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مركز الدراسات  
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جامعة الأزهر  
مركز صالح عبد الله كامل  
للاقتصاد الإسلامي

## المؤتمر الدولي الثروة السمكية والأمن الغذائي في الدول العربية والإسلامية في الفترة من ٢٢-٢٤ أكتوبر ٢٠٠٣م

التقييم الاقتصادي لاستزراع أسماك البلطي النيلي  
في حقول الأرز تحت تأثير معاملات غذائية مختلفة

إعداد

**عبد الرحمن سلامة**

قسم الاقتصاد السمكي

المعمل المركزي لبحوث الثروة السمكية

بالعباسة محافظة الشرقية

كلية الزراعة - جامعة الأزهر - مدينة نصر - القاهرة - ت: ٤٠٢٤١٣٢ - ٤٠٢٤١٩٠ فاكس: ٤٠١١٧١٠ E-mail: azwolla@yahoo.com	مركز صالح كامل - جامعة الأزهر - مدينة نصر - القاهرة - ت: ٢٦١٠٣٠٨ - ٢٦١٠٣١١ فاكس: ٢٦١٠٣١٢ www.SAKC.gy.nu E-mail: salchkamel@yahoo.com
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## التقييم الاقتصادي لاستزراع أسماك البلطى النيلى فى حقول الأرز تحت تأثير معاملات غذائية مختلفة

عبد الرحمن سلامة

قسم الاقتصاد السمكى - المعمل المركزى لبحوث الثروة السمكية بالعباسة محافظة الشرقية- مصر .

أجريت هذه التجربة لدراسة القيمة الغذائية ومعدلات النمو والإنتاجية الكلية والكفاءة الاقتصادية لاستخدام الطحالب الخضراء المزرقة المجففة كنوع من الغذاء لأسماك البلطى النيلى المرباه فى حقول الأرز، حيث تم استخدام ثمانية أحواض مساحة الحوض واحد فدان زرعت بالأرز ، وقسمت إلى أربع مجموعات ، المجموعة الأولى استخدمت فيها الطحالب الخضراء المزرقة المجففة بمعدل 5% من وزن الأسماك أسبوعياً أما المجموعة الثانية فاستخدمت غذاء صناعى عادى (20% بروتين خام) والمجموعة الثالثة فاستخدمت التسميد ب 30 كجم زرق دواجن أسبوعياً والمجموعة الرابعة فاستخدمت كمجموعة ضابطه بدون معاملات و تم تسكين البلطى النيلى فى كل الأحواض بمعدل 1000 اصبعية بوزن ابتدائى (30 جرام) . وقد استغرقت التجربة مدة 90 يوم .

ويكن تلخيص النتائج كالتالى :

- أتضح أن مقاييس الجسم ( وزن - طول ) قد زادت بتغذية الأسماك على الأعلاف الصناعية ، كما أن الأسماك المغذاه على الطحالب المجففة قد اظهرت قيماً أكبر لهذه المقاييس مقارنة بتلك التى حصلنا عليها باستخدام التسميد العضوى وكانت الفروق بين المعاملات الغذائية ذات دلالة احصائية .
- وأظهرت النتائج ان أعلى معدل اعاشة تم الحصول عليه من المجموعة الثانية (غذاء صناعى 20% بروتين خام) تليها المجموعة الأولى (الطحالب الخضراء المزرقة المجففة) ثم الثالثة (التسميد ب 30 كجم اسبوعياً) ثم الرابعة (الضابطه) على التوالى .
- كما اظهرت النتائج زيادة الأنتاج الكلى من الأسماك للمعاملة الثانية (غذاء صناعى 20% بروتين خام) يليها المعاملات الأولى (الطحالب الخضراء المزرقة المجففة) والثالثة (التسميد ب 30 كجم اسبوعياً) والرابعة على التوالى .
- وأشارت النتائج الى وجود زيادة ملحوظة للعائد الصافى لأسماك المعاملة الأولى (الطحالب الخضراء المزرقة المجففة) يليها أسماك المعاملات الثالثة (التسميد ب 30 كجم اسبوعياً) والثانية (غذاء صناعى 20% بروتين خام) والرابعة على التوالى .

**ECONOMICAL EVALUATION OF NILE TILAPIA  
(*Oreochromis niloticus*) CULTURE IN RICE FIELDS RECEIVING  
VARYING FEEDING INPUTS.**

**BY**

**Abdel- Rahman A. Salama**

Department of fish Economic, Central Laboratory for Aquaculture Research at  
Abbassa, Sharkia Governorate, Egypt.

**Key words:** Nile tilapia, productivity, Rice fish culture . Blue green algac, Economical efficiency.

**ABSTRACT**

This study aimed to evaluate the nutritive value, growth parameters, productivity and economical efficiency of dried Blue green algae for feeding Nile tilapia (*Oreochromis niloticus*) cultured in rice fields. Eight rice fields (one fed. each) were cultivated by rice and divided into four groups, the first group of two fields with dried Blue green algae at a rate of 5% of body weight per week, and the second one was fed on artificial diet containing 20% crud protein. The third group was fed on natural food resulting from fertilization only (30 Kg. chicken manure/week) and the fourth group has served as a control (without any treatment). All fields were stocked with Nile tilapia (1000 fingerlings/fed.) with average weight of 30 g. The growing season for tilapia fish was 90 days. Results obtained can be summarized in the following:

- Treatments applied had significant effect on final body weight, specific growth rate, body length and condition factor of Nile tilapia.
- The highest survival rate was obtained with group of fish on T<sub>2</sub> followed by T<sub>1</sub>, T<sub>3</sub>, T<sub>4</sub> treatments respectively
- The highest net production was recorded with group of fish on T<sub>2</sub> followed by T<sub>1</sub>, T<sub>3</sub> and T<sub>4</sub> treatments respectively.
- The highest net return was recorded with group of fish on T<sub>1</sub> followed by T<sub>3</sub>, T<sub>2</sub> and T<sub>4</sub> treatments respectively.

## INTRODUCTION

In 1998, only 12440 tons of fish were produced from 23360 feddan (rice fish integrated system) and this contributed only 2.28% of the total Egyptian fish production (Abdel-Hakim *et al.* 2000a).

In aquaculture, feed is the most expensive cost item, commonly contributing between 40-70% of total variable expenses. Protein is the principal and most expensive component of the diet, where the protein sources in tilapia feeds comprising 55-75% of the dietary material cost. Consequently protein cost is usually given the first priority in formulating fish feeds (Hanley, 2000).

Average body weight of Nile tilapia (*Oreochromis niloticus*) culture in rice fields has been increased from 4.08 to 81.97g. and the rice yield increased by 148 Kg/feddan beside 77.9 Kg. fish/feddan (Abdel-Hakim *et al.* 2000). Mohamed Bakeer *et al.*,(2003), reported that the grass carp(25 g.) which fed on Blue green algae plus Lucerne (5% of body weight/5days a week for 150 days) cultured in earthen pond recorded the highest final body weight and specific growth rate (SGR). The total fish production in rice fields is about 20,000 tons as reported by GAFRD(2001).

The objective of the present study is to evaluate the technical and economic feasibility of cultivating Nile tilapia in rice fields under varying feeding systems.

## MATERIALS AND METHODS

### **Location:**

The present study was carried out in a private rice farm, at Abbassa village, Abu-Hammad, Sharkyia Governorate, Egypt.

### **Facilities and fish:**

Eight rice fields (one fed. each) were cultivated by rice and divided into four groups. the first group of two fields was fed with dried Blue green algae at a rate of 5% of body weight per week, and the second one was fed on artificial diet (20% crud protein). The third group was fertilized on only with 30 Kg. chicken manure/weekly and the fourth group served as control (without any treatment). Rice fields were prepared with ditches in the middle of the pond with a depth and width of 0.75 x 0.50 m, respectively. Screens were fixed at the end of the canals to prevent fish from escaping or the entrance of foreign fishes into rice fields. Rice was cultivated in the field at first 30 days, and then transplanted in the permanent rice fields. After 7 days of rice transplantation all ponds were stocked with Nile tilapia fingerlings at a density of 1000 fingerlings/feddan with an average initial weight of 30 g. The growing season for tilapia fish was 90 days.

### **Experimental diet**

Application of chicken manure at a rate of 300 kg/ feddan was carried out before rice transplantation. During the growing season, the third group received 30 Kg. chicken manure/week. The second group was fed on pellets containing 20% crude protein at a rate of 2% daily of fish biomass. Feeding rate of artificial diet was recalculated and adjusted biweekly according to the change in fish biomass as assessed by fish sample. The food pellets were applied once a day for 5 days a week by broadcasting the pond surface near the supply gate. No pesticides were used during the entire experiment. The experimental diet was chemically analyzed according to the methods of AOAC (1990). The chemical compositions of experimental diets are shown in (Table 1 a, b, c.)

### **Growth performance parameters:**

Live body weight and length of a random sample of 150 fish from each pond were taken at start and every 15 days and were recorded till the termination of the experiment. The fish were netted from the water and weighed to the nearest gram. Standard length of fish was measured at the beginning and at the end of the experimental period to the nearest mm. Then the fish were returned immediately to their ponds.

### **Samples and measurements:**

Water temperature, dissolved oxygen and pH were measured daily at 6<sup>00</sup> a.m. and 12<sup>00</sup> p.m. using temperature and dissolved oxygen meter (YSI model 57) and pH meter (model Corning 345). Determinations of water quality parameters (alkalinity, phosphorus and ammonia) were carried out every two weeks according to the methods of Boyd (1979). Phytoplankton and zooplankton communities in pond water were determined every two weeks according to the methods described by Boyd (1990) and A.P.H.A (1985). Samples were collected from different sites of the trench center randomly to represent the water of the whole rice fields. Parameters of specific growth rate (SGR) and condition factor (K) were calculated according to the following equations: Specific growth rate (SGR)  $SGR\% = 100(\ln W_2 - \ln W_1) / (T_2 - T_1)$  (Bagenal and Tesch, 1978) Where  $W_1$  and  $W_2$  are the first and following fish weight in grams,  $\ln$  is the natural logarithm and  $T$  is the growing period in days.

Condition factor (K):  $K = \text{weight g} \times 100 / \text{length cm}^3$  (Hopkins, 1992)

Where  $W$  and  $L$  are the individual weight and length of the fish.

After 90 days of fish culture, tilapia was harvested from each field and a sample of 30 fish was randomly taken for body weight and body length measures. The rice was harvested after 120 days of sowing.

### **Statistical analysis:**

The statistical analysis of data was carried out by applying the computer program of Harvey (1990).

## **RESULTS AND DISCUSSION**

### **Water Quality parameters:**

Results of water quality parameters of paddies as affected by receiving varying feeding inputs during the experimental period (90 days) as averages of the monthly samples are summarized in table (2) In general, water temperature of the different treatments were 26.55; 26.16; 28.00 and 25.00 °C. for T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub>, respectively The least value 25.00 °C was for T<sub>4</sub> (control) and the highest (28.00C) was for T<sub>3</sub> (fertilization). The higher difference in water temperatures in fertilized fields may be attributed to the increased organic matter contents of these fields that may lead to temperature increases. These results are in agreement with those of Boyd, (1983); Jobling, (1983) and Abdel -HaKim *et al.*, (2000), who found a slight increase in water temperature with increasing manure and the optimum temperature ranged between 15 and 30°C for Nile tilapia (*Oreochromis niloticus*).

The concentration of dissolved oxygen (mg/L) for T<sub>3</sub> and T<sub>4</sub> ranged between 6.12 and 7.00 mg/L. These values are beneficial to fish cultivation and indicate that water dissolved oxygen was slightly decreased in fertilized fields compared to the other fields. These results are in agreement with Boyd, (1992), who reported that levels of dissolved oxygen above 4 ppm is considered a limiting, below which, fish may live but can not feed or grow well. Averages of available phosphorus ranged between 0.10 and 0.13 mg /L which represent the normal range of phosphorus in rice fish fields. This range was found to be suitable for growth of fish as reported by Fortes *et al.*, (1986) and Boyd *et al.*, (1981). Nitrite (No<sub>2</sub>) concentrations were higher in T<sub>3</sub> (fertilizer) than the other treatments, which may be due to the accumulation of nitrogen from the fertilizer in the ditch (Boyd, 1990).

The average concentration of unionized ammonia (NH<sub>3</sub>) (Table 2) ranged between 0.53 and 0.68 ppm for T<sub>4</sub> and T<sub>3</sub>. The increase in the total ammonia observed in fertilized treatment may be due to decomposition of the heavy organic load of the unexploited blue green algae which fall to the bottom of the ditches after death. The European Inland Fisheries Advisory Commission, (1993) reported that the toxic level of NH<sub>4</sub> to fish is 2 mg/L.

Averages of pH values for the treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 9.2, 9.0, 8.1 and 9.41, respectively. The lower values of pH in fertilized paddies may be attributed to the increase in organic matter contents of

these paddies, which may lead to lower pH levels. The acid and alkaline death points were found between pH 4 and 14 (Swingle 1961 and Calabrese 1969).

The values of the total alkalinity ranged between 301 and 335 ppm for T<sub>4</sub> and T<sub>3</sub>. The above results showed that all parameters of water quality were in the suitable range, however fish with T<sub>4</sub> (control) recorded minimum levels of NO<sub>2</sub>, NH<sub>3</sub> and alkalinity and the highest levels of DO and pH.

The average values of most water quality parameters were very close for T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>.

### **Phytoplankton**

As shown in table (3) the total phytoplankton counts for treatments T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub> were 5094, 3673, 4926 and 4532 organisms ML<sup>-1</sup>, respectively on the average. The phytoplankton total counts increased in water samples collected from T<sub>1</sub>, T<sub>3</sub> and the differences were highly significant ( $P < 0.01$ ) and ( $p < 0.001$ ) for the abundance of phytoplankton groups (Chlorophyta, Cyanophyta and the total phytoplankton organisms). These results could be explained by the fact that chicken manure and decomposed Blue green algae have more fertilization potential compared with other treatments. Table (1) revealed that chicken manure contains 1.64% nitrogen and 0.29% phosphorus and also the decomposed Blue green algae contain 0.27 % (K) and 0.89% phosphorus which may reflect the better fertilization potential of Blue green algae and chicken manure, respectively.

The present study indicates that Chlorophyta was the dominant group followed by Cyanophyta and Bacillariophyta in the all treatment paddies. The community composition of phytoplankton reported in this study is in accordance with the findings of EL- Serafy and EL- Zahaby (1991) and Abdel-Hakime *et al* (2000)<sup>a and b</sup>, who pointed out that Chlorophyta predominated all the other groups followed by Cyanophyta and Bacillariophyta.

Table (3) also shows that the average number of zooplankton organisms per liter were higher in water samples of T<sub>1</sub> and T<sub>3</sub> and the differences were significant for Copepoda, Cladocera and total zooplankton organisms per liter. The present study indicates that Rotifera is the dominate group followed by Copepoda and Cladocera in all fields. This community composition of zooplankton is in conformity with observations of Abdel-Hakim *et al*, (2000)<sup>a and b</sup>.

The present study indicates that the community composition of phytoplankton and zooplankton in all treatment ponds fluctuated greatly with temperature, fertilization and feeding habits of fish. In this concern,

Riely (1947), reported statistically that no strict relationship between the total zooplankton and the total phytoplankton numbers.

### **Growth performance**

As described in Table (4), the average body weight of Nile tilapia increased from 30.12 to 108.10; 120.70; 91.71 and 78.13 g. for T<sub>1</sub>; T<sub>2</sub> T<sub>3</sub> and T<sub>4</sub>, respectively. Daily gain (g) was between 6.53 and 1.00g. These values were higher than obtained by Mang-Umphun and Arce (1988); who found that, under the integrated rice fish system, the body weight of Nile tilapia increased from 8.3-8.59 to 33.78-36.69 g. during 75 days rice fish culture period, where fields were supplied with inorganic fertilizers. Table (4) also shows that the body length of Nile tilapia increased from 6.24 to 13.70; 14.95; 12.96 and 10.96 cm. for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. After 90 days of culture in rice fields and the values of fish condition factor recorded 4.20; 3.61; 4.2 and 5.91 for T<sub>1</sub>, T<sub>2</sub>, and T<sub>3</sub> and T<sub>4</sub> respectively. Specific growth rate (SGR) recorded 1.4; 1.5; 1.2 and 1.05 for T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub> respectively. These values are in agreement with that reported by Sadek, (1986), Haroon and Pittman (1997) and Sadek, (1998), who found that SGR of Nile tilapia was 1.8 when cultured in paddies. The high value of daily gain and the other growth traits found in this study may be attributed to the presence of the natural food organisms enhanced by the fertilization of the paddy environment which served as a direct source of food for Nile tilapia (Chapman and Fernando, 1994).

Table (5) shows that, rice yields in the present study were 2640; 2560; 2544 and 2440Kg./feddan for T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub>, respectively. So approximately about 5-10% increase in rice yield was achieved as a result of the integration of fish in rice baddies. The increase in rice yield is in agreement with that obtained by EL-Bolok and Labib (1967), who found that the rice yield increased, by 5-7% in rice fields. As illustrated in Table (5) the fish yields were 102.69; 115.87; 85.29 and 75.66 Kg. for T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub>, respectively. The fish yield in the present study was higher than that obtained by Haroon and Pittman (1997) and Abdel-Hakim *et al* (2000)<sup>b</sup> who found that the total fish yields of Nile tilapia were 59.4 and 158.2 kg/ha when there initial weights were 3.1 and 30.7, respectively. (Li, 1992), they reported that fish yields vary from 50 kg/ha to 2.25 tons/ha, depending unsystematically on country, fish species, density, fish diets and other factors.

### **Survival Rate**

As shown in table (5) survival rate were 95; 96; 93 and 92%, for T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub>, respectively. These results are in agreement with Perez-Athanasiadis and Bellido- de Cedeno (1989), who obtained 90% survival

rate for Nile tilapia in rice culture fields, while Haroon and Pittman (1997) found a survival rate from 66.4 to 65.6% for Nile tilapia in paddies for 78 days.

### **Economic Efficiency.**

Table (5) shows the results of economical evaluation including the costs and returns for treatments applied in kg./ feddan and income in (L.E) for 90 days. Total costs were 1293; 1675; 1350 and 1275 L.E /feddan for the T<sub>1</sub>; T<sub>2</sub>; T<sub>3</sub> and T<sub>4</sub>, respectively. These results revealed that the total cost of T<sub>2</sub> (diet with 20% protein) was the highest than other groups. On the other hand, the total cost of T<sub>4</sub> (without treatment) was the lowest due to the absence of input costs. Net returns in L.E per feddan were 1860.45; 1463.35; 1620.45 and 1524.3 for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, respectively.

Percentages of net return to total cost for treatments cited above were 143.8; 87.36; 120.03 and 119.55% for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> respectively, indicating that the highest returns were obtained with the group T<sub>1</sub>(Blue green algae at a rate of 5% of body weight per week) and T<sub>3</sub>( fertilized with 30 kg. chicken manure/weekly).

### **Recommendation**

Based on the obtained results, the use of dried Blue green algae in rice fish culture could be recommended for Nile tilapia (weighing 30g) and the feeding rate was 5% of fish body weight every week.

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**Table (1): The chemical analyses of experimental diets for Nile tilapia in rice fish culture.**

<b>(A): Analyzed % of Blue green algae</b>					
Crude protein	Ash	Vitamin C mg/100g	k	P	
9.62	48.17	3.5	0.27	0.89	
<b>(B): Analyzed % of Chicken manure</b>					
Crude protein %	Carbon %	Nitrogen %	Phosphorus %	C:N Ratio	N:P Ratio
9.83	38.39	1.64	0.29	23.41	5.66
<b>(C): Composition of the artificial diet 20% protein</b>					
Ingredients				Diet %	
Yellow corn				36	
Wheat bran				20	
Fish meal (72.3% C.P)				5	
Soybean meal (44% C.P)				6	
Rice bran				14	
Decorticated Cotton Seed Meal				11	
Poultry Slaughter by- Products				5	
Vitamin premix*				1.5	
Mineral mixture**				1.5	
Total				100	
<b>Calculated diet composition as fed</b>					
Protein%				20	
Gross energy k cal/kg Diet***				3198	
<b>Analyzed % on dry mater basis</b>					
Moisture				10.20	
Crude protein(C.P)				20.08	
Ether extract (E.E)				6.54	
Crude fibers				6.72	
Ash				6.06	

\*Each gram of vitamin premix contains 20,000IU vit. A, 2000IU vit. D3, 400 vit. E, 20 mg Niacin, 4.5 mg riboflavin, 3 mg pyridoxine, 0.013 mg vit. B12, 100 mg chorine chloride and 2 mg. vit. K.  
 \*\* Each gram contains 0.83 Ca, 0.63P, 0.78 Na, 0.018 Mn, 0.011 Zn and 0.001 Cu. The Mixture was prepared by mixing 35 parts of dicalcium phosphate, 3 parts of mineral premix and 2 parts of common salt.

\*\*\* According to Jobling. (1983).

Table (2): Average water quality parameters at paddies during the experimental Period (90 days).

samples	No of samples	T <sub>1</sub> Blue green algae	T <sub>2</sub> Diet (20% C.P)	T <sub>3</sub> Fertilization	T <sub>4</sub> (control)	Averages
Temp C	15	26.55 G±1.57	26.16± 0.88	28± 0.33	25± 1.20	26.42 ± 0.99
Dissolved oxygen (mg/l)	15	6.42 ±0.44	6.15± 0.76	6.12± 0.44	7.00± 0.57	6.42± 0.55
Total phosphor (mg/L)	15	0.73 ±0.24	0.51± 0.16	0.81± 0.06	0.43± 0.01	0.62 ± 0.11
Available phosphorus (mg/L)	15	0.21± 0.08	0.10± 0.01	0.24± 0.01	0.31± 0.05	0.21± 0.03
No (mg/L)	15	0.39 ±0.06	0.34± 0.02	0.58± 0.04	0.28± 0.03	0.39± 0.03
NH <sub>4</sub> (mg/L)	15	0.58 ±0.12	0.67± 0.02	0.78± 0.4	0.53± 0.1	0.64± 0.16
PH	15	9.2 ±0.13	9.0± 0.02	8.1 ± 0.23	9.41± 0.12	8.9± 0.12
Alkalinity	15	323 ±50.8	308± 50.2	335± 40.8	301± 50.7	316.75± 48.12

**Table (3): Least square means and standard errors for plankton abundance in all experimental groups.**

Treatments	Phytoplankton (Organisms) L			
	Chloro phyta	Cyan ophyta	Bacill arophyta	Total. phyto plankton
	***	**	**	***
Tr <sub>1</sub>	2493±60.3	1380±30.5	1221±31.0	5094±105.3
Tr <sub>2</sub>	1850±60.3	1013±30.5	810±31.0	3673±105.3
Tr <sub>3</sub>	2481±60.3	1335±30.5	1110±31.0	4926±105.3
Tr <sub>4</sub>	2431±60.3	1211±30.5	890±31.0	4532±105.3
Treatment	Zooplankton (Organisms)L			
	Rotifer	Copepod	Cladocera	Total zooplankton
	**		**	***
Tr <sub>1</sub>	1452±	898±35.5	672±29.1	3022±107.3
Tr <sub>2</sub>	1350±29.3	818±33.5	515±29.1	2683±107.3
Tr <sub>3</sub>	1412±29.5	891±33.3	650±29.1	2953±107.3
Tr <sub>4</sub>	1352±29.5	898±33.3	672±29.1	2839±107.3

+ Mean of 12 samples (2 replicates and 6 samples for each replicate)

\*\* P<0.01    \*\*\* P<0.001

**Table (4): Growth performance of Nile tilapia (*Oreochromis niloticus*) as affected by varying feeding inputs.**

Treatments	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Initial Body Weight (g)	30.12	30.12	30.12	30.12
Final Body weight (g)	108.10±1.38	120.70±1.48	91.71±1.50	78.13±1.35
Weight gain (g)	77.98	90.58	61.59	48.01
Daily gain (g)	0.86	1.00	0.68	0.53
Initial Body length	6.24	6.24	6.24	6.24
Final Body length cm	13.70±0.71	14.95±0.71	12.97±0.71	10.97±0.70
Condition factor (K)	4.20 ±0.23	3.61±0.12	4.2±0.20	5.91±0.36
S.G.R	1.4	1.5	1.2	1.05

**Table (5): Economic efficiency (%) for Nile tilapia (*Oreochromis niloticus*) as affected by varying feeding inputs.**

Item	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Stocking data				
Stocking rate (No / fed)	1000	1000	1000	1000
Average size at stoking (g)	30	30	30	30
Average size at harvesting	108.10	120.70	91.71	78.13
Survival rate %	95.0	96.0	93.0	92.0
Production Kg. /fed.				
Rice	3300	3200	3180	3050
Fish	102.69	115.87	85.29	75.66
<b>A- Operating costs</b>				
Fish fingerlings	100	100	100	100
Rice seeds	75	75	75	75
Food	-	400	-	-
fertilization	-	-	75	-
Labor	500	500	500	500
Blue green algae	18	-	-	-
Land renting	600	600	600	600
Total costs/feddan	1293	1675	1350	1275
<b>B- Returns</b>				
Rice	2640	2560	2544	2440
Fish	513.45	578.35	426.45	359.35
Total Returns / Fed	3153.45	3138.35	2970.45	2799.35
Net returns	1860.45	1463.35	1620.45	1524.3
<b>C-% Net returns to operating cost</b>				
	143.8	87.36	120.03	119.55

The economical evaluation of results was carried out according to market prices in 2002 in L.E.