EFFECT OF SOME FEEDING REGIMES ON WATER QUALITY, GROWTH AND PRODUCTIVITY OF NILE TILAPIA, *OREOCHROMIS NILOTICUS* REARED IN EARTHEN PONDS

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Abstract

The present experiment aimed to investigate the effect of organic fertilization and artificial feed, beside the addition of some untraditional feedstuffs as well as Biogen to artificial feed on reducing feeding costs in tilapia culture. Twelve earthen ponds with the same area were stocked with Nile tilapia and represented 6 treatments (2 replicates for each). In the first treatment (T1), ponds were fertilized by 25 kg/day poultry litter throughout the experimental period (6 months) while the same organic fertilization was used in the second treatment (T2) for 3 months followed by artificial feed (25% crude protein) during the following period (3 months). For the third treatment (T3), organic fertilization was applied during the whole experimental period and the artificial feed (2% of fish biomass) was applied during the last three months only. In the other three treatments (T4, T5 and T6) organic fertilization was applied for 3 months followed by feeding on artificial feed (25%CP) beside blue green algae, Azolla or Biogen at a rat of 10, 10 and 2 kg/ton, respectively. Results of the experiment could be summarized as follows:

- Water temperature ranged from 26.55 to 27.81°C, Dissolved oxygen (DO) from 3.40 to 5.58 mg/liter, values of pH ranged between 8.19 - 8.64 with insignificant differences among the different treatments in water temperature and pH values. T1 had the greatest drop in the overall mean of phytoplankton and zooplankton number (organism/l) compared to the other experimental treatments.
- T1 had the lowest body weight (BW), body length (BL), weight gain (WG) and specific growth rate (SGR) while T6 gained the highest BW, BL, WG and SGR, the differences among treatments for these parameters were significant.
- The final total fish yield was the lowest for fish fed the natural food only (T1). The other feeding regimes T2, T3, T4, T5 and T6 increased the total fish yield by 54.2, 57.4, 59.9, 67.8 and 87.0%, respectively compared to T1.
- The averages dressing percentage found to be 57.72, 57.75, 58.34, 60.40, 61.36 and 61.50%, fish protein content were 67.93, 67.77, 68.19, 70.66, 71.84 and 72.74 for T1, T2, T3, T4, T5 and T6, respectively and the differences among these percentages were significant and these results relatively parallel to those of ether extract, while the opposite trend was observed for ash content of whole fish body.
- The highest net returns/feddan (4215.96 LE) were recorded for T6 followed in a descending order by T5 (3648.99 LE), T4 (2139.82 LE), T2 (1822.20 LE), T3 (1821.74 LE) and T1 (930 LE).

INTRODUCTION

Feed often represents 60% or more of the total fish production costs. A biologically feasible production system can be uneconomical because production costs associated with feed are expensive (Green, 1992). The utilization of organic manure as the principal nutrient for earthen ponds is a traditional management practice in Asian aquaculture (Pekar, 1994). The readily decomposable organic matter of the manure provides dissolved and particulate substances for bacteria, and the bacterial particles supply food to the filter-feeding and detritus-consuming animals, while the mineralized fraction of the manure stimulates phytoplankton productivity similar to the action of inorganic fertilizers (Hepher and Pruginin 1981).

Blue green algae is considered as protein rich feed ingredients for tilapia because it contains 39.62% crude protein in its dry matter (Abdel-Hakim *et al.* 2004 a). In another study, Abdel-Hakim *et al.* (2004 b) reported that, combination of 10% blue green algae and 90% of tilapia feed mixture improved total fish yield.

Recently, the use of Azolla meal which is a genous of small aquatic plants, are wide spreader and can be incorporated in fish diets. Abdel-Fattah and Abdel-Aziz (1990) used Azolla pinnata in feeding of Nile tilapia fingerlings as a sole dietary source or replaces 25, 50, 75 and 100% of fishmeal in 30% crude protein and 3500-4000 kcal GE/kg diet. The authors found that, control diet (without Azolla) was not significantly differed from those fed on diets with 25% Azolla. It is noticed that, with increasing Azolla level in the experimental diets, fish performance was significantly reduced and the worst performance was associated with the highest level of Azolla in the diet (100%) as a sole dietary source. In the same manner, El-Sayed (1992) reported that less than 25% of Azolla pinnata substitution was possible for fishmeal in Nile tilapia (*O. niloticus*) feeds. Tharwat (1999) stated that growth and feed utilization of *O. niloticus* were not significantly reduced when Azolla meal was incorporated into the control diet up to 50% while fish fed on fresh Azolla alone exhibited extremely poor growth performance.

Recently, higher interest was directed to the use of feed additives to increase feed efficiency and fish growth rate, as they could be used as immune stimulants for fish. Biogen is a potent compound that contains, garlic extract, high unit hydrolytic enzymes, proteolytic, lipolytic, amylolytic and cell separating enzyme as well Bacillus subtilis and gienseng extract. It showed bactericidal and fungicidal activities for bacteria and fungi isolated from freshwater fish (Diab, 2002) and from man and animals (Hanafy and Hatem, 1991).

The present study aimed to study the effect of organic fertilization on reducing feed costs in tilapia culture. Also, the effect of using Azolla, blue green algae as an untraditional feedstuffs as well as Biogen in tilapia diets was studied.

MATERIALS AND METHODS

This work was conducted in the region of Edku, El-Behera, Egypt during the period between 1 May and 1 November 2004 (6 months) to investigate the effect of organic fertilization (poultry litter) and artificial feed beside blue green algae, Azolla or Biogen in six different feeding regimes on growth performance of Nile tilapia under the Egyptian conditions. Twelve rectangular earthen ponds (200×42×1.3 m) with a total area of 8400 m^2 were used and represented 6 treatments (2 replicates for each). Experimental ponds are supplied with fresh water from Edku drainage and stocked by 16,000/pond of Nile tilapia *Oreochromis niloticus* fingerlings (19.86 - 20.46 g) and the experimental treatments were designed as follows:

T1 (Organic fertilization only) poultry litter was added at a rate of 25 kg/pond/day during the whole experimental period (6 months).

T2 (3 months organic fertilization + 3 months artificial feed) poultry litter was applied at a rate of 25 kg/pond/day for the first three months followed by artificial feed (25% CP) at a rate of 2% of total biomass (three months).

T3 (6 months organic fertilization+3 months artificial feed) poultry litter was applied at a rate of 25 kg/pond/day throughout the experimental period (6 months) and the artificial feed (25% CP) at a rate of 2% of total biomass was applied during the last three months.

T4 (3 months organic fertilization+3 months artificial feed enriched by 10 kg/ton blue green algae) poultry litter (25 kg/pond/day) was applied during the first three months followed by artificial feed (25% CP) enriched by 10 kg blue green algae/ton at a rate of 2% of total biomass (3 months).

T5 (3 months organic fertilization + 3 months artificial feed enriched by 10 kg/ton Azolla) poultry litter (25 kg/pond/day) was applied during the first three months followed by artificial feed (25% CP) enriched by 10 kg Azolla/ton at a rate of 2% of total biomass (3 months).

T6 (3 months organic fertilization+3 months artificial feed enriched by 2 kg/ton Biogen) poultry litter (25 kg/pond/day) was applied during the first three months followed by artificial feed (25% CP) enriched by 2 kg Biogen/ton at a rate of 2% of total biomass (3 months).

Chemical analysis of artificial feed, poultry litter, blue green algae and Azolla are presented in table (1).

Before the experiment start, all ponds were drained and left to complete dryness, and the low spots were treated with potassium permanganate to kill any wild fish and larvae as well as their eggs. After 10 days, ponds were filled with water to 100 cm and let filled for a period of 15 days before stocking the fish.

Poultry litter was distributed over the pond surface. Feed was offered five days/week (twice/day at 9.00 am and 3.00 pm) at a rate of 2% of the total fish biomass. Feed amount was monthly adjusted for each pond separately according to the biomass available which determined using a fish sample (100 fish for each pond).

Fish samples and measurements:

Fish samples (100 fish/pond) were monthly taken early morning and kept in fiberglass containers filled with fresh water from the same pond to avoid fish stress during recording the body measurements. Fish samples were returned to their ponds after recording the measures of individual body weight and length. The following fish parameters were estimated:

Condition factor (K) was calculated according to Lagler (1959):

$K = [\text{weight (g)} / \text{length}^3 \text{(cm)}] \times 100$

Specific growth rate (SGR) was calculated according to Jauncey and Rose (1982):

$$SGR = [LnW2 - LnW1]/t \times 100$$

Where: W_1 = fish initial weight (g), W_2= fish final weight (g) and t = period in days.

Weight gain (WG) was estimated according to the following equation:

$$WG = W_2 - W_1$$

Where: W_1 = fish initial weight (g), W_2 fish final weight (g)

At harvesting ten fish were randomly taken from each treatment for carcass analysis. Another ten fish were taken and kept frozen at -20°C for the whole body chemical analysis. Carcass analysis was determined according to Lovell (1981). Fish proximate analysis (moisture, protein, fat and ash) were determined according to AOAC (1990). Economic analysis was done according to Green (1992).

Water quality analysis:

Water quality was carried out weekly to determine temperature (°C), dissolved oxygen (DO), Secchi disk visibility (SD), hydrogen ions (pH) and Phyto and zooplankton (organism/l) according to the standard methods of APHA (1985) and Boyd (1992).

Statistical analysis:

Statistical analysis of the obtained data was analyzed according to SAS (1996). Differences between means were tested for significance according to Duncan's multiple rang test as described by Duncan (1955). The following model was used to analyze the obtained data:

$Y_{ij} = \mu + \alpha i + E_{ij}$

Where: Y_{ij} = the observation on the ij^{th} fish eaten the i^{th} diet, μ = overall mean, α_i = the effect of i^{th} diet and E_{ij} = random error.

RESULTS AND DISCUSSION

1. Water quality and primary productivity:

As described in table (2), water temperature ranged from 26.55 to 27.81°C for the different treatments during the entire experimental period of the study with no significant differences. Generally tilapia show the best growth when temperature is between 25 and 30°C (Balarin, 1988).

The average values of dissolved oxygen (DO) were 3.40, 4.48, 4.91, 4.91, 4.89 and 5.58 mg/l for T1, T2, T3, T4, T5 and T6, respectively. Boyd (1992) reported that the level of DO should be above 4 mg/liter which is considered limiting level. Results of the present experiment indicated that, T2 was the greatest treatment that caused immense decrease in density of aquatic organisms (refer to the following results), and consequently decrease the DO released by the aquatic organisms during photosynthesis process.

Secchi disk visibility ranged between 11.56 and 14.33 cm for all experimental ponds and these values are within the acceptable limits described by Boyd (1992). pH values ranged between 8.19 - 8.64 with insignificant differences for the different treatments. The highest values of pH (8.64 and 8.63) were recorded for treatments that fertilized by the poultry litter (T1 and T3, respectively) for 6 months while the lowest pH values were recorded in treatments received the artificial feed for 3 months. These results may be due to the higher photosynthesis activity occurred in ponds received the organic fertilizer compared to ponds that received the artificial feed. pH values did not reached critically high or low levels as denoted by Boyd (1990).

Results of Table (2) indicated that, the overall mean of phytoplankton (organism/l) for poultry litter (T1) showed the greatest drop in phytoplankton count compared to the other experimental treatments because the natural food (enhanced by organic fertilization) in this treatment is the sole source of food while the other treatments received artificial feed beside natural food available in ponds.

The main effect of organic fertilizer was decomposing and releasing inorganic nutrients (nitrogen and phosphorus) that stimulated phytoplankton growth. The organic matter of poultry litter was especially efficient in increasing the abundance of zooplankton and benthic organisms and may serve as direct source of food for invertebrates and fish (Boyd, 1990).

As shown in table (2), fertilization by poultry litter only caused the greatest decrease in the total number of zooplankton (organism/l). The average number of zooplankton for the overall experimental period were 245, 249, 254, 257, 262 and 295 organism/l for T1, T2, T3, T4, T5 and T6, respectively because the natural food (phyto and zooplankton) in T1 are the available sources of fish food while the other treatments received artificial feed beside natural food. Nile tilapia is known to feed on the grazing zooplankton as well as plant material (Orachunwong *et al.* 1988).

The highest average of zooplankton count was obtained in T6 and the lowest value was recorded with T1. These results disagreed with Hickling (1962), who reported that organic fertilizers are especially efficient in increasing the abundance of zooplankton and benthic organisms. Gomaah (1997) found that, ponds fertilized with poultry litter then followed by artificial feed supported the fastest growing zooplankton leading to an increase in the natural food from animal organisms with suitable quantity for feeding of Nile tilapia fingerlings.

2. Growth performance:

The initial body weight (BW) for fish received the different treatments ranged between 19.86 and 20.46 g with insignificant differences (Table, 3) and the same trend was also observed for body weight after 30, 60 and 90 days from the experimental start. After 120, 150 and 180 days from the experimental start, averages BW were significantly different according the different feeding regimes where T1 showed the lowest ($P<0.05$) BW followed in an increasing order by those received the other treatments and these results may be due to the availability of both natural food and artificial feed in T2, T3, T4, T5 and T6 while in T1 natural food only was the unique source of fish feeding. The obtained results are in agreement with those of Osman *et al.* (2005) who found that with decreasing artificial feed in the feeding regimes of Nile tilapia the growth performance was negatively affected. Abu-Seif *et al.* (2001) reported that fish reared on artificial ration gave higher harvest weight than those reared in ponds fertilized by inorganic treatments. Green (1992) concluded that chicken manure can replace 100% of pelleted supplemental feed without significant effects on growth of tilapia during the first 60 days of the culture and this in agreement with the results obtained in the present study.

The greatest final BW (210.31 g) was achieved with T6 in which artificial feed was enriched by 2 kg Biogen/ton during the last three months of fish culture. Biogen can enhance the energy metabolism in fish body cells, improves the efficiency of feed utilization and balance the secretion of various secretary glands, moreover it increases the vitality of cells by supplying oxygen to whole body, improves the immune responses (Diab, 2002), helps to excrete heavy metals, inhibits aflatoxin toxic effects and maintains the normal endocrine system. Biogen has bactericidal effects and increases the palatability and the appetite (Abdel-Hamied *et al.* 2002). Biogen at level of (2 kg/ton diet) can be recommended in fish farming to improve production since it enhances the growth rate of tilapia (Bayoumi, 2004) which in agreement with the present data.

Average BL at the beginning of the experiment ranged between 10.40 and 10.77 cm (Table 4) with insignificant differences among the different experimental treatments. During the following three experimental periods (30, 60 and 90 days from the experiment start) the differences in BL among the different experimental fish groups were not significant. During the last three experimental periods (After 120, 150 and 180 days from the experimental start) the highest BL was obtained with T6 (Artificial feed+2 kg/ton Biogen) and the lowest one was recorded for T1 (fertilization by poultry litter only).

Averages BL during the experimental periods until harvesting were found to follow the same order of BW. Oren (1981) revealed that fluctuations in ponds for fish growth (length and weight) are affected by different factors such as feeding regime, population density and environmental conditions.

At experimental start condition factor values ranged between 1.62 and 1.77 (Table 5). After 30, 60 and 90 days form the experimental start the K values were relatively the same and did not significantly different while K values during the last three measurements (120, 150 and 180 days) were significantly different among the experimental treatments. At experimental termination, T1 had the highest K value and did not significantly different from those recorded for treatments T2, T3, T4 and T5, the last treatment (T6) showed the lowest significant value (0.91). Condition factor of fish is a measure of relative muscle to bone growth and the differing growth responses of these tissues to diet treatment may be reflected by changes in condition factor (Ostrowski and Garling, 1988). Condition factor also provides a measure of fish fatness and food conversion efficiency (Power, 1990). It is frequently assumed to reflect not only characteristics of fish such as health, reproductive state and growth but also characteristics of the environment such as habitat quality, water quality and prey availability (Liao *et al.* 1995).

Results of table (6) show that weight gain (WG) did not significantly different among the different treatments during the first three periods (0-30, 30-60 and 60-90 days). During the period (90 - 120 days) the highest WG value was recorded by T6 (Artificial feed+2kg/ton Biogen), and the lowest WG was recorded by fish group in T1 and the same trend was observed during the last successive experimental periods (120-150, 150-180 and 0-180 days).

During the first three months of the experiment (0-30, 30-60 and 60-90 days) WG of Nile tilapia that fed natural food only (T1) did not significantly different from those of the other treatments that received artificial feed (T2, T3, T4, T5 and T6). This result means that natural food (enhanced by applying poultry litter) was sufficient to cover all nutrients requirements of fish in the first three months while during the subsequent periods, food requirements increased and did not covered by natural food only. Applying pelleted feed after three months was necessary to maintain fast growth where the fish able to consume pellets (Green, 1992 and Gomaah, 1997). This confirmed that tilapia, especially Nile tilapia, *Oreochromis niloticus* depends on the natural food at the first period of age (approximately 1 - 90 days) while applying supplemental feeding after this stage is very important to get high daily gain and high fish yield. Wu *et al.* (1995) reported that young tilapia eats mainly zooplankton and phytoplankton while the adults accept a variety of artificial feed, vegetables, larvae and insects.

With respect to feed additives, Safinaz (2000) reported that the addition of Biogen to fish diet improved the normal physiological function of *O. niloticus*. The improvement in WG due to the effect of Biogen may be attributed to the fact that Biogen has a particular good flavor and appetizing function which can increase the palatability of feed, promote the secretion of digestive fluids and stimulate the appetite (Bayoumi 2004). Also, Mehrim (2001) found that the dietary inclusion of Biogen increased the utilization of feed intake and improved growth performance.

The differences in SGR values among the different experimental treatments during the first three periods (0-30, 30-60 and 60-90 days from the experimental start) were not significant (Table 7). During the following three periods (90-120, 120-150 and 150-180 days), the highest SGR value was recorded for T6 in which fish received artificial feed supplemented with 2kg/ton Biogen and the differences among the different experimental fish groups were significant. During the entire experimental period (0-180 days) results showed that fish group fed artificial feed supplemented by Biogen had the best SGR value followed in a descending order by those for T5, T4, T3, T2 and T1. The obtained results were in agreement with those of Abdel-Rahman *et al.* (2003) and Osman *et al.* (2005) who indicated that SGR of *O. niloticus* were significantly higher for fish fed pelleted artificial feed rather than fish reared in ponds fertilized by chicken or cow manure.

The higher values of SGR observed in T6 may be attributed to the positive effect of Biogen at the level of 2 g/kg diet on fish growth rate through strength their immunity and save food for growth. The obtained results are in accordance with those reported by (Bayoumi 2004) who reported that fish fed artificial diet supplemented with 2g of Biogen/kg diet exhibited the highest SGR. Khattab *et al.* (2004)

incorporated Biogen in *O. niloticus* diets at 0.1, 0.2 and 0.4% and found that final BW, WG and SGR significantly increased with increasing Biogen level in the diet.

3. Total yield:

Total fish yield (Table, 8) at the end of the present experiment are listed in table (8). The lowest yield was recorded for fish fed the natural food only (T1). Total fish yield increased by 54.2%, 57.4, 59.9, 67.8 and 87.0% for T2, T3, T4, T5 and T6, respectively compared to T1. In recent study, Kamal *et al.* (2004) tested three feeding regimes for Nile tilapia reared in earthen ponds. Feeding regimes are (T1) fertilization plus artificial diet, (T2) blue green algae plus fertilization and artificial diet and T3 artificial diet only. The authors found that, the highest net fish production was recorded on fish group T2 followed by T1 and T3, respectively.

4. Carcass and proximate analysis of whole fish:

Table (9) presented the average edible parts (dressing percentages) lie in two clusters, the first cluster included T1, T2 and T3 (57.72, 57.75 and 58.34%) and the second cluster included T4, T5 and T6 (60.40, 61.36 and 61.50%). The differences among the two clusters are significant ($P<0.05$) while the differences among the different treatments within each cluster were not significant and the same trend was also obtained for the inedible part (by-products). Carcass analysis of Nile tilapia *O. niloticus* fish filleting is an important process or preparing a much better fish flesh than dealing directly with whole fish. Fish filleting has the following advantages. It is easier to prepare and cook, easier for packing and transportation especially when the refrigerated space in the transportation means is limited (Hussein 1990).

Table (9) presents the chemical composition of Nile tilapia treated with different feeding regimes. Averages of dry matter of whole fish body were found to be 22.99, 22.16, 23.01, 23.34, 23.48 and 22.63% and the differences among these percentages were not significant, while averages of protein contents in DM were 67.93, 67.77, 68.19, 70.66, 71.84 and 72.74 for T1, T2, T3, T4, T5 and T6, respectively and the differences were significant. The highest protein content of whole fish body was recorded in T6 followed in descending order by those of T5, T4, T3, T1 and T2 and these results were parallel to those of ether extract while the opposite trend was observed for ash content of whole fish body. To the same results came Osman *et al.* (2005) that tilapia fat content was higher in fish fed pelleted feed when compared by those raised with fermented manure. Brown and Murphy (1991) concluded that larger size fish class (as treatment T6 in the present study) usually had lower ash and higher fat contents than smaller size (treatment T1).

5. Economical evaluation:

Data presented in Table (10) indicated that total costs (variable + fixed costs) for the different feeding regimes T1, T2, T3, T4, T5 and T6 were found to be 4417.50, 7840.60, 7939.66, 7778.18, 7759.11 and 7384.041 LE/feddan, respectively. The highest (7939.66 LE) total costs were recorded for T3 where fish received the artificial feed beside the organic fertilization during the entire experimental period while the lowest (4417.50 LE) costs were recorded for T1 where organic fertilization was only applied. The highest net returns/feddan (4215.96 LE) were recorded for T6 followed in a decreasing order by T5 (3648.99 LE), T4 (2139.82 LE), T2 (1822.20 LE), T3 (1821.74 LE) and T1 (930 LE).

The obtained results indicated that, there were no difference in net returns between the two feeding regimes T2 (organic fertilization for 3 months followed by supplementary feed for three months) and T3 (organic fertilization + artificial feed during the whole experimental period).

CONCLUSION

Fertilization by poultry litter can replace 100% of high cost pelleted feed in the first three months followed by applying pelleted diets to cover the increasing feed requirements of fish without adverse effect on growth performance. The addition of growth promoters such as Biogen to pelleted feeds improves growth performance and the net returns of Nile tilapia.

Table 1. Chemical analysis of feed, poultry litter, blue green algae and Azolla (DM basis).

Item	Artificial feed	Poultry litter	Blue green algae	Azolla
Crude protein%	25.00	24.00	39.62	20.87
Crude fat%	4.10	7.50	2.80	2.99
Crude fiber%	5.70	7.00	18.08	20.23
Ash%	10.30	20.27	11.28	19.72

Table 2. Means and standard error (SE) for the effect of feeding regimes on water quality parameters.

Parameters	Feeding regime						SE
	T_1	T_2	T_3	T_4	T_5	T_6	
Temperature (°C)	27.81	27.09	27.36	26.55	27.01	27.19	±1.5
Dissolved oxygen (mg/l)	3.40^c	4.48 b	4.91 b	4.91 b	4.89 b	5.58 a	±0.43
Secchi disk visibility (cm)	13.00 a	11.56 b	14.33 a	12.25 ab	11.89 b	12.33 ab	±1.11
pH (degrees)	8.64	8.56	8.63	8.55	8.52	8.19	±0.22
Phytoplankton (organism/l)	9,849 c	11,098 b	11,416 b	11,477 b	11,898 b	15,816 a	±150
Zooplankton (organism/l)	245 b	249 b	254 b	257 b	262 b	295 a	±23

Means followed by the different letters in each row are significantly different (P<0.05)

Table 3. Means and standard error (SE) for the effect of some feeding regimes on body weight (g) of Nile tilapia.

Feeding regime	Start	30 day	60 day	90 day	120 day	150 day	180 day
T1	19.98	50.01	76.81	105.49	128.33 d	146.48 c	164.14 f
T2	20.24	49.68	76.48	105.30	130.37 bc	147.67 c	171.81 d
T3	20.46	50.53	76.29	105.38	129.83 c	157.23 b	168.48 e
T4	19.94	49.48	77.15	106.08	131.10 b	156.68 b	178.57 c
T5	20.12	50.68	76.58	105.55	130.10 bc	156.97 b	185.66 b
T6	19.86	49.19	76.70	105.68	134.24 a	173.00 a	210.31 a
SE	±0.18	±0.33	±0.42	±0.34	±0.41	±0.82	±0.71

Means followed by the different letters in each column are significantly different (P<0.05).

Table 4. Means and standard error (SE) for the effect of some feeding regimes on body length (cm) of Nile tilapia.

Feeding regime	Start	30 day	60 day	90 day	120 day	150 day	180 day
T1	10.53	14.79	17.39	20.08	20.34 b	22.61 c	24.08 b
T2	10.77	14.74	17.42	20.06	21.26 a	23.70 b	24.89 b
T3	10.70	14.96	17.38	20.08	21.48 a	24.24 a	24.96 b
T4	10.43	14.80	17.56	20.06	21.74 a	23.75 b	25.07 b
T5	10.53	14.91	17.50	20.03	21.39 a	24.19 a	25.81 b
T6	10.40	14.69	17.53	20.08	21.77 a	24.98 a	28.41 a
SE	±0.11	±0.13	±0.04	±0.24	±0.07	±0.06	±0.07

Means followed by the different letters in each column are significantly different (P<0.05)

Table 5. Means and standard error (SE) for the effect of some feeding regimes on condition factor (K) of Nile tilapia.

Feeding regime	At start	30 day	60 day	90 day	120 day	150 day	180 day
T1	1.71	1.55	1.46	1.30	1.53 a	1.27 a	1.18 a
T2	1.62	1.51	1.45	1.30	1.36 b	1.11 c	1.11 a
T3	1.67	1.51	1.45	1.30	1.31 b	1.10 c	1.09 a
T4	1.71	1.53	1.43	1.31	1.28 b	1.17 b	1.13 a
T5	1.72	1.51	1.42	1.31	1.33 b	1.11 c	1.08 a
T6	1.77	1.56	1.42	1.31	1.30 b	1.11 c	0.91 b
SE	±0.01	±0.02	±0.02	±0.01	±0.02	±0.01	±0.03

Means followed by the different letters in each column are significantly different (P<0.05)

Table 6. Means and standard error (SE) for the effect of some feeding regimes on weight gain (g) of Nile tilapia.

Feeding regime	0-30 day	30-60 day	60 -90 day	90-120 day	120-150 day	150 -180 day	0-180 day
T1	30.03	26.80	28.68	22.84 b	18.15 c	17.66 d	144.16 c
T2	29.44	26.80	28.82	25.07 b	17.30 c	24.14 c	151.57 bc
T3	30.07	25.76	29.09	24.45 b	27.40 b	11.25 e	148.02 c
T4	29.54	27.67	28.93	25.02 b	25.58 b	21.89 c	158.63 bc
T5	30.56	25.90	28.97	24.55 b	26.87 b	28.69 b	165.54 b
T6	29.33	27.51	28.98	28.56 a	38.76 a	37.31a	190.45 a
SE	±0.72	±0.79	±0.85	±0.70	±1.57	±1.44	±4.11

Means followed by the different letters in each column are significantly different ($P<0.05$)

Table 7. Means and standard error (SE) for the effect of some feeding regimes on specific growth rate (SGR) of Nile tilapia.

Feeding regime	0-30 day	30-60 day	60 -90 day	90-120 day	120-150 day	150 –180 day	0-180 day
T1	3.06	1.43	1.06	0.65 b	0.44 c	0.38 c	1.17 c
T2	2.99	1.44	1.07	0.71 b	0.42 c	0.49 b	1.19 c
T3	3.04	1.37	1.08	0.67 b	0.64 b	0.23 d	1.17 c
T4	3.03	1.48	1.06	0.71 b	0.59 bc	0.44 c	1.22 b
T5	3.08	1.37	1.07	0.70 b	0.63 b	0.56 b	1.23 b
T6	3.02	1.48	1.07	0.80 a	0.84 a	0.65 a	1.31 a
SE	±0.09	±0.16	±0.07	±0.01	±0.04	±0.03	±0.01

Means followed by the different letters in each column are significantly different ($P<0.05$)

Table 8. Fish production for the different feeding regimes.

Feeding regimes	Yield kg/Feddan	% of the smallest yield	% increase of smallest yield
T1	855.6	100	0
T2	1319.2	154.2	54.2
T3	1346.4	157.4	57.4
T4	1368.0	159.9	59.9
T5	1435.6	167.8	67.8
T6	1600.0	187.0	87.0

Table 9. Least square means and standard error (SE) for the effect of some feeding regimes on carcass and chemical analysis of Nile tilapia.

Item	T_1	T_2	T_3	T_4	T_5	T_6	SE
Carcass analysis (%)							
Dressing	57.72 b	57.75 b	58.34 b	60.40 a	61.36 a	61.50 a	±0.65
By-products	42.28 a	42.25 a	41.66 a	39.60 b	38.64 b	38.50 b	±0.44
Head	27.58 a	28.69 a	28.48 a	24.42 b	22.71 b	25.85 ab	±0.20
Viscera	8.75 b	7.30 ab	7.60 ab	10.00 a	10.90 a	6.48 c	±0.07
Scales	3.59 a	3.47 a	3.30 a	3.09 a	2.92 b	3.98 a	±0.07
Fins	2.36 b	2.79 a	2.28 b	2.09 c	2.11 c	2.19 bc	±0.12
Chemical composition of whole fish body (%)							
Dry matter	22.99	22.16	23.01	23.34	23.48	22.63	±0.58
Protein	67.93 b	67.77 b	68.19 b	70.66 ab	71.84 a	72.74 a	±0.21
Ether extract	13.36 ab	12.57 b	14.71 a	14.72 a	15.04 a	15.34 a	±0.09
Ash	17.63 a	18.60 a	15.04 b	13.03 c	11.04 c	10.80 c	±0.62

Means followed by the different letters in each row are significantly different (P<0.05)

Table 10. Economical efficiency for the different feeding regimes.

Item	T1	T2	T3	T4	T5	T6
Operating costs:						
Fish fingerlings	2000	2000	2000	2000	2000	2000
Pletted feed	-	3440.46	3231.36	3283.2	3215.7	2841.6
Chicken litter	300	150	300	150	150	150
Material	-	-	-	100	150	180
Labor	500	500	500	500	500	500
Equipment – repair	250	250	250	250	250	250
Pond maintaince	200	200	200	200	200	200
Interaction operating capital	292.5	425.14	583.3	419.98	418.41	387.44
Total variable costs	3542.5	6965.6	7064.66	6903.18	6884.11	6509.04
Fixed costs :						
Depreciation*	400	400	400	400	400	400
Interaction investment	475	475	475	475	475	475
Total fixed cost	875	875	875	875	875	875
Total costs	4417.5	7840.6	7939.66	7778.18	7759.11	7384.04
Return :						
Total return / Feddan **	5347.5	9662.8	9761.4	9918	11408.1	11600
Net return/Feddan	930	1822.2	1821.74	2139.82	3648.99	4215.96

* Depreciation of pond equipments.

** The economical evaluation of results was carried out according to market price in 2004 in LE.

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تأثير بعض نظم التغذية على صفات المياه ونمو وإنتاجية أسماك البلطى النيلى المربى فى الأحواض الترابية

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استهدفت هذه الدراسة بحث تأثير التسميد العضوى والغذاء المصنع وتأثير إدخال بعض مواد العلف الغير تقليدية مثل الطحالب الزرقاء المخضرة والأزولا والبيوجين على العلف المصنع على خفض تكاليف التغذية. تم إستخدام ١٢ حوض ترابى (مساحة كل منها ٢ فدان) وتم تخزين أسماك البلطى النيلى بها وقد تم إختبار ٦ معاملات (حوضين لكل معاملة). المعاملة الأولى تم تسميد كل حوض ب ٢٥ كجم/يوم فرشة دواجن طول فترة التجربة (ستة أشهر)، المعاملة الثانية تم إستخدام التسميد العضوى لمدة ٣ أشهر فقط تلاها إستخدام العلف المصنع (٢٥% بروتين) لمدة ثلاثة أشهر بمعدل ٢% من الكتلة الحيه ، المعاملة الثالثة تم إستخدام التسميد العضوى طول فترة التجربة (٦ أشهر) بجانب التغذية الصناعية بنفس المعدلات السابقة خلال الأشهر الثلاثة الأخيره . أما باقى المعاملات فقد تم فيها إستخدام التسميد العضوى لمدة ٣ أشهر بعدها تم إستخدام العلف المصنع (٢٥% بروتين) مضافاً إليه الطحالب الزرقاء المخضرة الجافه أوالأزولا أوالبيوجين بمعدل ١٠، ١٠، ٢ كجم/طن للمعاملات الرابعة والخامسة والسادسة على التوالى، وتمت التغذية بمعدل ٢% من وزن الجسم. وكانت النتائج المتحصل عليها فى التجربه مايلى:

- تراوحت درجات الحرارة فى مياه الأحواض للمعاملات المختلفة مابين ٥٥ر٢٦-٨١ر٢٧ درجة مئوية ، تركيز الأكسجين الذائب ٤٠ر٣ إلى ٥٨ر٥ مجم/ لتر ، درجة تركيز أيون الأيدروجين ١٩ر٨ – ٦٤ر٨ . كانت الفروق بين المعاملات المختلفه غير معنوية بالنسبة لدرجة الحرارة وقيم تركيز ايون الأيدروجين. محتوى مياه أحواض المعاملة الأولى من الهائمات النباتية والهائمات الحيوانيه (الفيتووالزوبلانكتون) أقل من باقى المعاملات الأخرى.
- أعطت المعاملة الأولى أقل المقاييس بالنسبة لوزن وطول الجسم والزيادة فى وزن الجسم ومعدل النمو أما المعاملة السادسة فقد أعطت أعلى قيم لهذه المقاييس مقارنة بباقى المعاملات فى نهاية الدراسة وكانت الفروق بين المعاملات معنوية بالنسبة لهذه الصفات.
- محصول الأسماك فى نهاية الدراسة كان الأقل فى المعاملة الأولى أما المعاملات الأخرى فقد كانت الزيادة فى محصول الأسماك بنسبة ٢ر٥٤، ٤ر٥٧، ٥ر٥٩، ٨ر٦٧، ٠ر٨٧% للمعاملات الثانية والثالثه والرابعة والخامسة والسادسة على التوالى مقارنة بالمعاملة الأولى.
- وصلت نسبة التصافى إلى ٧٢ر٥٧، ٧٥ر٥٧، ٣٤ر٥٨، ٤٠ر٦٠، ٣٦ر٦١ ، ٥٠ر٦١% ، نسب البروتين ٩٣ر٦٧، ٧٧ر٦٧، ١٩ر٦٨،٦٦ر٧٠، ٨٤ر٧١، ٧٤ر٧٢ للمعاملة ١، ٢، ٣، ٤، ٥، ٦

على التوالى وكانت الفروق بين هذه المتوسطات معنوية. هذه النتائج كانت متوازية مع تلك المتحصل عليها بالنسبة لمستخلص الأثير أما محتوى جسم الأسماك من الرماد فى المعاملات المختلفة فقد أظهر نتائج مخالفة لنتائج البروتين ومستخلص الأثير.

- دلت نتائج التحليل الإقتصادى أن أعلى عائد صافى (٩٦ر٤٢١٥ جنيه/فدان) قد تم الحصول عليه فى المعاملة السادسة تلاها (٩٩ر٣٦٤٨ جنيه/فدان) للمعاملة الخامسة ثم المعاملة الرابعة (٨٢ر٢١٣٩ جنيه/فدان) ثم المعاملة الثانية (٢٠ر١٨٢٢ جنيه/فدان) والمعاملة الثالثة (٧٤ر١٨٢١ جنيه/فدان) كما حققت المعاملة الأولى أقل عائد صافى (٩٣٠ جنيه/فدان).