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EFFECT OF STOCKING RATE AND ORGANIC FERTILIZATION ON THE GROWTH PERFORMANCE OF TILAPIA AUREA (*Oreochromis aureus)*

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ABSTRACT

This study was carried out to investigate the effect of stocking rate of tilapia aurea (*Oreochromis aureus*) and fertilization rate on the growth performance , water quality in 18 earthen ponds (1000 m^2 / pond) representing two stocking densities (1500 and 2000 fish per pond) along with three manuring rate (150,250 and 350 kg chicken manure / fedden) . Average initial weight was 65.8 g /fish .Results obtained can be summarized as follows :

1-Regardless of stocking tensity, increasing the fertilization rate from 150 to 350 kg /feddan increased significantly ($p< 0.05$)the body weight and length during all experimental periods .On the other hand ,increasing the stocking density from 1500 to 2000 fish / pond decreased significantly body weight and length .

2-Treatments applied released significantly effects on carcass trait tested .

3-The average of water quality parameters as affected by treatments during the present study within the range recommended for fish cultured.

Based on the results obtained it could be recommended that, the using of chicken manure 350 / feddan weekly with stocking density 1500 tilapia aurea /pond , had the higher yield and carcass quality

Keywords . *Oreochromis aureus* ,Organic fertilizer , Stocking rate , Poultry manure.

INTRODUCTION

The purpose of pond fertilization in aquaculture is to stimulate phytoplankton productivity to provide natural foods for culture organisms (schroeder *et al.*, 1990).Pond fertilization supplies soluble nitrogen, phosphoeus and carbon for algal uptake and growth, while the availabilities of sufficient solar radiation and appropriate temperatures are functions of weather, pond location, and pond turbidity. The use of animal manures has resulted in relatively high fish production without the use of feeds (Schnoonbee *et at.*, 1979). Bhanot and Vass (1976) used chicken manure to culture Daphnia as forage. The use of manures in fish farming has been reviewed by Wohlfarth and Schroeder (1979). They found that the best results were obtained when manure was applied to ponds in frequent applications .

Rapid growth rates, high tolarance to low water quality, efficient food conversion, ease of spawning , resistance to diseases, and good consumer acceptance make tilapia a suitable fish for culture(Santiago and Laron,2002).

The tilapias are an increasing important group of cultured fishes . Nevertheless, our understanding of the nutritional requirements of tilapias under practical culture conditions, and studies which attempt to reduce the cost of production are lacking. Therefore, the present study was undertaken to investigate the effect of varying rates of organic fertilizer and different stocking densities on the growth performance, carcass quality of tilapia fingerlings and water quality of earthen ponds . It may be also contributd to improre aquaculture management practices and increasing fish farm profitability.

MATERIALS AND METHODS

Pond management procedures

Eighteen earthen ponds of $1000m^2$ each, located at Wady El-Nitron, El-Behera governorate, were used in this study . The water exchange was minimal, in amounts needed to compensate for water seepage and evaporation pond management procedures for manuring with chicken manure at150, 250and 350 kg / feddan weekly each in two treatments cultured with 1500 and 2000 tilapis aurea *Oreochromis aureus* .

The experimental treatments were follows

T_1S_1 =1500 fish/pond +150 kg chicken manure /feddan (T_1)
T_1S_2 = 2000 fish/pond +150 kg chicken manure /feddan (T_2)
T_2S_1 =1500 fish/pond +250 kg chicken manure /feddan (T_3)
T_2S_2 =2000 fish/pond +250 kg chicken manure /feddan (T_4)
T_3S_1 =1500 fish/pond +350 kg chicken manure /feddan (T_5)
T_3S_2 =2000 fish/pond +350 kg chicken manure /feddan (T_6)

Stocking of fish

Nile tilapis reared in earthen ponds (1000 m^2 / pond) at a density of 1.5 or 2 fish / m^3 (65 g / fish). Fish were counted indivually during stocking which was performed late in the afternoon .

Fish sampling and harvesting

Fish were sampled at biweekly intervals and weights and length of 150 fish of each treatment were measured. All ponds were completely harvested after 3 months of rearing period, first by seine net and then by draining out of the ponds .All fish of each pond were counted and measured for weight individually to assess the production .

Experimental ponds and water quality measurements :

Experimental ponds were supplied with ground water contains about % 5.3 ppt salinity . the water remained static, except for periodic replacement to the off set evaporation (= 2 % or the volume / day) . Water temperature, dissolved oxygen levels and pH measurements were taken through the mid – afternoon period twic weekly for the 3 months duration of the trial (May 2005 to July 2005) the range of values for these parameters through out the trial were 30.0- 30.7c° , 4.7- 6.0 ppm and 8.5- 8.9, respectively. Dissolved oxygen (mg/l) and pH were measured directily by using a digital dissolved oxygen meter (Model YSI- 58, USA) and pH meter (Jenway model- 3020) . respectively. Transparency (cm) was measured with Scchi disc of 1 m diameter, daily .

Pond fertilization:

The amount of natural food in the experimental ponds were established by applying dried poultry manure as organic fertilizer (2.6 % total nitrogen , 2.01 % total phosphorus and 21.07% organic matter) . Manure was spread over the pond weekly at rates of 150 , 250 and 350 kg / feddan . At each application level both stocking densities of tilapis aurea were cultured each in three replicates (each treatment contained 3 ponds).

Carcass traits:

Samples of fish were weighed individully ,then the head, fins, skin, vescira and skeleton were removed and then weighed to the nearest gram. The remaining flesh were obtained from each individual to calculate drasing percentage according tc carcass test as described by Lovell (1981) as follow :

$$\text{Dressing percentage} = \text{Weight of the flesh} / \text{Body weight} \times 100$$

Statistical analysis :

All collected data were analyzed using the SAS ANOVA procedure (Statistical Analysis Systems Institute Inc, 1988). Differences among means were tested for the significance according to Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

Growth performance :

Table (1) show that increasing of stocking rate of tilapia aurea *Oreochromis aureus* decreased body weight of the fish . These results may due to the decreasing in the production of natural food (phytoplankton and zooplankton) . Teichert – coddington *et at* . (1990) , Diana *et at*. (1991) , Abdel-Wares (1993) and Soltan (1998) found that , final body of *Oreochromis niloticus* decreased with increasing stocking rate, but the net yeild was increased.The negative correlation between growth rates and stocking density of Nile tilapia has been investigated by a number of authors. Macintosh and De silva (1984) and Sayed *et al* . (2004) reported that increasing stocking density of *O.mossambicus* and *O. niloticus* might have lead to diminishing social dominance, leading to higher yield but lower individual growth rates (as found herein in T_2 ,T_4 and T_6 groups) . It has also been reported that increasing fish density leads to social stress causing chronic stress response. This leads in turn to impaired fish growth, presumably due to the mobilization of dietary energy by the physiological alterations provoked by the stress response (Kebus *et al* , 1992) . Also , Miguel *et al.* (2005) found that, cuttlefish culture at the lower density grew more than those ones cultured at the higher density. Hence the differences in growth in the present study could be explained by the different culture denities and higher fertilization in T5 group .

Mean lengths of fish in the various treatment groups were significantly influenced by frtilization concentration and decreased stocking density (Table2). Chicken manure is an organic fertilizer which is usually applied during pond preparation to stimulate benthic algal growth. Aside from providing nutrients for algal, it is directly eaten by fish, zooplankton and bottom fauna in the ponds (Schroeder , 1974) . Biweekly gains in weight and body length were inversely related to stocking rate,as already noted by Forster and Beard (1974) .

Table (1) : Effect of stocking densities and chicken manure rate on body weight (g) of Tilabia *Oreochromis aureus* (Mean± S .E) .

Period(week) / Treatments	0	2	4	6	8	10	12
T_1S_1	65.80±1.61a	71.51±3.20 b	80.65±2.61 b	95.02±5.02 b	117.10±6 30 c	135.7±4.12 c	168.90±4.55 b
T_1S_2	65.80±1.61a	70.33±3.20 b	76.28±2.61 b	86.30±5.02 b	95 25±6.30 d	116 05±4.12 d	133.18±4.55 c
T_2S_1	65.80±1.61a	78 72±3.20 ab	87.11±2.61 ab	104.07±5.02 ab	132.60±6 30 ab	165.19±4.12 ab	203.20±4.55 ab
T_2S_2	65.80±1.61a	72.17±3.20 b	85.30±2.61 b	105.31±5.02 ab	114.02±6.30 c	142.30±4.12 c	171.16±4.55 b
T_3S_1	65.80±1.61a	88.50±3 20 a	92 72±2.61 a	113.78±5.02 a	142.00±6.30 a	183.07±4.12 a	230.82±4.55 a
T_3S_2	65.80±1.61a	75.20±3.20 ab	87.00±2.61a b	104.30±5.02 ab	125 11±6.30 b	151 08±4.12 b	182.36±4.55 b

a , b , c and d : Values in the same column having the same superscript letters are not significantly different ($p > 0.05$)

Table (2) : Effect of stocking densities and chicken manure rate on body length (cm) of Tilabia *Oreochromis aureus*(Mean± S .E) .

Period(week) / Treatments	0	2	4	6	8	10	12
T_1S_1	14.70±1.13 a	15.66±2.01 a	16 02±1.69 b	17.81±2.03 ab	19.40±1.93 ab	22.24±2.25 a	24.17±3.02 a
T_1S_2	14.70±1.13 a	15.07±2.01 a	15.32±1.69 b	16.95±2.03 b	17.63±1.93 b	18.80±2.25 b	20.55±3.02 b
T_2S_1	14.70±1.13 a	15.50±2.01 a	16.82±1.69 ab	18.11±2.03 a	19.90±1.93 ab	20.45±2.25 ab	23.30±3.02 ab
T_2S_2	14.70±1.13 a	15.15±2.01 a	15.72±1.69 b	17.45±2.03 b	20.31±1 93 ab	20.40±2.25 ab	20.91±3.02 b
T_3S_1	14.70±1.13 a	15.19±2.01 a	17 05±1.69 ab	18.20±2.03 a	22.19±1.93 a	22.43±2.25 a	24.60±3.02 a
T_3S_2	14.70±1.13 a	15.32±2.01 a	18.20±1 69 a	19.33±2.03 a	21.88±1.93 a	21.95±2.25 a	23.35±3.02 ab

a and b: Values in the same column having the same superscript letters are not significantly different ($p > 0.05$)

Also, live weight and length were strongly affected by the fertilization rate,indicating that fertilization and low stocking rate delayed the consumption of higher food availability. The experimental data and corresponding growth rate fitted using relative body weight and daily gain are present in Tables (3) and (4) . Higher values were obtained when ponds receiving 350kg / feddan poultry manure with lower stooking density (1.5 fish /m^3) .

Pond fertilized with 350kg / feddan weekly had higher concentration of natural food . Therefore, increased fish production can be attributed to a greater availability of suitable plankton for fish food at lower stocking density. Larger density of phytoplankton were present in T1S1 , T2S2 and T3S1 ponds increased fish yield with high marketable size of fish which increased the economic efficiency of using 350kg poultry manure per feddan weekly at lower stocking density (1.5 fish /m^2). Condition factor (K values) is close to 1.0 , wheras departure from 1.0 mean either increasing stocking rates or decreasing weight gain (Hernandez *et af* , 1995). The results obtained in the present study indicated that K values were better at a low density when the ponds were fertilized by 350 kg organic fertilizer per feddan weekly (Table 5) .

Increasing stocking rate showed a significant effect on dressing percentage of fish (Table 6) . The same trend was observed with flesh weight percentage where the treatments applied had insignificant effect on this parameter at lower
stocking density with lower fertilization (150 kg / feddan weekly) . As evident in Table (6) , the by- product value was increased with lower growth of fish (T2 group). The yield data for ponds receiving high level of fertilizer (350kg chicking manure per feddan) reflected on the role of natural productivity for maximization the growth rate and the pest yield of production .

This study showed that ammonia level in T5 and T6 ponds were higher, this would remove dissolved oxygen but under the condition oprating in these ponds it was not affecting on fish growth because the levels of the most critical water quality parameters, ammonis and dissolved oxygen , were kept within the reasonable limits by metabolic activity of the phytoplankton . Thus the fish were never subjected to intermediate levels ammonia for long periods of time (Table 7).

The water temperature, dissolved oxygen , pH, salinity and ammonia recorded during this trait (were within the optimum range for the tilapia culture (Philippart and Ruwet, 1982).

Table (3) : Effect of stocking densities and chicken manure rate on relative growth rate of Tilabia *Oreochromis aureus* (Mean± S .E) .

Period(week) Treatments	0 - 2	2 - 4	4 - 6	6 - 8	8 -10	10 - 12
T_1S_1	8.68±0.41 c	12.78±1.07 ab	17.82±1.52 b	23.24±1.90 ab	15.88±1.83 c	24.47±2.30 a
T_1S_2	6.88±0.41 d	8.46±1.07 c	11.61±1.52 c	10.37±1.90 c	21.84±1.83 b	14.76±2.30 b
T_2S_1	19.63±0.41 ab	10.66±1.07 b	19.47±1.52 ab	27.41±1.90 a	24.58±1.83 ab	23.01±2.30 a
T_2S_2	9.68±0.41 c	18.19±1.07 a	23.46±1.52 a	8.27±1.90 d	24.80±1.83 ab	20.28±2.30 ab
T_3S_1	34.50±0.41 a	4.77±1.07 d	22.71±1.52 a	24.80±1.90 a	28. ±1.83 a	26.14±2.30 a
T_3S_2	14.29±0.41 b	15.69±1.07 ab	19.88±1.52a b	19.95±1.90 b	20.76±1.83 b	20.70±2.30 ab

a , b , c and d : Values in the same column having the same superscript letters are not significantly different (p >0.05)

Table (4): Effect of stocking densities and chicken manure rate on daily gain (g / fish) of Tilabia *Oreochromis aureus* (Mean± S .E) .

Period(week) Treatments	2	4	6	8	10	12
T_1S_1	0.41±0.01 c	0.65±0.03 b	1.03±0.12 c	1.58±0.10 b	1.33±0.19 f	2.37±023 c
T_1S_2	0.32±0.01d	0.43±0.03c	0.72±0.12d	0.64±0.10d	1.49±0.19 e	1.22±023 e
T_1S_1	0.92±0.01 ab	0.60±0.03b	1.21±0.12 b	2.04±0.10 a	2.33±0.19 b	2.72±023 b
T_1S_2	0.46±0.01 c	0.94±0.03 a	1.43±0.12 a	0.62±0.10 d	2.02±0.19 c	2.06±023 d
T_1S_1	1.62±0.01 a	0 30±0.03d	1.50±0.12 a	2.02±0.10 a	2.93±0.19 a	3.42±023 a
T_1S_2	0.67±0.01b	a 0.84±0.03a	1.24±0.12 ab	1.49±0.10 c	1.85±0.19 d	2.23±023 c

a ,b ,c ,d ,e and f :*Values in the same column* having the same superscript letters are not significantly different (p >0.05)

Table (5) : Effect of stocking densities chicken manure rate on condition factor of Tilabia *Oreochromis aureus*(Mean± S .E) .

Period(week) Treatments	0	2	4	6	8	10	12
T_1S_1	2.07±0.12	1.86±0.20 c	1.96±0.18 a	1.68±0.11 c	1.60±0.07 a	1.23±0.09 d	1.20±0.05 d
T_1S_2	2.07±0.12	2.11±0 20 b	2.12±0.18 a	1.77±0.11 b	1.74±0.07 a	1.75±0.09 b	1.53±0.05 b
T_2S_1	2.07±0.12	2.11±0.20 b	1.83±0.18 b	1.75±0.11 b	1.68±0.07 a	1.93±0.09 a	1.61±0.05 b
T_2S_2	2.07±0 12	2.07±0.02 b	2.20±0.18 a	1.98±0.11 a	1.36±0.07 b	1.68±0.09 b	1.87±0.05 a
T_3S_1	2.07±0 12	2.52±0.20 a	1.87±0.18 b	1.89±0.11 a	1.30±0.07 b	1.62±0.09 b	1.55±0.05 b
T_3S_2	2.07±0.12	2.09±0.20 b	1.44±0.18 c	1.44±0.11 d	1.19±0.07 c	1.43±0.09 c	1.43±0.05 c

a , b , c and d: Values in the same column having the same superscript letters are not significantly different (p >0.05)

Table (6) : Effect of stocking densities and chicken manure rate on some carcass traits of Tilabia *Oreochromis aureus*(Mean± S .E) .

Period(week) Treatments	Weight	Dress-out	Filet	Edible	Non Edible	Vicera	Scales	Fins	Head
T_1S_1	166.17 c ±7.22	132.80 d ±5.12	78.91 d ±6.03	84.50 d ±7.31	81.67 c ±5.50	23.22 c ±2.71	6.15 c ±1.75	4.66 c ±0.91	36.13 c ±3.42
T_1S_2	132.55 d ±7.22	107.13 e ±5.12	63.95 e ±6.03	67.40 e ±7.31	65.15 d ±5.50	16.37 d ±2.71	4.22 d ±1.75	3.10 d ±0.91	29.50 d ±3.42
T_2S_1	200.19 ab ±7.22	154.30 b ±5.12	95.77 b ±6.03	115.82 b ±7.31	84.37 c ±5.50	29 80 a ±2.71	6.01 c ±1.75	5.23 b ±0.91	48.00 b ±3.42
T_2S_2	170.66 c ±7.22	135.72 d ±5.12	76.35 d ±6.03	86.78 d ±7.31	83.88 c ±5.50	25.76 b ±2.71	6.50 b ±1.75	4.70 c ±0.91	38.17 c ±3.42
T_3S_1	224.35 a ±7.22	178.70 a ±5.12	120.85 a ±6.03	126.13 a ±7.31	98.22 a ±5.50	32.17 a ±2.71	7.85 a ±1.75	6.61 a ±0.91	61.11 a ±3.42
T_3S_2	180.20 b ±7.22	142.21 c ±5.12	87.19 c ±6.03	92.72 c ±7.31	87.48 b ±5.50	25.76 b ±2.71	6.60 b ±1.75	5.18 b ±0.91	37.56 c ±3.42

a - e :Values in the same column having the same superscript letters are not significantly different ($p > 0.05$)

Table (7): Effect of stocking densities and chicken manure rate on water quality of Tilabia *Qreochromis aureus.*

Period(week) Treatments	Temp.(°C)	pH	DO(mg /L)	NH3(mg/L)	SD(cm)	Saliniy(ppt)
T_1S_1	30.0	8.6	4.7	0.19	15.3	5.12
T_1S_2	30.2	8.7	4.9	0.20	15.4	5.14
T_2S_1	30.4	8.5	5.4	0.20	12.7	5.14
T_2S_2	30.4	8.9	5.7	0.21	11.9	5.15
T_3S_1	30.6	8.9	5.8	0.22	9.1	5.15
T_3S_2	30.7	8.7	6.0	0.23	8.7	5.16

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تأثير معدل الكثافة والتسميد العضوى على أداء النمو لأسماك ا لبلطى الأوريا

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أجريت هذه التجربة بهدف دراسة تأثير استزراع كثافتين مختلفتين من أسماك البلطى الأوريا هذا بالإضافة إلى دراسة تأثير تسميد الأحواض بزرق الدواجن على معدلات النمو والإنتاج الكلى للأسماك ونسب التصافى والتشافى وذلك خلال ١٢ أسبوع . تم استخدام عدد ١٨ حوض ترابى بمساحة ١٠٠٠ م٢ / حوض وتم تخزينها بعدد ١٥٠٠ و ٢٠٠٠ سمكة / حوض مع استخدام ثلاث معدلات تسميد لكل كثافة (١٥٠ ، ٢٥٠ و٣٥٠ كجم زرق دواجن / فدان). وكان متوسط الوزن الابتدائى للأسماك ٦٥,٨ جم / سمكة .

وكانت النتائج المتحصل عليها كما يلى :

١-بغض النظر عن معدلات التسكين فان زيادة معدل التسميد من ١٥٠ إلى ٣٥٠ كجم / فدان أدى إلى زيادة معنوية عن ٥% إلى زيادة وزن الجسم خلال جميع فترات التجربة ومن ناحية أخرى فقد أظهرت النتائج أن زيادة معدلات التسكين من ١٥٠٠ إلى ٢٠٠٠ سمكة / حوض أدى إلى نقص معنوى فى الأوزان .

٢-كان هناك تأثير معنوى للمعاملات على مكونات الأجزاء المأكولة من اللحم ونسب الأجزاء غير المأكولة .

٣-أوضحت النتائج أن خصائص البيئة المائية المتأثرة بالمعاملات المختلفة من معدلات التسكين والتسميد العضوى كانت فى المدى المناسب والملائم لتربية الأسماك .

توصى الدراسة باستزراع أسماك البلطى الأوريا فى الأحواض الترابية مع استخدام كثافة تخزين ١٥٠٠ سمكة للحوض (مساحة ١٠٠٠ م٢) مع استخدام زرق الدواجن بمعدل ٣٥٠ كجم للفدان أسبوعيا وذلك للحصول على أعلى إنتاجية من الأسماك وأفضل صفات جسم .