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Effect of Feed Additives and Fertilization on Growth Performance of *Oreochromis niloticus* and Common Carp (*Cyprinus carpioio*)

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ABSTRACT

The aim of this study is to evaluate the effect of fertilization by rigir, feed additives (Biogen) and stocking rate on earthen ponds productivity cultured with *Oreochromis niloticus* and Common carp (*Cyprinus Cyprinus carpioio*). Six ponds (21×100 m) were stocked with 4000 of Nile tilapia fingerlings for each pond. The Six ponds were assigned into three groups, each group composed of two ponds (two stocking rates 500 and 1000 *Cyprinus carpio* fish/pond), the first group was treated by artificial feed containing 25% crude protein, second group was treated by artificial feed 25% crude protein with 0.2% Biogen and the third group was treated by artificial feed 25% crude protein fertilized by poultry litter 65 kg/feddan/week. *Oreochromis niloticus* and *Cyprinus carpio* fingerlings averaging 17.50 and 19.31g in weight were assigned randomly to three tested different feed and two stocking rates. Results obtained can be summarized as following: *Oreochromis niloticus*: Feeding regime: Treatment 3 (artificial feeding with fertilization by poultry litter 65 kg/feddan/week) recorded the highest averages of body weight (BW), body length (BL), daily weight gain (DWG) and specific growth rate (SGR).while Treatment 2 (artificial feeding with 0.2% Biogen) recorded the highest averages of condition factor. Stocking rate: SR1 (4000 *Oreochromis niloticus* +500 *Cyprinus carpio*) recorded the highest averages of body weight (BW), body length (BL), condition factors (K), daily weight gain (DWG) and specific growth rate (SGR). While SR2 (4000 *Oreochromis niloticus* +1000 *Cyprinus carpio*) recorded the highest averages of condition factors (K). Common carp *Cyprinus carpio*: Feeding regime: Treatment 3 (artificial feeding with fertilization by poultry litter 65 kg/feddan/week) recorded the highest averages body weight (BW), body length (BL), daily weight gain (DWG) and specific growth rate (SGR). while Treatment 1 (artificial feeding) recorded the highest averages of condition factor. Stocking rate: SR1 (4000 *Oreochromis niloticus* +500 *Cyprinus carpio*) recorded the highest averages of body weight (BW), body length (BL), condition factors (K), daily weight gain (DWG) and specific growth rate (SGR). Based on results obtained in this study and on the economical evaluation, it could be concluded that, *Oreochromis niloticus* and *Cyprinus carpio* can be cultured together in earthen ponds and growth parameters of the two species improved when fish fed on diet 25% crude protein with fertilization by poultry litter 65 kg/feddan/week. The favored economics of this treatment was reflected in the best ratio of returns to total costs.

INTRODUCTION

Feed additives are substances which added in trace amounts provide a mechanism by which such dietary deficiencies can be addressed which benefits not only the nutrition and thus the growth rate of the animal concerned, but also its health and welfare in modern day fish farming. Some of the most utilized growth-promoting feed additives include hormones, antibiotics, ionospheres and some salts (Fuller, 1992; Go´ngora, 1998; Klaenhammer and kullen, 1999). Probiotics are also feed additives (Zootechnical additives) which are defined as live microbes that may serve as dietary supplements to improve the host intestinal microbial balance and growth performance (Gatesoupe, 1999). The Probiotics in aquaculture have been shown to have several modes of action: competitive exclusion of pathogenic bacteria through the production of inhibitory compounds; improvement of water quality; enhancement of immune response of host animal; and enhancement of nutrition of host animal through the production of supplemental digestive enzymes Carnevali *et al*., (2006).

Polyculture, between tilapia and other aquatic species, is an established option when natural food from different pond niches are independently exploited by fish, when there is a market for all species in culture and when their combination provides an economic benefit which is high enough to cover extra labour expenses required to grade and sort fish at sampling and harvesting (Ibrahim *et al*., 2001).

The aim of the present study was to evaluate the effect of feed additives and fertilization on earthen ponds productivity and stocking rates of *Oreochromis niloticus* with Common carp (*Cyprinus Cyprinus carpioio*).

MATERIALS AND METHODS

Experimental design

The present experiment was conducted during the period between 19th may and lasted on 20th October 2013 (22 weeks (154 days) in Six fresh water earthen ponds each of a total area of ½feddan at a private farm (in Tollumbat No.7 in Riyad City, Kafr El-Sheikh Governorate, Delta district at the Northern part of Egypt). The objective of the present study aimed also to evaluate the effect of artificial feeding, and compared to artificial feeding with 0.2% Biogen and artificial feeding with fertilization by poultry litter 65 kg/feddan/week on the production of *Oreochromis niloticus* and *Cyprinus carpio* fingerlings(two replicates with each treatments).

Ponds description and preparation

Erthen ponds with 125 cm water depth were supplied with fresh water from El-Gharbia drainage canal. The water system of the experimental ponds is maintained by gravity. The Six ponds were stocked with 4000 of *Oreochromis niloticus* fingerlings for each pond. Then the Six ponds were assigned into two groups, the experimental groups were stocked by stocking rate 500 and 1000 fish/pond of *Cyprinus carpio*. These groups were treated by three treatment. The first group was treated by artificial feed 25% croude protein, second group was treated by artificial feed with 0.2% Biogen and third group artificial feeding with fertilization by poultry litter 65 kg/feddan/week as described in Table (1).

Feed was offered six days per week (except Friday) during the experimental period. The feeding rate was 3% of the total fish mass presented in each pond and the feed amount was adjusted biweekly for each pond separately according to the new recorded biomass.

Table (1): Stocking rate of *Cyprinus carpio* and *Oreochromis niloticus* under the three feeding treatments. All exeprimental ponds were stocked with equal number of mullet 2000 fish/pond

Treatment	Stocking rate	pond No.	stocking rate per pond	Stocking rate per feddan
Supplementary Feed (3% of body Weight) (T_1).	SR1	1	4000 *O. niloticus* +500 C *Cyprinus carpio*	8000 *O. niloticus* +1000 C *Cyprinus carpio*
	SR2	3	4000 *O. niloticus* +1000 C *Cyprinus carpio*	8000 *O. niloticus* +2000 C *Cyprinus carpio*
Supplementary Feed with 0.2%Biogen (T_2).	SR1	5	4000 *O. niloticus* +500 C *Cyprinus carpio*	8000 *O. niloticus* +1000 C *Cyprinus carpio*
	SR2	6	4000 *O. niloticus* +1000 C *Cyprinus carpio*	8000 *O. niloticus* +2000 C *Cyprinus carpio*
Supplementary Feed with Fertilization by poultry litter (T_3)	SR1	8	4000 *O. niloticus* +500 C *Cyprinus carpio*	8000 *O. niloticus* +1000 C *Cyprinus carpio*
	SR2	9	4000 *O. niloticus* +1000 C *Cyprinus carpio*	8000 *O. niloticus* +2000 C *Cyprinus carpio*

Experimental fish

Fish species

The experimental ponds were stocked with fish species; *Oreochromis niloticus* and Common carp (*Cyprinus Cyprinus carpioio*). *Oreochromis niloticus* were stocked with an average initial length of 13.52cm and an average initial total weight of 17.51g for all treatments. The average initial length of Common Cyprinus carpio were 14.63cm and the average initial body weight of 19.31g for all treatments. The fingerlings of *O. niloticus* and *Cyprinus carpio* were supplied from different fish farms Riyad City, Kafer El-Shiek Governorate.

Pond management

Fertilizers applications

Organic fertilizer: fertilization with poultry litter 65 kg/feddan/week.

Concening the Biogen supplement each kg Biogen® contained: Allicin 0.247 micromil, high-unit hydrolytic enzyme 3690 units, (proteolytic- lipolytic- amylolytic and cell separating enzymes), Bacillus subtilis Nato 6x 107 cells, Ginseng extract. Manufactured by China Way Corporation 16-4 No. 424 Chung Ming Road. Taichung Taiwan.

Supplementary feed

Commercial diet was manufactured by Sherbeen-Domiatte, local factory. Sample of fish feed was collected from several sacks and send for proximate analysis at the Central Laboratory for Aquaculture Research at Abbassa. Chemical analysis of experimental artificial feed is presented in Table (2). The fingerlings were fed on the commercial floating diet and fed six days per week at a daily feeding rate of 3% of the estimated fish-weight twice daily at 9.00am and 3.00pm during the experimental period.

Table 2: ***Composition and proximate chemical analysis of the experimental diet***

Item	Supplementary feed
Moisture %	9.36 ±0.36
Crude protein %	24.79 ±0.28
Crude fat %	4.22 ±0.09
Crude fiber %	4.16 ±0.38
Ash %	9.12 ±0.35

Feed quantity was adjusted according to average body weight of the biweekly sample of each pond. In order to determine the average weight of fish, biweekly samples were taken by seining where 20 fishes / species from each pond were collected and then released again in the pond after individual measuring the weight and length.

Fish samples and measurements

Random samples 20 fish from each species of each pond were taken every biweekly during the experimental period. During this experiment, body measurements (body weight in g and body length in cm) at biweekly interval throughout the whole experiment period were recorded.

Condition factor was determined by using the following formula:

K= [weight (g) / length (cm) 3] ×100

Specific growth rate was calculated according to **Jauncey and Rose (1982)** by using the following formula:

$$\textbf{SGR} = \frac{\mathrm{LnW2} - \mathrm{LnW1}}{t} \times 100$$

Harvesting

At the end of the experiment (20th of October, 2013), ponds were gradually drained from the water and fish were harvested by seining and transferred to fiberglass tanks and carried to the processing centre where they washed, and the fish of the different fish species were sorted and collectively weighed.

Statistical analysis

The statistical analysis of data collected was analyzed using two way analysis of variance and carried out by applying the computer program (**SAS, 1996**) by adopting the following fixed model:

$x_{ij} = \mu.. + \alpha_i + \beta_j + \alpha\beta_{ij}$.

Where:

Xij = observation of the ijkl-th fish

μ = Overall mean.

αi = the effect of I-th feeding regime.

βj = the effect of J-th stocking density.

αβij = the effect of interaction between I-th feeding regime and stocking rate J-th.

Differences among means were tested for significance according to Duncan's multiple range tests (**Duncan**, **1955**).

RESULTS AND DISCUSSION

Body weight

Table (3) shows The averages of body weights, the initial of body weights of *Oreochromis niloticus* and *Cyprinus carpio* were 17.51 and 19.31g, respectively; while at the end of the experiment, the averages of body weight for fish species were 298.66 and 329.09g, respectively. These results indicate that, the body weight for common Cyprinus carpio was higher than obtained in *Oreochromis niloticus*. These results may be attributed to the feeding habits of fish species.

Concerning body weight of *O. niloticus* (Table, 3), the effect of feeding regime (artificial feeding, artificial feeding with 0.2%Biogen and artificial feeding with poultry litter 65 kg/feddan/week on body weight, Table 3 showed that, the initial body weight was 17.18, 17.63 and 17.71g, respectively. While at the end of experiment the averages of body weight for treatments were 290.64, 296.34 and 309.00g for the three treatments, respectively. These results indicate that, the average of body weight for third treatment artificial feeding with fertilization by poultry litter 65 kg/feddan/week was higher than other treatments and the differences among treatments were significant ($P<0.05$). This result some what came close to those mentioned by **El-Ebiary (1998)** when he studied the use of organic manures in polyculture system for tilapia, mullet and common carp. He found that, final body weights of fish species reared in group (A – 150kg poltery manur/feddan with artificial feed 18% crude protein) were improved compared with those reared in group (B – 150kg cow manure/feddan with artificial feed 18% crude protein) and group (C- artificial feed 18% crude protein without fertilization) which were given supplementary feed (SF) only in the ponds.

Averages of *Cyprinus carpio* body weight, the effect of feeding regime (artificial feeding, fish rigir and artificial feeding with 0.2%Biogen) on body weight, Table 3 showed that, the initial body weight was 18.59, 19.79 and 19.52g, respectively. While at the end of experiment the means of body weight for treatments were 320.13, 323.55 and 343.58g for the three treatments, respectively. These results indicate that, the average body weight for third treatment was higher than other treatments. Analysis of variance of results indicated that the differences among treatments were significant ($P<0.05$). Such findings neerly agreed with **Bogut *et al.*, (1998)** and **Soltan *et al.* (2010)**.

Averages of *Oreochromis niloticus* body weight, the effect of stocking rates (4000 fish of *Oreochromis niloticus* with 500 and 1000 fish of *Cyprinus carpio* on body weight, Table 4 showed that, the initial body weight was 17.65 and 17.38g, respectively. While at the end of experiment the means of body weight for treatments were 306.23 and 291.09g for the two stocking rates, respectively. These results indicate that, the average body weight for first stocking rate (4000 fish of *Oreochromis niloticus* with 500 fish of *Cyprinus carpio*) was higher than that obtaind in stocking rate 4000 fish of *Oreochromis niloticus* with 1000 fish of *Cyprinus carpio* and the differences among treatments were significant ($P<0.05$). This may be atributed to increasing the amount of artificial feed which was available for tilapia fish more than *Cyprinus carpio*, **(Uddin, 2007)**.

Averages of *Cyprinus carpio* body weight, the effect of stocking rates (4000 fish of Oreochromis niloticus with 500 and 1000 fish of *Cyprinus carpio*) on body weight, Table 3 shows that, the initial body weight was 19.22 and 19.39g, respectively. While at the end of experiment the means of body weight for treatments were 331.96 and 326.21g forthe two stocking rates, respectively. These results indicate that, the average body weight for the first stocking rate (4000 fish of *Oreochromis niloticus* with 500 fish of *Cyprinus carpio*) was higher than that obtaind in stocking rate 4000 fish of *Oreochromis niloticus* with 1000 fish of *Cyprinus carpio* and the differences among treatments were significant (P<0.05).

Abdel-Hakim, *et al*., (2006) and **Bakeer, (2006)** who found that the growth of *Oreochromis niloticus* was influenced by the different stocking density, fertilization and supplementary feeding.

Results presented in Table (3) show that, variations were significant (P<0.05) due to the interaction between feeding regime treatments and stocking rates which indicated that these two factors act dependently on each other and also each of them had its own significant effect. As showed in this Table, for *Oreochromis niloticus* the best final weight was obtained for fish fed artificial feeding with fertilization by poultry litter 65 kg/feddan/week (318.56g) at stocking rate of 4000 fish of *Oreochromis niloticus* and 500 *Cyprinus carpio* fish/pond. Also for *Cyprinus carpio* the best final weight was obtained while te same treatment fish fed artificial feeding fertilization by poultry litter 65 kg/feddan/week (346.87g) at stocking rate of 4000 fish of *Oreochromis niloticus* and 500 fish of *Cyprinus carpio* pond. These were higher than obtained for other feeding regime and stocking rate.

Table 3: ***Least-square means and standard errors of the tested factors affecting body weight (gm).***

Variable	No.	*Oreochromis niloticus*		*Cyprinus carpio*	
		Initial weight	**Final weight**	**Initial weight**	**Final weight**
Feeding regime (F).					
T1 (control)	40	17.18±1.42a	290.64±1.93b	18.59±1.42a	320.13±1.93b
T2	40	17.63±1.42a	296.34±1.93a	19.79±1.42a	323.55±1.93b
T3	40	17.71±1.42a	309.00±1.93c	19.52±1.42a	343.58±1.93a
Stoking rate (SR).					
SR1	60	17.65±1.66a	306.23±2.56a	19.22±1.66a	331.96±2.56a
SR2	60	17.38±1.66a	291.09±2.56b	19.39±1.66a	326.21±2.56b
F*SD					
AF*SR1	20	17.26±1.09a	297.49±1.71bc	18.48±1.09a	321.81±1.71bc
AF*SR2	20	17.11±1.09a	283.79±1.71d	18.71±1.09a	318.45±1.71c
AFO*SR1	20	17.96±1.09a	302.64±1.71b	19.68±1.09a	327.21±1.71b
AFO *SR2	20	17.31±1.09a	290.05±1.71c	19.91±1.09a	319.89±1.71c
AFB*SR1	20	17.72±1.09a	318.56±1.71a	19.50±1.09a	346.87±1.71a
AFB*SR2	20	17.71±1.09a	299.44±1.71bc	19.55±1.09a	340.30±1.71ab
General main	120	17.51±1.89	298.66±3.09	19.31±1.89	329.09±3.09

a, b, c ± Means with the same letter in each column are not significantly different (P≥ 0.05).

Table 4: ***Least-square means and standard errors of the tested factors affecting body length (cm).***

Variable	No.	*Oreochromis niloticus*		*Cyprinus carpio*	
		Initial length	**Final length**	**Initial length**	**Final length**
General main	120	13.52±1.14	27.50±1.59	14.63±1.14	33.08±1.59
Feeding regime (F).					
T1 (control)	40	12.98±1. 01b	28.58±1. 38b	14.57±1. 01a	32.24±1. 38b
T2	40	13.71±1. 01a	27.57±1. 38c	14.79±1. 01a	32.91±1. 38b
T3	40	13.86±1. 01a	29.35±1. 38a	14.52±1. 01a	34.10±1. 38a
Stoking rate (SR).					
SR1	60	13.43±1. 03a	28.72±1. 42a	14.48±1. 03a	33.09±1. 42a
SR2	60	13.60±1. 03a	26.29±1. 42b	14.78±1. 03a	33.07±1. 42a
F*SD					
AF*SR1	20	12.89±0.82b	29.42±1. .07ab	14.48±0.82a	32.63±1. .07b
AF*SR2	20	13.07±0.82ab	27.75±1. .07c	14.67±0.82a	31.86±1. .07c
AFO*SR1	20	13.65±0.82a	26.53±1. .07d	14.69±0.82a	33.18±1. .07a
AFO*SR2	20	13.77±0.82a	22.62±1. .07e	14.89±0.82a	32.63±1. .07b
AFB*SR1	20	13.76±0.82a	30.21±1. .07a	14.26±0.82a	33.47±1. .07a
AFB*SR2	20	13.96±0.82a	28.50±1. .07b	14.79±0.82a	34.73±1. .07a

a, b, c ± Means with the same letter in each column are not significantly different (P≥ 0.05).

Body length

Table 4 shows the averages of total body length, at the start and the end of this experiment. As described in this Table the initial averages of *Oreochromis niloticus* and *Cyprinus carpio* were 13.52 and 14.63cm, respectively while at the end of the experiment, the averages of total body length for fish species were 27.50 and 33.08cm, respectively. These results indicate that body length for *Oreochromis niloticus* was significantly higher than *Cyprinus carpio*.

Concerning the effect of feeding regime on body length for *Oreochromis* *niloticus* in Table 4, these results indicate that the total body length for third treatment was higher than other treatments. Analysis of variance of results indicated that the differences among treatments were significant (P<0.05).Such results were emphasized by **Uddin (2007)** who found that, supplementary feeding increased body length of Nile tilapia more than the poultry litter. The opposite trend was obtained with silver carp. The significance increased for tilapia and silver carp. Due to the effect of the stocking rate, the increase of body length of Nile tilapia was more pronounced compared with the other two densities and the significance among means. While with respect to silver carp, the increase was more due to the effect of the stocking rate.

Concerning the body length of *Cyprinus carpio* in the third treatment, was higher than other treatments and the differences among treatments were significant (P<0.05).

Moreover these results indicate that, the average body length for first stocking rate was higher than other stocking rate and the differences between stocking rates were significant (P<0.05). **Ibrahim *et al.*, (2000)** and **Jasmine (2011)** found that, the results revealed also that the decrease in body length was more pronounced at the highest stocking densities of *Cyprinus carpio* compared with the lower densities where differences in this trait among the groups started to be significant.

On the other side results of *Cyprinus carpio* indicate that, the average body length for first stocking rate was higher than other stocking rate and the differences between treatments were significant (P<0.05). **Hafez *et al*., (1991)** found a strong correlation between body weight and body length for tilapia and carp fish.

In addition to that, results presented in Table (4) show that variation in body length were significant (P<0.05) due to the interaction between feeding regime and stocking rate. As showed in this Table, the best final length for *Oreochromis niloticus* was obtained for fish fed on artificial feeding with poultry litter 65 kg/feddan/week (30.21cm) at stocking rate of 4000 fish of *Oreochromis niloticus* and 500 fish of *Cyprinus carpio*/pond and higher than obtained in other treatments. While the best final length for *Cyprinus carpio* was obtained for fish fed on artificial feeding with poultry litter 65 kg/feddan/week (34.73cm) at stocking rate of 4000 fish of *Oreochromis niloticus* and 1000 fish of *Cyprinus carpio*/pond were higher than obtained for other feeding regime and stocking rate.

Condition factor (K):

Condition factor of fish is essentially 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. Condition factor (K) was considered to be a sufficient measure of shape, although shape is usually not considered as a character of interest to breeding programs, since it has no obvious economic value **(Nilsson, 1992)**.

Table 5 presents means of K at the start and the end of the experiment as affected treatments and fish species. As described in this Table the averages of K values at the start for *Oreochromis niloticus* and *Cyprinus* *carpio* was 0.71 and 0.62, respectively while at the end of experiment the means of K for fish species were 1.45 and 1.36, respectively. These results indicate that the total condition factor for second treatment was higher than other treatments. Analysis of variance of results indicated that the differences among treatments were significant (P<0.05). **Fath El-bab *et al.*, (2011)** found that, feeding treatment in adequate quantities and the increase in feeding rate resulted in higher condition factor since the fish grow well when the supply of food is adequate. Similar results in which condition factors increased with the feeding rate have been reported by **Chua and Teng (1982)**.

Table 5: Least-square means and standard errors of the tested factors affecting on condition factor (K).

Variable	No.	*Oreochromis niloticus*		*Cyprinus carpio*	
		Initial CF(K)	**Final CF(K)**	**Initial CF(K)**	**Final CF(K)**
General main	120	0.71±0.09	1.45±0.28	0.62±0.09	1.36±0.28
Feeding regime (F).					
T1 (control)	40	0.79±0.08a	1.24±0.24b	0.60±0.08b	1.88±0.24a
T2	40	0.68±0.08b	1.87±0.24a	0.61±0.08b	1.32±0.24b
T3	40	0.66±0.08b	1.22±0.24b	0.64±0.08a	0.87±0.24c
Stoking rate (SR).					
SR1	60	0.73±0.08a	1.25±0.25b	0.63±0.08a	1.40±0.25a
SR2	60	0.69±0.08b	1.64±0.25a	0.60±0.08b	1.31±0.25b
F*SD					
AF*SR1	20	0.80±0.07a	1.17±0.22d	0.61±0.07b	1.91±0.22a
AF*SR2	20	0.77±0.07a	1.33±0.22c	0.59±0.07b	1.84±0.22ab
AFO*SR1	20	0.71±0.07ab	1.62±0.22b	0.62±0.07ab	1.37±0.22b
AFO*SR2	20	0.66±0.07b	2.51±0.22a	0.60±0.07b	1.28±0.22c
AFB*SR1	20	0.68±0.07b	1.15±0.22d	0.67±0.07a	0.92±0.22d
AFB*SR2	20	0.65±0.07c	1.29±0.22cd	0.60±0.07b	0.81±0.22e

a, b, c ± Means with the same letter in each column are not significantly different (P≥ 0.05).

Also concerning *Cyprinus carpio* results indicate that, the average condition factor for second treatment was higher than other treatments and the differences among treatments were significant (P<0.05).

Averages of *Oreochromis niloticus* condition factor indicate that, the average (K) for first stocking rate was higher than second stocking rate and the differences between two stocking rates were significant (P<0.05). **Hafez (1991)**, who found a strong correlation between body weight, body length and condition factor for tilapia and carp fish.

While results of *Cyprinus carpio* indicate that, first stocking rate was higher than second stocking rate and the differences between two stocking rates were significant (P<0.05).

Results presented in Table (5) show that variation in K values were significant (P<0.05) due to the interaction between feeding regime and stocking rate. As showed in this Table, the best K values for *Oreochromis niloticus* was obtained for fish fed on artificial feeding with Biogen (2.51) at stocking rate of 4000 fish of Oreochromis niloticus and 1000 fish of common Cyprinus carpio/pond) and higher than obtained in other treatments. While for common Cyprinus carpio the best K values was obtained for fish fed on artificial feeding only (1.91) at stocking rate of 4000 fish of *Oreochromis niloticus* and 500 fish of *Cyprinus carpio*/pond) were higher than obtained for other feeding regime and stocking rate.This neerly agreed with Prabaharan and Murugan (2012).

Daily weight gain (DWG)

Concerning the effect of feeding regime on DWG for *Oreochromis niloticus* Table 6, the DWG was 1.77, 1.81 and 1.89 g/fish for three treatments T1, T2 and T3 respectively. These results indicate that, the average DWG for third feeding regime was higher than other treatments. **Khattab *et al.*, (2004)** demonstrated that, WG of Nile tilapia *O. niloticus* were significantly (P<0.05) increased with increasing Biogen level in the diet and the highest WG was recorded at 0.1% Biogen level. Also, **Bayoumi (2004)** reported that fish fed artificial diet supplemented with 2g of Biogen/kg diet exhibited highest DWG.

Concerning DWG of *Cyprinus carpio* Table 6 showed that, the third stocking rate was higher than other treatments. **Bayoumi (2004)** found that, the improvement in WG of fish in group 3 due to the growth promoter 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 enzymes and stimulate the appetite, also to the mode of action of probiotics (as one of Biogen components) which may operate by producing antibiotic substances and inhibiting harmful bacteria which altering the beneficial microbial metabolism and decrease intestinal pH**.**

On the effect of stoking rate are showing in table (6). The averages of *Oreochromis niloticus* DWG, the effect of stocking rates (4000 fish of *Oreochromis niloticus* with 500 and 1000 fish of *Cyprinus carpio*/pond) on DWG, Table 6 showed that, the DWG was 1.87 and 1.78g/fish, respectively.

Table 6: Least-square means and standard errors of the tested factors affecting Daily weight gain (DWG, g/fish) and Specific growth rate (SGR, %/d).

Variable	No.	Daily weight gain(DWG), G/fish		Specific growth rate (SGR), %/day	
		Oreochromis niloticus	*Cyprinus carpio*	*Oreochromis niloticus*	*Cyprinus carpio*
General main	120	1.82±0.38	1.69±0.38	1.80±0.42	1.67±0.42
Feeding regime (F).					
T1 (control)	40	1.77±0.30b	1.68±0.30b	1.79±0.43b	1.68±0.43b
T2	40	1.81±0.30a	1.68±0.30b	1.69±0.43c	1.62±0.43c
T3	40	1.89±0.30c	1.70±0.30a	1.93±0.43a	1.70±0.43a
Stoking rate (SR).					
SR1	60	1.87±0.31a	1.70±0.31a	1.82±0.43a	1.67±0.43a
SR2	60	1.78±0.31b	1.68±0.31b	1.79±0.43b	1.66±0.43a
F*SD					
AF*SR1	20	1.82±0.26b	1.69±0.26b	1.80±0.45b	1.68±0.45b
AF*SR2	20	1.73±0.26c	1.67±0.26bc	1.78±0.45bc	1.66±0.45bc
AFO*SR1	20	1.85±0.26b	1.68±0.26b	1.71±0.45c	1.61±0.45d
AFO*SR2	20	1.77±0.26c	1.67±0.26bc	1.67±0.45d	1.63±0.45c
AFB*SR1	20	1.95±0.26a	1.72±0.26a	1.95±0.45a	1.73±0.45a
AFB*SR2	20	1.83±0.26b	1.68±0.26b	1.91±0.45ab	1.69±0.45b

a, b, c ± Means with the same letter in each column are not significantly different (P≥ 0.05).

Averages DWG of *Cyprinus carpio* (Table, 6), The effect of stocking rates (4000 fish of Nile tilapia with 500 and 1000 fish of common carp *(Cyprinus carpio*/pond) on DWG, Table 6 showed that, the DWG was 1.70 and 1.68, respectively. These results indicate that, the average DWG for first stocking rate was higher than obtaind in the second stocking rate. The differences between the two stocking rates were significant (P<0.05). This result may be attributed to the competition between *Oreochromis niloticus* and *Cyprinus carpio* for the natural food available in the pond. These results are in agreement with the resulting of **Ibrahim *et al*., (2000) and Uddin (2007)**.

Specific growth rate (SGR)

As described in Table 6 the averages of SGR values for *Oreochromis niloticus* and *Cyprinus carpio* was 1.80 and 1.67%/day, respectively indicating that, the average of SGR for the third feeding regime was higher than other treatments matching the results of **Bayoumi (2004)** the reported that, fish fed artificial diet supplemented with 2g of Biogen/kg diet exhibited highest SGR. Moreover, the growth stimulating effect may be also attributed to the various components of Biogen, where allicin has anti- microbial properties (the product of garlic) and ginseng which could have a growth promoting ability via prevention and treatment of sub- clinical infections. The same findings were observed by **(Galal *et al.*, 1997).** Probiotics are also sometimes expected to have a direct growth promoting effect on fish either by a direct involvement in nutrient uptake, or by providing nutrients or vitamins **(Ringo and Gatesoupe, 1999)**.

Concerning the effect of feeding regime on SGR for *Cyprinus carpio* the third feeding regime was higher than other treatments.This was confirmed by **Ibrahim *et al.*, (2000)**.

Table 6 showed that, the SGR was 1.67 and 1.66%/day, respectively. These results indicate that, the average SGR for first stocking rate was higher than other treatments. **Uddin (2007)** found that, Specific growth rate of tilapia and silver carp, in polyculture system, during the experimental intervals decreased due to the interaction between first treatment (poultry litter) and increasing stocking rates. While due to the interaction between second feeding treatment and increasing stocking rate, SGR of Nile tilapia increased and SGR of silver crap decreased.

Total yield

Averages of total yield at the end of the experiment are listed in Table (7). As described in this Table, *Oreochromis niloticus* gained the highest yield 6599.00kg (100% - from all ponds) compared with 1.365.25kg– 20.69% gained by *Cyprinus carpio* (from all ponds). Treatment were as showed in this Table, as affected by *Oreochromis niloticus* Table 7, the total yield was 2174.81 (91.61%), 2050.31 (86.37%) and 2373.88 (100%) for the three treatments T1, T2 and T3 respectively. These results indicate that, the third feeding regime was higher than other treatments.

Concerning *Cyprinus carpio*, the total yields were 453.39 (93.66%), 427.82 (88.38%) and 484.05kg (100.00%), respectively. These results indicate that, the average of total yield for the third feeding regime was higher than other treatments.

(Green, 1992, Diana *et al.*, 1994; 1996, Brown *et al.*, 2000) indicates that phytoplankton may not be enough to meet protein requirement of fish or that fish could not efficiently assimilate the produced phytoplankton in these ponds. **Fath el-Bab *et al.* (2011)** reported that, These findings may be due to the fact that under organic and in-organic systems an interspecies competition on natural food occurred and this is reflected on total yield. This phenomenon appeared too

Table 7: Total yield of different fish species as affected by feeding treatments.

Variable	*Oreochromis niloticus*		*Cyprinus carpio*	
	Yield (kg)	**%total yield of the biggest value**	**Yield (kg)**	**%total yield of the biggest value**
	6599.00	100.00%	1365.25	20.69%
T1 (control)	2174.81	91.61%	453.39	93.66%
T2	2050.31	86.37%	427.82	88.38%
T3	2373.88	100.00%	484.05	100.00%
SR1	3412.68	100.00%	463.55	51.41%
SR2	3186.33	93.37%	901.71	100.00%
AF*SR1	1130.46	91.46%	152.86	47.87%
AF*SR2	1044.35	84.49%	300.53	94.12%
AF*SR3	1046.20	84.64%	145.92	45.70%
FR*SR1	1004.11	81.24%	281.89	88.28%
FR*SR2	1236.01	100.00%	164.76	51.60%
FR*SR3	1137.87	92.06%	319.28	100.00%

with other fish species through the same treatment. **Saleh (2007)** incorporated Biogen in Shrimp, *Penaeus japonicus* diets at levels of 0, 0.1, 0.2, 0.3% and he found that, at the st, 2th, nd, rd, 4th, 5th and 6th weeks from the experimental start, survival rate significantly increased as Biogen level increased from 0 to 0.1% then it decreased at level of 0.3%.

The effect of stocking rates on total yield for *Oreochromis niloticus* is shown in table 7. The total yield was 3412.68 (100.00%) and 3186.33kg (100%) for the two stocking rates SR1 and SR2 respectively. These results indicate that, the average total yield for the second stocking rate was higher than that obtaind in the first stocking rate. Analysis of variance of results indicated that the differences among treatments were significant (P<0.05). As showed in this Table, total yields of *Cyprinus carpio* were 463.55 (51.41%) and 901.91 (100.00%), SR2 and SR1 respectively. These results indicate that, the average of total yield for second feeding regime was higher than other treatments. This came in agreement with the findings of **(El-Sayed; 2002, and Eid, 2006)**, who recorded that fish survival percentage, weight gain and specific growth rate (SGR %) negatively correlated with stocking density.Moreover **Ibrahim *et al.*, (2000)** and **Uddin (2007)** reported that, The interaction between type of

Table 8: **The effect of the experimental diets on economic efficiency (LE/¼Feddan)**

Items		T1	T2	T3	T3	T5	T6
a. costs of fish fingerlings:							
C. Cyprinus carpio		880	880	880	880	880	880
G. Mullet		140	280	140	280	140	280
b. Feeds		9406.95	10100.87	9554.05	10281.83	10105.2	10701.17
c. fish rigir		0	0	489.72	615.88	0	0
d. Biogen		0	0	0	0	493.35	493.35
Total variable costs (LE/½Feddan)		10426.95	11260.87	11063.77	12057.71	11618.55	12354.52
a. Depreciation (materials&others) 10%		180	180	180	180	180	180
b. Taxes		140	140	140	140	140	140
Total fixed costs (LE/½Feddan)		320	320	320	320	320	320
Total operating costs (variable&fixed)		10746.95	11580.87	11383.77	12377.71	11938.55	12674.52
Interest on working capital *		680.15	732.93	720.45	783.356	755.56	802.14
Total costs		11427.10	12313.80	12104.22	13161.07	12694.11	13476.66
% of the smallest value		1	1.08	1.06	1.15	1.11	1.18
Total return (LE) **	CC	13760.52	13535.44	14589.89	14551.41	15396.00	14708.49
		1194.83	2480.72	1284.30	1382.28	1337.70	2666.25
	Total	14955.35	16016.16	15874.19	15933.69	16733.70	17374.74
Net return (LE/½Feddan)		3528.26	3702.36	3769.96	2772.63	4039.59	3898.08
% of the smallest value of net return		127.25	133.53	135.97	100	145.69	140.59
% Net returns to total costs		30.88	30.07	31.14	21.07	31.82	28.92

* 15% × total operating costs × 154/365 days.
** The economical evaluation of results was carried out according to market prices in 2013 in LE.
N tilapia = LE 220 /1000 fry. C Cyprinus carpio = LE 280 /1000 fry. Poultry litter = LE 690/1000 Kg. Biogen = LE 65/kg.
Fish feed (25% protein) = LE 3200 /1000 Kg.

feeding and stocking rate was found to be significant. This may indicate that for tilapia fish under the manuring system, the total yield of tilapia decreased with each increase in the stocking rate of silver Cyprinus carpio.

Economical evaluation

Table (8) shows the results of economical evaluation including the costs and returns for treatments applied in kg /½ feddan and income in (L.E) for 154 days. All of the treatments in this experiment generated a profit (Table 8). Total costs were 11427.10, (4000 *Oreochromis niloticus* and 500 fingerlings *Cyprinus carpio* fed on artificial feeding with poultry litter 65 kg/feddan/week) was higher than treatments of net returns in L.E per ½feddan. Percentages of net return to total cost were 30.88%, 30.07%, 31.14%, 21.07%, 31.82% and 28.92% for T1, T2, T3, T4, T5 and T6, respectively. These results revealed that the total cost of (T1, T2, T3, T4, T5 and T6), and a net return of T8 (4000 fingerlings *Oreochromis niloticus* and 500 fingerlings *Cyprinus carpio* fed on artificial feeding with poultry litter 65 kg/feddan/week) was the highest folowed by T3 (4000 *Oreochromis niloticus* and 500 fingerlings *Cyprinus carpio* fed on artificial feeding with 0.2%Biogen), and the lowest net return was T4 (fish fed on artificial feeding at stocking rate 4000 *Oreochromis niloticus* and 1000 *Cyprinus carpio*) when fed on artificial feeding with 0.2%Biogen.

These results indicated that, feeding of *Oreochromis niloticus* (4000 fish) in polyculture with *Cyprinus carpio* (500 fish) in earthen ponds (½ feddan) on on artificial feeding containing 25% crude protein with poultry litter 65 kg/feddan/week resulted in best Net return (4039.59LE/½ feddan) compared to the other treatments.

CONCLUSION

Based on results obtained in this study and on the economical evaluation, it could be concluded that , the use of artificial feeding 25% crude protein with poultry litter 65 kg/feddan/week of 3% of total biomass of *Oreochromis niloticus* and *Cyprinus carpio* in erthen fish ponds culture. From the economical point of view, this treatment seemed to be the best in terms of ratio of returns to feddan. The current study offers different systems for fish farming could be used in areas with limited possibilities and by the ability of each farmer material

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تأثير إضافات الأعلاف والتسميد على أداء النمو لأسماك البلطي النيلي و المبروك العادى

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تهدف هذه الدراسة هو تقييم تأثير التسميد بسبلة الدواجن، إضافات الأعلاف (بيوجين) و معدل التخزين في إنتاجية ألأحواض الترابية المستزرعة بأسماك البلطى النيلى والمبروك العادى . تم استخدام ستة أحواض ترابية، مساحة الحوض (٢١ ×١٠٠م) بمعدل تخزين٤٠٠٠ من إصبعيات البلطى النيلى لكل حوض .تم تقسيم ألأحواض الستة إلى ثلاثة مجموعات ، كل مجموعة مكونة من حوضين ترابيين، بمعدلين للتخزين مع بمعدل٥٠٠ و١٠٠٠ سمكة من اسماك المبروك العادى لكل حوض) ، تمت معاملة المجموعة الأولى عن طريق تغذية اصطناعية تحتوي على ٢٥٪ بروتين خام ، المجموعة الثانية بالتغذية الصناعية على عليقة تحتوي على ٢٥٪ بروتين مع ٠,٢ ٪ بيوجين خام وعوملت المجموعة الثالثة بالتغذية الصناعية على عليقة تحتوي على ٢٥٪ بروتين مع التسميد بسبلة الدواجن بمعدل ٦٥ كيلو جرام /اسبوع / الحوض .تم تسكين إصبعيات البلطى النيلى و المبروك العادى بمعدل وزن ١٧,٥٠ و ١٩,٣١جم على التوالى. ويمكن تلخيص النتائج المتحصل عليها على النحو التالي :

أسماك البلطى النيلى:

نظام التغذية: سجلت المعاملة الثالثة والمغذاة تغذية صناعية مع التسميد بسبلة الدواجن بمعدل ٦٥ كيلو جرام /اسبوع / الحوض أعلى معدلات من وزن الجسم، طول الجسم، الزيادة اليومية فى الوزن و معدل النمو النوعى. بينما سجلت المعاملة الثانية والمغذاة تغذية صناعية مع ٠,٢٪ بيوجين اعلى معدل من معامل الحالة.

معدلات التخزين: سجل معدل التخزين الأول (٤٠٠٠ إصبعة من أسماك البلطى النيلى +٥٠٠ إصبعية من اسماك المبروك العادى/ الحوض) أعلى معدل من وزن الجسم ، طول الجسم، والزيادة اليومية فى الوزن و معدل النمو. بينما سجل معدل التخزين الثانى (٤٠٠٠ إصبعة من أسماك البلطى النيلى +١٠٠٠ إصبعية من اسماك المبروك العادى/ الحوض) أعلى معدل من معامل الحالة.

أسماك المبروك العادى:

نظام التغذية: سجلت المعاملة الثالثة والمغذاة تغذية صناعية مع التسميد بسبلة الدواجن بمعدل ٦٥ كيلو جرام /اسبوع / الحوض أعلى معدلات من وزن الجسم، طول الجسم، الزيادة اليومية فى الوزن و معدل النمو النوعى. بينما سجلت المعاملة الأولى والمغذاة تغذية صناعية فقط اعلى معدل من معامل الحالة.

معدلات التخزين: سجل معدل التخزين الأول (٤٠٠٠ إصبعة من أسماك البلطى النيلى +٥٠٠ إصبعية من اسماك المبروك العادى/ الحوض) أعلى معدل من وزن الجسم ، طول الجسم، معامل الحالة، الزيادة اليومية فى الوزن و معدل النمو.

استنادا إلى النتائج التي تم الحصول عليها في هذه الدراسة و على التقييم الاقتصادي ، يمكن أن نخلص إلى أن أسماك البلطى النيلى و المبروك العادى يمكن استزراعهما معا في الأحواض الترابية (٤٠٠٠ إصبعة من أسماك البلطى النيلى +٥٠٠ إصبعية من اسماك المبروك العادى/الحوض) حيث تحسنت قياسات النمو فى الأسماك التى تغذت على عليقة تحتوى على ٢٥٪ من البروتين الخام مع التسميد بسبلة الدواجن بمعدل ٦٥ كيلو جرام /اسبوع / الحوض. وقد انعكست اقتصاديات هذه المعاملة على أفضل نسبة من العائدات إلى إجمالي التكاليف.