel -Hakim *et al.,* 2009). Among fish culture methods, aquaculture in earthen ponds is the most common practice. The advantage of pond culture is that fish are able to utilize natural foods and the natural food can be enhanced by using organic or inorganic fertilizers. Level of nutritional inputs varied from use of fertilizers to use of high quality extruded feed according to production system practiced in the farm. Fish feeds represent the major part of fish production, as it represents about 60-70 % of fish farm operation cost. Fish feed prices have increased significantly during the last few years which reduced the profit margin of fish farming and caused losses in some farms .As a direct result of that farming net profits declined and most of the business has changed their production plan depending more on fertilizers.

Fertilizers are applied for fertilization of fish ponds to increase plant nutrients cantraction and to stimulate natural fish growth and ultimately increase fish production. Availability of natural food in pond water reduces fish demand for artificial feeds, leading to reduce production costs and improve farm income. Chicken manure has been used extensively as organic fertilizers in fish farms for increasing natural food web and consequently reducing production costs. Chemical fertilizers are highly soluble and release nutrients that can cause eutrophication of natural waters.

Organic and inorganic fertilizations can produce high plankton abundance to be capable of supporting fish growth (Jha *et al.*, 2008). Fertilizers, fresh feed or both are manipulated in fish ponds to increase production (Lane, 2000). Organic fertilizers have been widely used in tilapia, common carp and mullets ponds, especially in Asia (Edwards *et al.*, 1994 and Shevgoor *et al.*, 1994). Central America (Green *et al.*, 1990) and Africa (Hussein, 1995).

Recent studies have shown that the combined use of inorganic and organic fertilizers is effective in productivity improvement in earthen ponds (Afzal *et al.*, 2007; Jha *et al.*, 2008). Moreover, the combined use of inorganic and organic fertilizers is effective in maintaining phytoplankton and zooplankton population in rearing ponds (Afzal *et al.*, 2007).

The objective of this study was to investigate the effect of different fertilization and feeding systems on growth performance; feed and Nitrogen utilization; whole body chemical composition; water quality; plankton abundance; some blood parameters and economic evaluation of earthen ponds cultured with different fish species in polyculture system.

MATERIALS AND METHODS

Experimental treatments were applied in Ten earthen ponds with dimensions (21x100x1.25m) as width, length and depth, respectively of surface area (2100 m^2) each (1/2 fadden).The farm water source was mainly agricultural drainage water and comes from Elgarbia drainage canal. The water exchange rate was 10% of the total pond area/day. *O. niloticus* fingerlings were stocked with an average initial weight and length of 17.18 g and 5.6 cm for all treatments. *C. carpio* fingerlings were stocked with an average initial weight and length of 16.50 g and 7.6 cm for all treatments. *M. cephalus* fingerlings were stocked with an average initial weight and length of 21.43 g and 10.9 cm for all treatments. *L. ramada* fingerlings were stocked at an average initial weight and length of 15.9 g and 7.5 cm for all treatments. Each pond was stocked with 6000 fish species (4000 *O. niloticus*, 500 *C. carpio*, 750 *M. cephalus* and 750 *L. ramada* fingerlings) corresponding to the rate of 12000 fish/ fadden. The trial lasted for 140 days started at the 5^{th} of July and harvested at 27th November 2010.

Five treatments (two replicates /each) were designed as follows:

Treatment (T1), artificial feed only (control) artificial feeding on a commercial Fish feed (25 % CP), where the daily allowance of the fish was calculated as 3 % of fish biomass/day for 6 days a week; Treatment (T2), artificial feed + organic manure (poultry manure32.5 kg/pond weekly); Treatment (T3), artificial feed + organic manure + inorganic fertilizers (poultry manure 32.5 kg) and fertilizer (1 kg urea plus 4 kg triple super phosphate /pond weekly); Treatment (T4), artificial feed + inorganic fertilizers (1 kg urea and 4 kg Triple super phosphate/ pond weekly); Treatment (T5), fertilization only (poultry manure 32.5 kg and fertilizer (1 kg urea plus 4 kg triple super phosphate /pond weekly).

The proximate analysis of artificial feeds, inorganic fertilizers (urea and triple-phosphate) and organic fertilizer (poultry manure) the experimental ration for each treatment group are presented in table (1).

Table1: Approximate chemical composition (%), of artificial feeds, inorganic fertilizers (urea and triple-phosphate) and organic fertilizer (poultry manure) as dry matter basis (% of dry weight) of the experimental ration.

Treatment	Artificial feeding	Organic fertilizer	Inorganic fertilizer(U+TSP)
Mois ture (%)	18.73	15.30	---
Dry matter (DM %)	91.41	84.70	---
Crude protein (CP%)	25.13	26.62	---
Ether extract (EE %)	6.37	2.22	---
Crude fiber (CF %)	20.53	15.90	---
Ash (%)	10.73	30.0	---
Nitrogen free extract[1] (NFE %)	37.24	25.26	---
Nitrogen (%)	1.68	2.18	46.50
Phosphorus (%)	---	3.0	20.0
Gross energy (Kcal/kg)[2]	3547	---	---

[1] Calculated by differences (NFE = 100-(protein + lipid+ fiber + ash)).
[2]Gross energy was calculated using values of 5.65, 4.1 and 9.44 kcal/g GE DM of protein, carbohydrate and lipid, respectively. (NRC, 1993).

Growth Parameters Tested.

Random samples of fish (10 fish/ species/ treatment) were weighed every two weeks during the experimental period. Individual body weight and length of fish were recorded for each sample, Growth performance and feed utilization parameters were calculated as follows:

Weight gain (WG) = Final mean weight (g)-Initial mean weight (g); Length gain (LG) = Final mean Length (cm)- Initial mean Length (cm); Average daily gain (ADG) g/day = Final fish weight (g)-Initial fish weight (g)/ Time (days) Specific growth rate (SGR) = 100 ($\ln W_2 - \ln W_1$) / T calculated according to Green *et al* (2002), where W_1 and W_2 are the initial and final weight, respectively, and T is the number of days in the period; Feed conversion ratio (FCR) = feed intake / weight gain according to Green *et al*. (2002); Condition factor (K) = [weight (g) / length^3 (cm)] x l00 according to Green *et al*. (2002); Relative growth rate (RGR) = Total weight gain (g)/ Initial weight (g) x 100; Gross yield of fish (GY) = harvested fish weight (kg) pond.

Water quality.

Water pH was measured every 15 days, using pH meter model 3050 Jenway electrochemical products, (range from 0 to 14). Dissolved oxygen and temperature were measured between 9.00 and 9.30 am each 15 days, using Thermo Orion (model 835A, Orion Research Inc) oxygen meter. Water samples were taken for analysis of total ammonia (NH_4-N), nitrate, nitrite and analytical methods were carried out according to APHA (1985) and salinity Conductivity meter model 4070 Jenway electrochemical product was used to estimate salinity in water samples as ppt/ l.

Determination of plankton.

Collection of plankton samples.

Ten liters of water samples were collected from different areas and depths of the ponds every 15 days, and passed through a 25 m mesh plankton net. Collected plankton samples were preserved in 4%buffered formalin in small plastic bottles.

Qualitative and quantitative analysis of plankton.

The preserved plankton samples were counted by using a Sedgwick- Rafter counting cell, under a compound binocular microscope (Swift M 4000-D). A 1 ml sub-sample from each of the samples was transferred to the cells, after which all plankton organisms, present on 10 squares of the cells chosen randomly, were counted and later were used for quantitative estimation using the formula given by Stirling (1985).

$$N = (A \times 1000 \times C) / (V \times F \times L)$$

Where: N = No. of plankton cells or units per liter of original water; A =Total no. of plankton counted; C = Volume of final concentrate of the samples in ml; V = Volume of a field in cubic mm; F = No. of fields counted; L = Volume of original water in liters. Plankton were identified up to the category of genus and enumerated according to APHA (1992).

Blood samples:

At the end of the experimental period, 6 fish from each species were randomly taken from each experimental group for blood samples. Blood samples for haematological analysis were collected by suction from the caudal vein and devided in two parts. The first part was kept as a whole blood in heparinied tubes used for determining hematological parameters, RBC and WBC counts were done according to Blaxhall and Dalsey (1973). Hemoglobin contents were determined by Sahli's haemoglobinometer according to Vankampen (1961) and hematocrit (Ht %) was determined using micro haematocrit capillaries filled with blood and centrifuged at 8,700×g for 5 min and expressed as percentage of total blood volume as described by Wintrobe (1974). Blood serum was separated from the second part collected and transferred to centrifuge tubes and allowed to clot at room temperature then separated by centrifugation at 3000 (rpm) for 20 minutes. Total serum protein was determined colorimetrically by using Biurette reagent according to Henry (1964), Albumin was determined colorimetrically at wave length 550 nm according to Dumas and Biggs, (1972), Globulin by differences between total protein (g/l) and albumin (mg/dl), Glucose was determined colorimetrically according to Karakaschev and Vichev (1966), Cholesterol (mg %) was determined colorimeterically by using potassium hydroxide and petroleum ether method according to Allain *et al*. (1974), Triglycerides (mg/dl) were determined colorimeterically according to McGowan *et al*. (1983); ALT and AST (u/ml))were determined colorimetrically according to Reitman and Frankel (1957).

Chemical analysis of feed and whole fish body:

At the beginning and the end of the experiment, 6 fish from each species and the diet were exposed to proximate composition of dry matter, crude protein, fat, ash. Dry matter was determined after drying the samples in an oven at 105°C until constant weight; ash content was determined in a muffle furnace at 600°C for 12 hrs in a muffle Furnace; Crude protein (N × 6.25) by kjeldhal method after acid digestion; ether extract by petroleum ether (60-80°C) extraction; fiber by drying and ashing after extraction with 0.5 μH_2SO_4 and 0.5 μNaOH; nitrogen free extract (NFE) was calculated by differences. All chemical analysis for fish body and diet were carried out according to A.O.A.C. (1990).

Partial budget analysis:

A partial budget analysis was conducted to determine the economic returns for the different tested fertilization regimes (Shang, 1990).

Statistical analysis.

The data were statistically analyzed as ANOVA and Duncan's Multiple- range testing to compare the mean values of the factors measured, using general linear models procedure adapted by SPSS,2008 version (16.0) statistical software package (SPSS, Inc., Chicago, Illinois, USA).The differences among treatments means were accepted as significant at $P<0.05$. The following model was performed.

$$X_{ij} = \mu + T_i + e_{ij}$$

Where: - X_{ij} represents the observation; μ= overall mean; Ti = effect of treatments; e_{ij} = experimental error.

RESULTS AND DISCUSSION

Fish growth performance:

In Nile tilapia, averages of FW; FL; WG; SGR; RGR and GY were significantly (P<0.05) the highest for T3 followed in a significant decreasing order by T2, T1, T4 and T5, respectively (Table2). On the other hand, T5 recorded significantly the highest values of (K) followed in a significant (P<0.05) decreasing respective order by T1; T4 and both T2 and T3 indicated that T5 gained more weight than length.

Table 2: Effect of fertilization sources or artificial feeds on body weight gain, specific growth rate, condition factor and relative growth rate of Nile tilapia (*O. niloticus*) reared in polyculture system (Mean±SE).

Treatment groups	T1	T2	T3	T4	T5
Initial weight (I W)	17.18	17.18	17.18	17.18	17.18
Final weight (FW)	229.28±2.64^{c}	247.38±3.37^{b}	311.06±3.26^{a}	210.00±3.72^{d}	152.00±2.64^{e}
Initial length (I L)	5.6	5.6	5.6	5.6	5.6
Final length (F L)	24.18±0.26^{c}	25.47±0.27^{b}	30.30±0.28^{a}	22.70±0.47^{d}	19.06±0.47^{e}
Weight gain (WG)	212.10±2.68^{c}	230.20±2. 37^{b}	293.88±3.42^{a}	192.82±2.64^{d}	134.82±2.54^{e}
Length gain (L G)	18.58±0.49^{c}	19.87±0.55^{b}	24.70±0.48^{a}	17.10±0.72^{d}	13.46±0.72^{e}
Daily Weight gain(DWG)	1.51±0.05^{c}	1.64±0. 05^{b}	2.09±0.08^{a}	1.37±0.00^{d}	0.96±0.02^{e}
Condition factor (K)	1.83±0.14^{b}	1.49±0.04^{d}	1.12±0.42^{d}	1.79±0. 24^{c}	2.19±0.08^{a}
Specific growth rate (SGR)	1.85±0. 68^{c}	1.90±0.22^{b}	2.07±0.00^{a}	1.79±0.32^{d}	1.55±0.04^{e}
Relative growth rate (RGR)	1234.6±2.63^{c}	1340.0±6.33^{b}	1710.6±1.89^{a}	1122.4±0.00^{d}	784.74±2.54^{e}
Gross yield (GY) kg / pond	918.0±1.87^{c}	990.0±4.35^{b}	1244.50±1.13^{a}	810.50±0.00^{d}	608.00±1.54^{e}

a, b, c, d, e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do.

Concerning Common carp FW; FL;WG; LG; DWG; SGR; RGR and GY, (T3) recorded the highest (P<0.05) values followed in a significant (P<0.05) decreasing order by T4; T2; T1 and T5, respectively (Table3). The same trend was observed for K values, where (T5) recorded the highest value (P<0.05) followed in a significant (P<0.05) decreasing order by T1 ;T2 ;T4 and T3, respectively which indicate that T5 and T1 grew more in weight than in length.

Table 3: Effect of fertilization sources or artificial feeds on body weight gain, specific growth rate, condition factor and relative growth rate of Common carp (*C. carpio*) reared in polyculture system (Mean±SE).

Treatment groups	T1	T2	T3	T4	T5
Initial weight (I W)	16.50	16.50	16.50	16.50	16.50
Final weight (FW)	301.53±2.79^{d}	355.02±2.89^{c}	478.02±3.19^{a}	399.25±2.70^{b}	221.25±2.76^{e}
Initial length (IL)	7.6	7.6	7.6	7.6	7.6
Final length (F L)	35.35±0.30^{d}	40.36±0.38^{c}	46.78±0.24^{a}	41.30±0.55^{b}	27.00±0.39^{e}
Weight gain (WG)	284.76±2.79^{d}	338.52±2.89^{c}	461.52±3.20^{a}	382.75±2.70^{b}	204.75±2.35^{e}
Length gain (L G)	27.75±0.31^{d}	32.76±0.38^{c}	39.18±0.24^{a}	33.70±0.55^{b}	19.40±0.43^{e}
Daily Weight gain (DWG)	2.03±0.28^{d}	2.41±0.40^{c}	3.29±0.24^{a}	2.72±0. 35^{b}	1.46±0.29^{e}
Condition factor (K)	0.67±0.01^{b}	0.53±0.01^{c}	0.46±0.01^{d}	0.56±0.01^{c}	1.12±0.31^{a}
Specific growth rate (SGR)	2.07±0.03^{d}	2.19±0.05^{c}	2.40±0.06^{a}	2.27±0.05^{b}	1.85±0.05^{e}
Relative growth rate (RGR)	1725.8±4.42^{d}	2051.73±2.53^{c}	2797.1±4.22^{a}	2319.7±2.62^{b}	1240.9±4.37^{e}
Gross yield (GY) kg / pond	150.50±0.50^{d}	177.50±0.82^{c}	239.50±0.67^{a}	199.62±0.60^{b}	110.50±0.65^{e}

a, b, c, d, e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do.

Concerning Bouri fish results, table (4) shows that group T3 recorded the highest FW; FL; WG; LG; DWG; SGR and RGR (P<0.05) followed in a significant (P<0.05) decreasing order by T4; T2; T1 and T5, respectively. Meamufile, results of GY indicate that T3 recorded significantly ($P<0.05$) the highest value followed in a significant decreasing ($P<0.05$) order by T2; T1; T4 and T5, respectively. Concerning (k) values result show that T1 and T2 recorded significantly ($P<0.05$) the highest K values followed in a decreasing order ($P<0.05$) by T4 and both T3 and T5 respectively.

Table 4: Effect of fertilization sources or artificial feeds on body weight gain, specific growth rate, condition factor and relative growth rate of Bouri Mullet (*M. cephalus*) reared in polyculture system (Mean±SE).

Treatment groups	T1	T2	T3	T4	T5
Initial weight (IW)	21.43	21.43	21.43	21.43	21.43
Final weight (FW)	346.50±2.60^{c}	395.82±2.47^{b}	464.93±2.99^{a}	400.33±2.11^{b}	200.50±2.57^{d}
Initial length (IL)	10.9	10.9	10.9	10.9	10.9
Final length (FL)	33.09±0.45^{d}	34.55±0.30^{c}	40.45±0.47^{a}	37.42±0.42^{b}	30.35±0.45^{e}
Weight gain (WG)	325.07±2.47^{c}	374.39±3.40^{b}	443.50±3.25^{a}	379.07±3.20^{b}	179.07±2.40^{d}
Length gain (LG)	22.19±0.49^{d}	23.65±0.36^{c}	29.55±0.54^{a}	26.52±0.43^{b}	19.45±0.36^{e}
Daily Weight gain (DWG)	2.31±0.35^{c}	2.67±0.15^{b}	3.17±0.25^{a}	2.70±0.30^{b}	1.27±0.15^{d}
Condition factor (K)	0.95±0.14^{a}	0.95±0.09^{a}	0.70±0.08^{c}	0.76±0.10^{b}	0.71±0.14^{c}
Specific growth rate(SGR)	1.98±0.15^{c}	2.08±0.20^{b}	2.20±0.23^{a}	2.09±0.15^{b}	1.59±0.20^{d}
Relative growth rate (RGR)	1516.9±44.60^{c}	1747.3±56.23^{b}	2069.5±64.15^{a}	1768.9±48.42^{b}	835.60±64.15^{d}
Gross yield (GY) kg / pond	260.0±0.23^{c}	296.86±0.73^{b}	348.50±0.43^{a}	300.50±0.53^{b}	150.50±0.63^{d}

a, b, c, d, e… within each raw bearing the same letters do not differ significantly $P<0.05$ other wise the do.

Concerning Tobara, results in the table (5) show that FW; DWG revealed that both T3 and T4 recorded the highest ($P<0.05$) values followed in a significant ($P<0.05$) decreasing order by T2; T1 and T5, respectively. In the same table, T3 recorded significantly ($P<0.05$) the highest FL; WG; LG; RGR; GY followed in a significant ($P<0.05$) decreasing order by T4; T2; T1 and T5, respectively.

Concerning SGR, T3; T4 and T2 recorded significantly ($P<0.05$) the highest values compared to T1 and T5. Concerning K values, T5 recorded significantly ($P<0.05$) the highest value followed in a significant decreasing order by T1 and both T2 and T4 then T3, respectively.

Table 5: Effect of fertilization sources or artificial feeds on body weight gain, specific growth rate, condition factor and relative growth rate of Tobara mullet (*L. ramada*) reared in polyculture system (Mean±SE).

Treatment groups	T1	T2	T3	T4	T5
Initial weight (IW)	15.9	15.9	15.9	15.9	15.9
Final weight (FW)	243.75±2.94^{c}	291.45±2.77^{b}	309.25±0.49^{a}	299.25±0.35^{a}	190.64±1.2^{d}
Initial length (IL)	7.5	7.5	7.5	7.5	7.5
Final length (FL)	32.06±0.28^{c}	35.3±0.51^{b}	37.25±0.17^{a}	35.73±0.48^{b}	23.45±0.55^{d}
Weight gain (WG)	227.85±3.01^{d}	275.55±2.71^{c}	293.35±0.40^{a}	283.35±2.74^{b}	174.74±0.2^{e}
Length gain (LG)	24.56±0.30^{c}	27.8±0.50^{b}	29.75±0.52^{a}	28.23±0.50^{b}	15.95±0.2^{d}
Daily Weight gain (DWG)	1.62±0.32^{c}	1.963±0.32^{b}	2.09±0.12^{a}	2.01±0.42^{a}	1.24±0.32^{d}
Condition factor (K)	0.73±0.30^{b}	0.66±0.03^{c}	0.59±0.01^{d}	0.65±0.03^{c}	1.47±0.42^{a}
Specific growth rate (SGR)	1.95±0.04^{b}	2.07±0.05^{a}	2.12±0.07^{a}	2.09±0.05^{a}	1.77±0.02^{c}
Relative growth rate (RGR)	1433.0±4.93^{d}	1733.0±6.03^{c}	1845.0±8.21^{a}	1782.1±5.65^{b}	1198.99±4.52^{e}
Gross yield kg / pond	183.0±1.12^{d}	218.58±2.62^{c}	232.0±3.12^{a}	224.50±2.22^{b}	143.0±1.72^{e}

a, b, c, d, e… within each raw bearing the same letters do not differ significantly $P<0.05$ other wise the do.

Results of the present study are in partial agreement with the findings of Eid *et al.* (2009) who found that average FW, WG, SGR; DWG and GY were significantly higher in T2 (feed plus poultry manure plus urea and Triple super phosphate) than T1 (fed on a diet 25% protein only); T3 (poultry manure plus urea plus TSP and supplementary feeding with rice bran; T4 (poultry manure only), respectively.

Also results of Hussein and Abdel-Hakim (2003) are in accordance with results of the present study. They reported that manuring of pond cultured with Nile tilapia; Tilapia aurea, Common carp and Mullets with chicken manure plus artificial feed improved growth performance of the cultured species compared to ponds received chemical fertilizers.

Nitrogen utilization and feed conversion ratio of the fish species.

Results in table (6) indicate that T3 showed higher nitrogen inputs; N gained in harvest from the fish species bodies cultured followed in a descending order by T2; T4; T1 and T5 respectively (Table 6). Also, T3 recorded higher nitrogen wastes due to the decomposition of the fertilizers in water and wastes from feed followed in a descending order by T2; T4; T1, respectively.

Table 6: Nitrogen inputs in the forms of fertilizer and feed, gain in the form of harvested biomass, feed conversion, and waste generated from various treatments over culture period.

	Treatment				
	T1	T2	T3	T4	T5
Nitrogen Input (Kg/pond)					
Manure	-	14.17	14.17	-	14.17
Urea	-	-	9.30	9.30	9.30
Sum of Fertilizers	-	14.17	23.47	9.30	23.47
Feed	119.15	134.89	163.37	115.38	-
Total N input	119.15	149.06	186.84	124.48	23.47
Nitrogen Output					
Tilapia	26.44	28.42	39.91	22.69	16.42
Common carp	4.76	5.61	6.71	6.24	3.37
Gray mullet	6.56	8.16	9.43	9.17	3.88
Liza ramada	4.61	5.78	7.13	6.60	3.65
N gained in harvest	42.37	47.97	63.18	44.70	27.32
Waste to environment	76.78	101.09	123.66	79.78	-3.85
Nitrogen utilization	35.56	32.18	33.81	35.90	116.40
Total fish production	1511.50	1682.94	2064.50	1535.12	1012
FCR	2.30	2.30	2.26	2.19	---

On the other hand T5 which received only fertilizers (poultry manure + urea and TSP) gained more nitrogen than the total N inputs which may be due to the dissolved atmospheric nitrogen which is converted to planktonic organisms consumed by the fish in such pond. This finding is supported by the fact reported by Boyd (1979) who showed that atmospheric nitrogen is soluble in water to the extent of about 12 mg/liter at 25 ^{0}C . Other inorganic forms of nitrogen in the usual order of increasing abundance are NO_2, NH_3, NO_3, and NH_4.

The same author added that some of the nitrogen added to water is obviously assimilated by plants and, when the plants die, the nitrogen is deposited in bottom muds as a component of the organic matter. The highest nitrogen utilization value was observed with T4 followed by T1; T3 and T2, regardless of T5.

These results indicate that fertilization of fish ponds only without supplementary feed increased the nitrogen utilization drastically due to addition. of nitrogen in form of natural feed, however such ponds could not produce as much natural feed as ponds receiving artificial feed plus fertilizers. In this respect, Mohamed (2010) reported that ponds cultured with Nile tilapia and Silver carp received artificial feed plus cow manure or urea +TSP showed higher nitrogen gain (37.63 and 38.26 kg Nitrogen / feddan), respectively compared to ponds received feed plus compost only or ponds received artificial feed plus cow manure only (34.0 and 34.2 kg nitrogen /feddan), respectively. As presented in table (6) results indicate that T4 showed the best FCR value (the lowest) followed by T3; T1 and T2, respectively. These results are in agreement with the findings of El-Tawil (2006) who reported that the best FCR values of Nile tilapia were obtained using compost as fertilizer (1.065) followed by fish reger as organic fertilizer (1.20), super phosphate + urea (1.23), while using artificial feed only resulted in the highest FCR values.

Chemical composition of whole fish body.

Table (7) presents the chemical composition of fish species treated with feed and fertilization. Dry matter (DM) of whole Nile tilapia; Common carp; Bouri and Tobara basis ranged between 30.65 % (T3) and 27.29 % (T5); 25.32 %(T3) and 29.30 %(T1); 27.45 % (T5) and 31.66 % (T4) and 33.00 %(T3) and 28.51 % (T5), respectively, with significant differences ($P<0.05$) among the treatments. Concerning protein contents in whole bodies of Nile tilapia; Common carp and Tobara, T3 recorded the highest ($P<0.05$) value, while in Bouri both T2 and T4 recorded the highest ($P<0.05$) protein contents in whole body.

Concerning EE content in whole bodies of Nile tilapia; Common carp and Bouri, the highest volue ($P<0.05$) was recorded by T3. While in Tobara, T1 recorded the highest volue ($P<0.05$), with significant differences ($P<0.05$) among the treatments for all fish culture species. Concerning ash contents in whole fish bodies, results revealed that the highest ($P<0.05$) ash contents in Nile Tilapia; gray mullet and Tobara were recorded by T3, while in Common carp the highest value was recorded by T1, with significant differences ($P<0.05$) among the treatments.

Concerning NFE contents in whole Nile tilapia bodies they ranged between 3.02 %(T3) and 9.41 % (T5), while the highest NFE value in Common carp was recorded T1 (3.10 %) and the lowest in T4 (2.10 %) Furthermore, the highest NFE ($P<0.05$) contents in Bouri were recorded by T3 and T5 compared to T1, T4 and T2. Also, T2 and T5 of Tobara recorded the highest ($P<0.05$) NFE values followed in a significant ($P<0.05$) decreasing order by T1, T4 and T3, respectively.

Concerning gross energy contents (GE. Kcal /100g) results in table (7) show that the highest GE contents ($P<0.05$) were recorded by T1 and T2 in Nile tilapia followed in a significant ($P<0.05$) decreasing order by T3, T4 and T5, respectively, while highest GE value in Common carp whole bodies ($P<0.05$) was recorded in T3 followed in a significant ($P<0.05$) decreasing order in T2, T4, T5, T1, respectively. Bouri the highest GE value was recorded by T1 followed in a significant decreasing ($P<0.05$) order by T3, T5, T4 and T2, respectively. Furthermore, in Tobara, the highest GE ($P<0.05$) was recorded by T1 followed in a significant decreasing ($P<0.05$) order by T4, T5, T2 and T3, respectively.

Results of table (7) are in partial agreement with the findings of El-Kotamy (2008) who applied four treatments (feed only, feed+ duck manure, feed+ duck manure +U and SP, feed+ U and SP) in ponds cultured with Nile tilapia, Common carp, Bouri and Tobara, and found that the third treatment (feeding+ manure +U and SP) showed the highest DM contents, protein contents in the whole fish bodies compared to the other treatments.

Table 7: Effect of fertilization sources or artificial feeds on chemical composition of the whole body of Gray mullet or Bouri (*M. cephalus*); Tobara (*L. ramada*), Nile tilapia (*O. niloticus*) and Common carp (*C. carpio*) reared in polyculture system.

Item	Treat.	Dry matter	Protein	Ether extract	Ash	*NFE	**GE Kcal/100g
Initial		27.36±0.51	62.80±0.50	18.00±0.51	12.78±0.54	6.42±0.51	547.92±1.54
Final Nile tilapia (*Oreochromis niloticus)*	T1	28.03±0.82^{b}	64.23±0.81^{c}	19.66±0.57^{b}	10.36±0.58^{b}	5.75±0.46^{c}	568.84±1.58^{a}
	T2	27.67±0.57^{c}	64.85±0.57^{b}	19.68±0.58^{b}	10.61±0.58^{ab}	4.86±0.45^{d}	568.85±1.57^{a}
	T3	30.65±0.58^{a}	65.40±0.57^{a}	19.84±0.58^{a}	11.74±0.58^{a}	3.02±0.45^{e}	565.95±2.58^{b}
	T4	28.01±.0.57^{b}	62.52±0.58^{d}	18.50±0.57^{c}	11.34±0.57^{a}	7.64±0.46^{b}	556.07±1.26^{c}
	T5	27.29±0.52^{c}	61.81±0.54^{e}	17.50±0.52^{d}	11.28±0.57^{a}	9.41±0.45^{a}	549.91±1.30^{d}
Initial		27.50±0.51	67.00±0.50	16.30±0.50	13.01±0.51	3.69±0.50	544.19±1.50
Final Common carp *(Cyprimus cario)*	T1	29.30±0.51^{a}	67.50±0.63^{c}	16.00±0.58^{c}	13.40±0.51^{a}	3.10±0.52^{a}	541.75±2.58^{d}
	T2	28.87±0.54^{a}	68.50±0.58^{b}	18.10±0.57^{b}	11.40±0.62^{c}	2.00±0.61^{c}	562.66±1.57^{b}
	T3	25.32±0.54^{a}	69.20±0.57^{a}	19.22±0.57^{a}	10.28±0.58^{d}	1.30±0.55^{d}	574.28±0.58^{a}
	T4	29.00±0.57^{a}	67.40±0.88^{cd}	18.07±0.88^{b}	12.43±0.58^{b}	2.10±0.53^{c}	556.63±1.57^{c}
	T5	28.50±0.55^{a}	67.00±0.55^{e}	18.00±0.85^{b}	12.50±0.58^{b}	2.50±0.55^{b}	555.37±2.57^{c}
Initial		29.50±0.05	57.62±0.04	27.99±0.05	12.82±0.04	1.57±0.05	597.42±1.03
Final Gray mullet – Bouri *(Mugih sephalus)*	T1	27.95±0.58^{c}	56.50±0.58^{c}	30.69±0.57^{b}	11.32±0.58^{c}	1.49±0.55^{b}	612.21±1.58^{a}
	T2	28.29±0.42^{bc}	60.49±0.58^{a}	26.70±0.58^{e}	11.63±0.57^{b}	1.18±0.56^{d}	595.61±1.37^{e}
	T3	30.34±0.58^{ab}	55.80±0.57^{d}	30.64±0.58^{a}	11.84±0.58^{a}	1.72±0.55^{a}	608.77±1.78^{b}
	T4	31.66±0.57^{a}	60.29±0.58^{a}	26.93±0.58^{d}	11.43±0.57^{c}	1.35±0.56^{c}	597.36±1.27^{d}
	T5	27.45±0.58^{c}	58.73±0.58^{b}	28.27±0.58^{c}	11.23±0.57^{c}	1.77±0.56^{a}	602.99±1.18^{c}
Initial		30.37±0.57	56.37±0.55	19.97±0.57	14.74±0.55	8.92±0.56	540.74±1.56
Final Topara (*Liza ramada*)	T1	29.73±0.61^{b}	53.07±0.57^{d}	24.78±0.58^{a}	15.30±0.58^{c}	6.85±0.57^{b}	559.19±2.27^{a}
	T2	29.90±0.57^{b}	55.29±0.57^{c}	21.72±1.18^{b}	15.80±0.58^{b}	7.19±0.55^{a}	544.12±1.47^{c}
	T3	33.00±0.57^{a}	58.21±0.58^{a}	20.35±0.58^{c}	16.57±0.57^{a}	4.87±0.55^{d}	538.03±1.53^{d}
	T4	32.61±0.58^{a}	56.37±0.55^{b}	21.60±0.58^{b}	15.49±0.60^{c}	6.54±0.61^{c}	546.38±1.82^{b}
	T5	28.51±0.58^{c}	56.09±0.58^{b}	21.52±0.58^{b}	15.13±0.58^{d}	7.26±0.55^{a}	547.00±0.57^{b}

a,b,c,d,e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do.
*Nitrogen Free Extract calculated as: 100-% (Protein + Lipid + Ash)
**GE (gross energy) calculated using the values 4.1 , 5.6 and 9.44 Kcal GE/g DM of carbohydrate , protein and fat, respectively (NRC, 1983).

El-Kotamy (2008) reported also that NFE in Nile tilapia whole bodies ranged between 15.12 and 20.58 %, in Common carp between 16.87 and 19.69 %, in gray mullet between 11.15 and 14.73 % and in Tobara between 11.13 and 14.81 %, The same auther added that NFE contents in whole fish bodies were significantly (P<0.05) affected with feeding, manuring and chemical fertilization systems tested.

On the other hand, Ali (2003) reported that protein, fat contents of whole tilapia body was significantly higher in pond received mixed fertilizers compared to that from ponds received chicken manure and both treatments recieved pelleted feed than ash. Kang'ombe *et al. (*2006) statied that *Tilapia rendalli* cultured in chicken manure had significantly higher fat compared to cattle manure treatments.

Mohamed (2010) reported that ash contents in whole bodies of Nile tilapia and Silver carp were not significantly affected with compost + feeding, cow manure+ feeding, compost + chemical fertilizers + feeding or cow manure + chemical fertilizers + feeding treatments . The same author reported that ash contents in whole Nile tilapia bodies ranged between 4.62 and 5.21 % and in Silver carp between 5.5 and 5.67 %concerning results of GE. Also,Hassouna *et al.*, (1998) reported that energy contents (Kcal /gm.) in whole Nile tilapia bodies were 5.57; 5.60 and 5.56 (Kcal /gm) in fish reared in ponds fertilized only with chicken litter + U + SP; ponds received artificial feed only and ponds received fertilization + artificial feed respectively.

Effect of the experimental treatments on some water quality parameters:

Water qualities of the experimental ponds are presented in Table (8). The results show that temperature ranged between 27.22 to 27.28 °C, These results are in accordance with the findings of Boyd (1979, 1984), Abdel-Hamid (2000) and Abdel-

Hamid, *et al*, (2002) who reported that the optimal temperature for warm water fish species ranged between 22.72 to 30.63 ^{o}C. Dissolved oxygen (DO) readings during the experimental period ranged from 5.09 to 6.18 mg/l. Lagler (1959) reported that water containing 4 to 5 mg/l of oxygen was suitable for fish farming.

Average values of pH ranged from 7.82 to 8.75 in the different treatments. (Ellis, 1973) reported that water with pH values ranged from about 6.5 to 9 at dawn are most suitable for fish production. Concerning Nitrate (NO_3- N) and nitrite (NO_2-N) mg/l concentration in ponds water as affected with the applied treatments, results of table (8) reveal that the nitrate and nitrite concentrations throughout the experimental period ranged between 0.26 to 0.77 and 0.09 to 0.18mg/l respectively. Also NH_4 ranged between0.22 to 0.34 mg/l .In this respect, the European Inland Fisheries Advisory Commission (1993) reported that the toxic level of NH_4 to fish is 2 mg/L. while the values of nitrite range between 0.02 and 0.03 mg/L. Furthermore, Diana and Lin (1998) noticed that nitrite and nitrate concentrations range 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. Water salinity (g/l) ranged from 2.20 to 2.30g/L in the different treatments. Abdel-Fattah (2008) agree with the results of salinity presented in table (8). This author reported that water salinity ranged between 2.2 to 2.4 (g/l) in ponds fertilization (local compost + feed or commercial compost + feed or chicken litter + feed or local compost + feed + mineral fertilizers).

Table 8: Average physical-chemical characteristics of water ponds during five different treatments.

Parameters /Treatment	T1	T2	T3	T4	T5
Water temperature(^{o}C)	27.3	27.22	27.26	27.30	27.28
Dissolved oxygen (mg/L)	6.18	5.41	5.19	5.09	5.24
pH value degrees	8.20	8.60	8.75	8.04	7.82
Total ammonia(NH_4)mg/l	0.22	0.25	0.34	0.24	0.33
Nitrate (NO_3-N) mg/	0.26	0.49	0.77	0.35	0.35
Nitrite (NO_2-N) mg/l	0.09	0.18	0.21	0.11	0.14
Salinity (g/l)	2.20	2.30	2.30	2.30	2.20

Plankton abundance. Plankton population in the experimental ponds comprised of six groups consisting of 36 genera (16) (Table 9). The total planktonic organism mainly composed of 4 groups of phytoplankton and 2 groups of zooplankton. Some 26 genera of phytoplankton belonging to Chlorophyceae (10); Cyanobacteria (6); Bacillariophyceae (8); and Euglenophyceae (2) were identified. Ten genera of zooplankton were also identified belonging to Crustacea (4) and Rotifera (6) (Table 9).

Phytoplankton: The highest Chlorophyceae; Cyanobacteria; Bacillariophyceae; Euglenophyceae and Total phytoplankton counts (org / ml) were recorded by T3 followed in a decreasing order by T2, T4, T5 and T1 respectively (Table 10). Total counts of phytoplankton as percentage of the treatment with the highest total count (T3 100%) were found to be 26.29; 79.65; 100; 67.69 and 44.82 %for T1, T2, T3, T4 and T5, respectively.

Zooplankton: the highest Crustacea; Rotifers and Total zooplankton counts (org/ ml) were recorded by T3 compared to other treatments (Table 10). Averages of total Plankton (Phyto + Zoo) for T1, T2, T3, T4 and T5 were 93.0; 259.4; 329.4; 223.4 and 157.4 org / ml, respectively. These results are in partial agreement with the findings of Begum *et al.* (2007) who reported that manuring fish ponds with poultry manure **or** cow manure plus urea and Triple super phosphate had showed the highest abundance (x 10^4 cells / l) of Chlorophyceae, Cyanophyceae Bacillariophyceae; Euglenophyceae and total phytoplankton counts compared to ponds fertilization or feed only.

Table 9: Generic status of phytoplankton and Zooplankton available in pond waters during experimental period.

Phytoplankton		Zooplankton
Chlorophyceae	*Merismopedia*	**Rotifers**
Ankistrodesmus	*Oscillatoria*	*Asplanchna*
Chlorella	*Microcystis*	*Brachionus*
Coilastrum	**Bacillariophyceae**	*Keratella*
Crucigenia	*Cyclotella*	*Lecane*
Pandorina	*Cymbella*	*Nothoica*
Pediastrum	*Gyrosigma*	*Polyarthra*
Scenedesmus	*Melosira*	**Crustacea**
Tetraedron	*Navicula*	Cladocera
Actinastrum sp	*Nitzschia*	Copepods
Pleurotaenium sp	*Pinnularia*	Daphnia
Cyanobacteria	*Synedra*	Nauplius
Anabaen	**Euglenophyceae**	
Chroococcus	*Euglena*	
Gleocapsa	*Phacus*	

Table 10: Average abundance of plankton (org/ml) in ponds waters under five different treatments and stocked fish species reared in polyculture system.

Plankton groups	Treatment				
	T1	T2	T3	T4	T5
Phytoplankton					
Chlorophyceae	26.4	73.6	86.4	62.6	45.8
Cyanobacteria	18.8	47.2	60.8	38.2	27.0
Bacillariophyceae	22.4	83.0	108.2	72.4	40.8
Euglenophyceae	7.42	24.0	30.6	20.4	14.6
Total Phytoplankton	75.2	227.8	286.0	193.6	128.2
% of the highest total	26.29	79.65	100	67.69	44.82
Zooplankton					
Crustacea	12	21.2	26.7	16.9	16.2
Rotifers	5.8	10.4	16.7	12.9	13.1
Total Zooplankton	17.8	31.6	43.4	29.8	29.23
% of the highest total	41.01	72.81	100	68.66	67.35
Total Plankton	93.0	259.4	329.4	223.4	157.4

Also, Yeamin Hossain *et al*. (2006) reported that ponds fertilized with poultry manure show higher Crustacea ,Rotifers and Total Zooplankton counts compared to ponds received cow manure or those received urea + triple super phosphate.Yeamin Hossain *et al*., (2006) who reported that the highest total Plankton abundance was recorded in ponds receiving PM(105.57 x 10^4 cells / l) followed in a significant decreasing order by U +TSP fertilized ponds (82.21 x 10^4 cells / l) and those received CM(45.76 x 10^4 cells / l), respectively .

Effect of the applied treatments on costs and returns.

In this study, results in table (11) indicate that the highest value of net return, total costs and total income was in (T3) and the lowest in (T5) (table11). These results are in agreement with those obtained by results of Mohamed (2010). In this experiment the highest benefit cost ratio (25.4) was obtained with tilapia ponds receiving chicken litter + artificial feed followed by ponds receiving no litter or feed (17.4), ponds receiving feed only (14.1) and ponds receiving compost + artificial feed. The same author reported that fertilization of Nile tilapia ponds with organic and inorganic fertilizers plus artificial feeding resulted in highest net returns compared with organic fertilization alone plus artificial feeding which agree with the results of the present study.

Results in table (11) show that differences in total Tilapia, Common carp, Bouri and Tobara where T3 had significantly ($P<0.05$) the highest yield followed in a significant decreasing ($P<0.05$) order by the other treatments (table 11). Results of the present study are in agreement with the findings of Mohamed (2010), who reported that ponds cultured with Nile tilapia and Silver carp and received artificial feed plus compost and chemical fertilizers (urea +TSP) or artificial feed plus cow manure and urea +TSP improved total fish production significantly(1559.3 and 1539.3 kg /fed) compared to applying organic fertilizers only (compost + artificial feeding or cow manure plus artificial feeding) which showed total production of 1396 and 1402.7 kg /fed, respectively .Fish yield was higher in mixed fertilizers 980 kg compared to manure treatment 760 kg /fed (Ali, 2003).

Blood analysis:

Results of Hematological parameters(Hemoglobin Hb g/d ; RBC's $x10^6$/ml ; WBC's $x10^3$/ml; Hematocrit Ht %) and Serum components (Total protein g/dl; Albumin g/dl;Globulin g/l; Glucose mg/l ;Cholesterol mg % ;Triglycerides mg/l; ALT u/ml and AST u/ml).

For tilapia fish, (table12) T4 recorded the highest ($P<0.05$) Hemoglobin value followed in a significant ($P<0.05$) decreasing order by T2 then both T3 and T5 and T1, respectively. while WBC's counts; Ht%; Albumin T1 recorded the highest value ($P<0.05$) and differences between this group and the other treatment groups were significant. On the other hand, T3 recorded the highest ($P<0.05$) RBC's counts; Total protein; Glucose; Cholesterol and Triglycerides in serum compared to the other treatment groups. Furthermore, T2 recorded the highest Globulin and liver enzymes (ALT and AST) ($P<0.05$) compared to the other treatment groups.

Concerning Common carp, table (13) revealed that T3 recorded the highest ($P<0.05$) hemoglobin; hematocrit value; RBC's values; total serum protein; albumin; glucose; cholesterol; triglycerides; ALT and AST compared to the other treatment groups, while both T1and T2 recorded the highest WBC's counts followed in a significant ($P<0.05$) decreasing order ($P<0.05$) by T2; T4 and T5, respectively, and T1 recorded the highest ($P<0.05$) globulin value compared to the other groups. Concerning Tobara, results in table(14) revealed that T3 recorded significantly ($P<0.05$) higher hemoglobin; RBC's; hematocrit values; total protein; albumin; glucose; cholesterol; triglycerides; ALT and AST compared to the other treatment groups, Furthermore, T1 recorded the highest ($P<0.05$) WBC's value compared to the other treatment groups, while both T3 and T4 recorded significantly ($P<0.05$) the highest globulin averages compared to the other groups. Concerning Bouri results in table (15) the T3 group recorded the highest hemoglobin; RBC's and hematocrit value averages ($P<0.05$) as compared to the other treatment groups, while groups T1and T2 recorded the highest ($P<0.05$) WBC's counts followed by the other treatment groups.

Table 11: Costs and returns of the applied treatments.

Item	Unit	Price (LE/ unit)	T1		T2		T3		T4		T5	
			Qua. (kg)	Value (L.E)	Qua. (kg)	Value (L.E)	Qua. (kg)	Value (L.E)	Qua. (kg)	Value (L.E)	Qua. (kg)	Value (L.E)
fingerlings: Tilapia	1000	25	4000	100	4000	100	4000	100	4000	100	4000	100
Common carp	1000	250	500	125	500	125	500	125	500	125	500	125
Porry	1000	880	750	660	750	660	750	660	750	660	750	660
Tobara	1000	280	750	210	750	210	750	210	750	210	750	210
Total fingerlings costs	------	----	----	1095	----	1095	----	1095	----	1095	----	1095
Feeds: amount	KG	2.65		8592.86		9725.60		11781.76		8319.33		---
Fertilizers:												
1-Organic amount	KG	0.58	----	----	650	377	650	377	----	---	650	377
2-Inorganic												
- Urea	KG	1.50	----	----	----	----	20	30	20	30	20	30
-Triple Super phosphate	KG	1.10	----	----	----	----	80	88	80	88	80	88
Total fertilizer costs				----		377		495		118		495
Total costs LE				9687.86		11197.60		13371.76		9532.33		1590
Tilapia Supper grade	KG	9.5	350	3325	570	5415	950	9025	475.5	4517.25	---	---
*1st grade	KG	8	220	1760	230	1840	150	1200	145	1160	50	375
* 2nd grade	KG	6.5	260	1690	130	845	100	650	100	650	200	1000
*3nd grade	KG	5	88	440	60	300	44	220	90	450	358	1611
Total Returns tilapia			918	7215	990	8400	1244	11095	810.5	6777..25	608	2986
*Common carp	KG	6.5	150.5	978.25	177.5	1153.75	239.5	1556.75	199.62	1297.53	110.5	663
**Bouri *(Mugil cephalus)*	KG	**	260	4940	269.86	5127.34	348.5	7308	300	5400	150.5	2107
****Tobara *(Liza ramada)*	KG	13	183	2379	218.58	2950.83	232	3596	224.5	2918.5	143	1573
Total production value, LE				15512.25		17631.92		23555.75		16393.28		7329
Net returns				5824.39		6434.32		10183.99		6860.95		5739

*Market prices (LE/kg)in fish T5 1st grade, 2nd grade, 3nd grade, Common carp (7.5, 5 ,4.5, 6 LE/kg), respectively.

** Market prices (LE/kg) in fish; Bouri (19, 19 , 21 , 18 , 14 LE/kg) for T1,T2,T3,T4,T5, respectively.

***Market prices (LE/kg) in fish Tobara in T2, T5 (13.5, 11 LE/kg), respectively.

Furthermore, T1 recorded significantly ($P<0.05$) the highest serum total protein; glucose; cholesterol; triglycerides; ALT and AST averages compared to T2;T3;T4 and T5 groups, while both T3 and T2 recorded the highest ($P<0.05$) albumin values compared to the other treatment groups. On the other hand, group T5 recorded the highest globulin value compared to the other groups. In this connection, Chen *et al*., (2005) reported that in tilapia the averages of Hematocrit Ht %; Total protein g/dl; Albumin g/dl; Globulin g/l; Glucose mg/l; ALT u/ml; AST u/ml and Cholesterol mg % ranged between 33.3 to 84.5 ; 3.3 to 5.0; 1.1 to 1.7; 2.2 to 3.5 ;52 to 156; 21 to 595; 40 to 874 and 162 to 440, respectively.

Table 12: Effect of fertilization sources or artificial feeding on blood components (hematological parameters, serum constituents) of Nile tilapia (*O.niloticus)* reared in polyculture system (Mean±SE).

Blood components	Treatments				
	T1	T2	T3	T4	T5
a- Hematology					
1- Hemoglobin Hb(g/d)	$4.19±0.14^d$	$5.50±0.05^b$	$5.12±0.0^c$	$5.87±0.02^a$	$5.14±0.02^c$
2-RBC (x10^6/ml)	$1.92± 0.17^a$	$1.80±0.07^b$	$1.97±0.0^a$	$1.73±0.03^{bc}$	$1.76±0.08^c$
3-WBC (x10^3/ml)	$42.14± 0.12^a$	$41.54±0.83^b$	$39.57±0.11^d$	$40.40±0.10^c$	$38.99±0.29^e$
4-Hematocrit (Ht %)	$50.29±0.17^a$	$40.25±0.34^d$	$48.11±0.08^b$	$42.23±0.06^c$	$42.23±0.02^c$
b-Serum Constituents					
1-Total protein (g/dl)	$4.85±0.03^c$	$5.15±0.03^b$	$5.25±0.01^a$	$4.75±0.14^d$	$4.59±0.02^e$
2-Albumin (g/dl)	$2.15±0.01^a$	$2.25±0.01^d$	$2.45±0.03^b$	$2.50±0.03^c$	$1.85±0.03^e$
3-Globulin (g/l)	$2.70±0.03^c$	$2.90±0.07^a$	$2.80±0.05^b$	$2.25±0.01^d$	$2.74±0.06^c$
4-Glucose (mg/l)	$61.38±0.10^c$	$62.29±0.06^b$	$63.14±0.06^a$	$62.28±0.01^b$	$59.28±0.02^d$
5-Cholesterol (mg %)	$105.13±0.01^b$	$102.93±0.28^c$	$106.07±0.03^a$	$102.12±0.04^d$	$99.45±0.14^e$
6-Triglycerides(mg/l)	$65.34±0.11^{ab}$	$63.22±0.02^c$	$65.91±0.03^a$	$64.73±0.68^b$	$60.74±0.00^d$
7-ALT (u/ml)	$36.70±0.03^c$	$39.60±0.20^a$	$38.75±0.14^b$	$39.60±0.34^a$	$33.47±.1617^d$
8-AST (u/ml)	$133.70±0.95^{bc}$	$139.92±0.12^a$	$135.69±0.08^{ab}$	$131.13±2.71^{cd}$	$127.18±0.97^d$

a, b,c,d,e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do.

Furthermore, Satheeshkumar *et al.* (2011) reported that averages of RBC $x10^6$/ml; WBC $x10^3$/ml; Hemoglobin (%) and Hematocrit (%) 2.52; 28.6; 37.6 and 28.66 in *Mugil cephalus*, respectively. The same anthers reported that averages of the same parameters in *L. calcarifer* fish were RBC$x10^6$/ml; WBC $x10^3$/ml; Hemoglobin (%) and Hematocrit (%) were 2.96; 21.6; 53.23 and 44.33, respectively.

Table 13: Effect of fertilization sources or artificial feeding on blood components (hematological parameters, serum constituents) of Common carp *(C. carpio)* reared in polyculture system (Mean±SE)

Blood components	Treatments				
	T1	T2	T3	T4	T5
a- Hematology 1-Hemoglobin Hb (g/d)	4.37 ± 0.05^{b}	4.38 ± 0.07^{b}	4.91 ± 0.03^{a}	4.22 ± 0.01^{c}	4.13 ± 0.02^{c}
2-RBC ($x10^6$/ml)	0.5660 ± 0.01^{c}	0.5724 ± 0.01^{b}	0.5731 ± 0.03^{a}	0.5564 ± 0.03^{d}	0.5551 ± 0.03^{e}
3-WBC ($x10^3$/ml)	13.91 ± 0.05^{a}	13.96 ± 0.08^{a}	13.03 ± 0.01^{b}	12.93 ± 0.16^{c}	12.16 ± 0.06^{d}
4-Hematocrit (Ht %)	13.10 ± 0.00^{c}	13.29 ± 0.08^{b}	13.74 ± 0.08^{a}	12.92 ± 0.02^{d}	12.80 ± 0.03^{e}
b-Serum Constituents 1-Total protein(g/dl)	3.14 ± 0.00^{c}	3.70 ± 0.12^{b}	4.39 ± 0.02^{a}	3.87 ± 0.08^{b}	3.19 ± 0.03^{c}
2-Albumin (g/dl)	6.31 ± 0.00^{c}	6.7 ± 0.03^{b}	6.91 ± 0.00^{a}	6.21 ± 0.00^{d}	6.16 ± 0.00^{e}
3-Globulin (g/l)	3.17 ± 0.12^{a}	3.00 ± 0.12^{b}	2.52 ± 0.12^{c}	2.34 ± 0.12^{d}	2.97 ± 0.12^{b}
4-Glucose (mg/l)	86.86 ± 1.04^{c}	$91.48\pm0.12^{a\,b}$	92.54 ± 0.12^{a}	90.72 ± 0.02^{b}	87.84 ± 0.07^{c}
5-Cholesterol (mg %)	110.21 ± 0.37^{c}	115.88 ± 1.39^{b}	120.81 ± 0.19^{a}	101.24 ± 0.29^{d}	96.77 ± 0.13^{e}
6-Triglycerides(mg/l)	68.35 ± 0.08^{c}	68.91 ± 0.00^{b}	69.16 ± 0.03^{a}	67.25 ± 0.04^{d}	66.78 ± 0.08^{e}
7-ALT (u/ml)	51.79 ± 0.01^{c}	52.25 ± 0.03^{b}	53.09 ± 0.02^{a}	50.14 ± 0.01^{e}	50.91 ± 0.03^{d}
8-AST (u/ml)	$56.03\pm0.14^{b\,c}$	57.09 ± 0.20^{ab}	58.10 ± 0.23^{a}	53.86 ± 0.92^{d}	55.41 ± 0.17^{c}

a, b,c,d,e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do.

Table 14: Effect of fertilization sources or artificial feeding on blood components (hematological parameters, serum constituents) of Tobara (*L.ramada)* reared in polyculture system (Mean±SE).

Blood components	Treatments				
	T1	T2	T3	T4	T5
a- Hematology 1- Hemoglobin Hb(g/d)	53.17 ± 0.02^{c}	54.12 ± 0.00^{b}	55.06 ± 0.02^{a}	52.52 ± 0.03^{e}	52.94 ± 0.01^{d}
2-RBC ($x10^6$/ml)	2.95 ± 0.03^{c}	2.98 ± 0.05^{b}	3.11 ± 0.00^{a}	2.87 ± 0.00^{d}	2.63 ± 0.01^{e}
3-WBC ($x10^3$/ml)	22.62 ± 0.05^{a}	21.80 ± 0.02^{b}	21.06 ± 0.05^{c}	21.10 ± 0.04^{d}	20.98 ± 0.00^{d}
4-Hematocrit (Ht %)	44.50 ± 0.03^{c}	44.72 ± 0.05^{b}	45.14 ± 0.04^{a}	44.06 ± 0.03^{d}	43.86 ± 0.03^{e}
b-Serum Constituents 1-Total protein(g/dl)	6.50 ± 0.00^{d}	6.54 ± 0.00^{c}	6.81 ± 0.05^{a}	6.70 ± 0.03^{b}	6.12 ± 0.00^{e}
2-Albumin (g/dl)	5.31 ± 0.08^{d}	5.40 ± 0.03^{b}	5.50 ± 0.03^{a}	5.35 ± 0.03^{c}	5.21 ± 0.05^{e}
3-Globulin (g/l)	1.19 ± 0.08^{b}	1.14 ± 0.08^{b}	1.31 ± 0.08^{a}	1.35 ± 0.08^{a}	1.09 ± 0.08^{c}
4-Glucose (mg/l)	57.25 ± 0.03^{c}	57.51 ± 0.05^{b}	58.06 ± 0.03^{a}	57.50 ± 0.00^{b}	56.00 ± 0.00^{d}
5-Cholesterol (mg %)	84.16 ± 0.02^{e}	85.21 ± 0.05^{b}	85.47 ± 0.01^{a}	84.51 ± 0.08^{c}	84.30 ± 0.00^{d}
6-Triglycerides(mg/l)	51.25 ± 0.03^{e}	52.00 ± 0.00^{b}	52.52 ± 0.01^{a}	51.66 ± 0.03^{d}	51.80 ± 0.00^{c}
7-ALT (u/ml)	25.13 ± 0.08^{e}	26.11 ± 0.05^{b}	26.50 ± 0.00^{a}	25.80 ± 0.00^{d}	25.50 ± 0.00^{c}
8-AST (u/ml)	80.11 ± 0.05^{e}	83.12 ± 0.03^{b}	83.50 ± 0.00^{a}	82.50 ± 0.00^{c}	81.36 ± 0.02^{d}

a, b, c, d, e… within each raw bearing the same letters do not differ significantly P<0.05 other wise the do

In this respect, Kopp *et al.* (2009) studied the biochemical parameters of blood plasma of common carp from a hypertrophy pond with cyan bacterial water bloom .They reported that ALT ranged between 0.36 to 2.18; AST from 1.87 to 5.12; Total protein form g/l^{-1} 28.54 to 37.86; Albumin from g/l^{-1} 7.60 to 9.50; Glucose mmol/ l^{-1} 1.32 to 5.60; Triglycerides mmol/ l^{-1} 2.08 to 7.23 and Cholesterol mmol/ l^{-1} 3.59 to 6.29, respectively.

Table 15: Effect of fertilization sources or artificial feeding on blood components (hematological parameters, serum constituents) of Bouri (*M .cephalus)* reared in polyculture system (Mean±SE).

Blood components	Treatments				
	T1	T2	T3	T4	T5
<u>a- Hematology</u> 1- Hemoglobin Hb(g/d)	$8.43±0.17^{b}$	$8.34±0.09^{bc}$	$8.74±0.01^{a}$	$8.14±0.00^{c}$	$8.06±0.03^{c}$
2-RBC ($x10^{6}$/ml)	$2.52±0.03^{c}$	$2.62±0.08^{b}$	$2.82±0.03^{a}$	$2.40±0.03^{d}$	$2.31±0.00^{e}$
3-WBC ($x10^{3}$/ml)	$28.53±0.01^{ab}$	$28.81±0.03^{a}$	$28.37±0.26^{b}$	$28.37±0.01^{b}$	$28.37±0.01^{b}$
4-Hematocrit (Ht %)	$28.63±0.08^{b}$	$28.77±0.08^{ab}$	$28.89±0.03^{a}$	$27.43±0.04^{d}$	$27.97±0.09^{c}$
<u>b-Serum Constituents</u> 1-Total protein(g/dl)	$8.82±0.58^{c}$	$8.91±0. 58^{b}$	$9.04±0. 43^{a}$	$8.84±0. 17^{c}$	$8.82±0.58^{c}$
2-Albumin (g/dl)	$6.73±0.08^{b}$	$7.07±0.02^{a}$	$7.13±0.15^{a}$	$6.29±0.08^{c}$	$5.88±0. 69^{d}$
3-Globulin (g/l)	$2.09±0.08^{c}$	$1.84±0.08^{d}$	$1.87±0.08^{d}$	$2.55±0.08^{b}$	$2.94±0.08^{a}$
4-Glucose (mg/l)	$65.15±0.06^{c}$	$66.01±0.03^{b}$	$67.10±0.01^{a}$	$64.52±0.01^{d}$	$64.64±0.09^{d}$
5-Cholesterol (mg %)	$94.66±0.02^{b}$	$94.76±0.06^{b}$	$95.73±0.02^{a}$	$94.72±0.05^{b}$	$94.26±0.04^{c}$
6-Triglycerides(mg/l)	$62.69±0.08^{b}$	$62.67±0.03^{b}$	$63.74±0.05^{a}$	$62.60±0.03^{bc}$	$62.54±0.01^{c}$
7-ALT (u/ml)	$27.98±0.43^{c}$	$28.12±0.49^{b}$	$28.57±0.23^{a}$	$27.68±0.23^{e}$	$27.83±0.58^{d}$
8-AST (u/ml)	$89.86±0.08^{c}$	$90.52±0.05^{b}$	$90.64±0.03^{a}$	$88.55±0.02^{e}$	$89.31±0.03^{d}$

a, b,c,d,e… within each raw bearing the same letters do not differ significantly $P<0.05$ other wise the do.

CONCLUSION

Based on the present results it could be concluded that applying the earthen ponds polyculture system (Nile tilapia, Common carp and Mullet species) using artificial feeding and manuring with poultry manure plus urea and triple super phosphate gave the highest net returns under Egyptian conditions.

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ARABIC SUMMARY

أثر مصادرالتسميد مع التغذية الصناعية على إنتاجية الأحواض الترابية المزودة بأنواع مختلفة من الأسماك

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١- قسم الإنتاج الحيواني - كلية الزراعة - جامعة الأزهر- القاهرة- مصر
٢- المعمل المركزي لبحوث الثروة السمكية- مركز البحوث الزراعيــة- العباسـة- الشرقيـة- مصـر

تم تنفيذ هذة الدراسة فى مزرعة أسماك خاصـة بطلمبـات ٧- محافظـة كفر الشيخ - مصر.أجريت الدراسـة لمدة ١٤٠ يوم فى المدة من ٥ يوليوالى ٢٧ نوفمبر ٢٠١٠حيث هدفت الى دراسـة تـأثير التسـميد المختلف وأنظمـة التغذيـة على اداء النمو، الأستفادة من النتروجين والغذاء المضـاف الـى الأحـواض ،التركيب الكيمـاوى للجسم، جودة الميـاة، كثافة البلانكتون، بعض قياسات الدم، التقييم الاقتصادى فى الأحواض الترابية المستزرعة بأنواع مختلفة من الاسماك فى نظام الأستزراع المتعدد. تمت الدراسة فى اطار خمس معاملات على النحو التالى: المعاملة الأولى: تغذية صناعية فقـط (غـذاء تجـارى للأسـماك ٢٥% بـروتين).الثانيـة: تغذيـة بـنفس الغـذاء بالإضـافة الـى التسـميد العضـوى (زرق دواجن٣٢,٥كجم /حوض اسبوعيا). الثالثة: تغذية بنفس الغذاء بالإضـافة الـى التسميد العضـوى (زرق دواجن نفس الكمية) بالإضافة الى التسميد الكيماوى (١كجم يوريا، ٤كجم تربل سوبر فوسفات/ حوض اسبوعيا). الرابعـة: تغذيـة بنفس الغذاء بالإضافة الى التسميد الكيماوى السابق بنفس الكميات) .الخامسة:تسميد عضوى (زرق دواجن) بالإضـافة الى التسميد الكيماوى (يوريا،تربل سوبر فوسفات) بنفس الكميـات السـابقة فقط بـدون اضـافة غـذاء. الغـذاء الصـناعى المستخدم للتغذية يحتوى ٢٥% بروتين خـام ،٣٥٤٧ ك كـالورى / كجم غذاء بمعدل ٣% من الـوزن الحـى للأسـماك لمدة ٦ أيام فى الإسبوع يضاف على مرتين فى اليوم الأولى فى ٩ صباحا والثانيـة ٣ بعد الظهر. تم تخـزين الأسـماك فى الاحواض بكثافات تصل الى ٤٠٠٠ اصبعية من أسماك البلطى النيلى متوسط الوزن الابتدائى ١٧,١٨ جم ، ٥٠٠ اصبعية من أسماك المبروك العادى بمتوسط وزن ابتدائى ١٦,٥ جم ، ٧٥٠ اصبعية من أسماك البورى بمتوسط وزن ابتـدائى ٢١,٤٣ جـم ، ٧٥٠ اصـبعية مـن أسـماك الطوبـارة بمتوسـط وزن ابتـدائى ١٥,٩ جـم وذلـك ليصـل معـدل المعاملـة/حـوض ٦٠٠٠ اصبعية وللفدان ١٢٠٠٠ اصبعية. مستوى المـاء فـى الأحـواض حفظ عند ١,٢٥ م طـوال التجربة ،كل المعاملات أجريت فى مكررات (عدد الأحـواض الكلـى ١٠ أحـواض) بمسـاحة ٢١× ١٠٠ متـر بإجمـالى ٢١٠٠ متر(مسـاحة ٢/١فدان). كانـت اهم النتـائج : سـجلت المعاملـة الثالثـة ارتفـاع الـوزن والطـول النهـائى، الزيـادة اليومية فى الوزن، والوزن والطول المكتسب، ومعدل النمو النوعى والنسبى، المحصول الكلى فى كل أنـواع الأسـماك المختبرة مقارنة بباقى المعاملات الأخرى بينما المعاملة الخامسة ارتفعت فى معامل الحالة فى أسماك البلطـى النيلـى، أسماك المبروك العادى، أسماك الطوبارة بينما فى أسماك البورى كانت المعاملة الثانية هى أعلى المعـاملات. المعاملـة الرابعة كانت الافضل فى معامل التحويل الغذائى تلاها المعاملات الثالثة، الأولى، الثانيـة علـى الترتيـب بينمـا المعاملـة الخامسة لم تسجل نتائج فى معدل التحويل الغذائى لأنها لم تعطى غذاء صناعى. الأستفادة من النتروجين (N الداخل / N الخـارج) المتوسـطات كانـت كـالأتى (١١٦,٤٠،٣٥,٩٠،٣٣,٨١،٣٢,١٨،٣٥,٥٦) للمعـاملات الأولـى والثانيـة والثالثة والرابعة والخامسة على الترتيب. المعاملات شهدت تغيرات فى محتويات التركيب الكيماوى (البروتين الخام، الدهن الخام، الاملاح الخام، النتروجين الحر، محتوى الطاقة الكلية) فى الجسم لكل أنواع الأسماك المختبرة. المعاملـة الثالثة كانت اعلى فى عدد الفيتوبلانكتون والزوبلانكتون والعدد الكلـى للبلانكتـون تبعهـا الانخفـاض ترتيبـا المعـاملات الثانية، الرابعة، الخامسة، الأولى على الترتيب. ارتفاع المحصول الكلى / حوض فى المعاملة الثالثة تلاها المعاملات الثانية، الرابعة، الأولى، الخامسة على الترتيب. وكذلك متوسطات النسبة المئوية للمحصـول الكلـى / حـوض المعاملـة الثالثة (ارتفع المحصـول ٢٠٤٦,٠ كجم) حيث ٧٣,٢٣ ، ٨١,٥٣، ٧٥,٨٠، ٤٩,٠٣ % للمعملات الأولـى، الثانيـة، الثالثة، الرابعة، الخامسة على الترتيب. المعاملات شهدت تأثيرات ملحوظة فى تركيب الدم فى كل الأنواع المختبرة.