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# INTENSIVE PRODUCTION OF COMMON CARP(*Cyprinus carpio .L.*) FINGERLINGS REARED IN CONCRETE PONDS

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## ABSTRACT

This study was carried out to investigate the effect of different stocking densities on the growth performance of common carp (*Cyprinus carpio*) fingerlings reared in concrete ponds to produce the requested fingerlings prior to the next production season.

This experiment was concluded the following treatments: Treatment 1 = stocked by the rate of 25 fish/$m^3$ Treatment 2 = stocked by the rate of 50 fish /$m^3$ Treatment 3= stocked by the rate of 75 fish /$m^3$.All treatments were in triplicate, and fed with 25% crud protein of prepared artificial pelleted feed and reared in 20 $m^3$ of concrete ponds. The duration of the experiment was 20 weeks.

**Results are summarized in the following:**

- Final body weight was affected with stocking density, the analysis of variance revealed that groups an average final weight decreased significantly (p≤ 0.05) with each increase in the stocking density. The same trend was observed in the body weight gain per fish. Total weight/pond and total weight gain /pond were in opposite trend where it were significant increase (p≤ 0.05) with each increase in stocking density.
- Total body length and relative growth rate (RGR%) of reared fish was significantly (p<0.05) decreased with each increase in stocking density at the end of the experimental period.
- The values of specific growth rate(SGR%) which influenced after rearing period (20 week) with the stocking density by slightly decrease with each increase in the stocking density.
- Condition factor (K) of *Cyprinus carpio ,* showed a slight decrease with each increase in three stocking densities applied after the rearing periods of 137 days.
- Feed conversion ratio (FCR) was indicated that for stocking density tested improved with each decrease of the stocking density.
- The highest survival rate(91%) was combined to the lowest stocking density 25 fish/$m^3$, while the lowest value (73%) was under the highest stocking density of 75 fish $m^3$.
- Daily weight gain(g/fish)significant decrease(p≤0.05)with each increase in stocking density
- Water quality parameters through the experimental duration was in favorable range for fish culture (water temperature, dissolved oxygen, ammonia, pH, total hardness and total alkalinity).
- All results indicated that the total production and other growth performance parameters were decreased significantly (p≤ 0.05) with the increasing stocking density.

## INTRODUCTION

Fish is an important dietary animal protein source in human nutrition. Production of aquatic species through freshwater fisheries and aquaculture for protein supply is being encouraged throughout the world (Abbas, *et al.*, 2010). World aquaculture production in 2006 reached to 36% as a percentage of total fisheries landing (FAO,2008b).

The common carp *(Cyprinus Carpio)* was introduced to Egypt in order to use it in artificial hatcheries for aquaculture fish production (Horvath 1984). The information currently available on using common carp under characteristics features and design approaches to various units are based on general reports of tank systems and where details are available. Hussein(1986)recorded that the survived fish(%)decreased with increasing of stocking density. Zhang *et al.* , (1999)cited that the effectiveness of carp culture under various densities effect on the net production. Common carp fingerlings are the species stocked in rice fields.

This study was conducted to evaluate the effect of different stocking densities on the growth performance and total yield/$m^3$of common carp*(C.carpio)*fingerlings reared in concrete ponds to produce the fish required to the next production season.

## MATERIALS AND METHODS

This study was carried out in the research farm of Central Laboratory of Aquaculture Research (CLAR). at Abbassa village, Abu- Hamad district, Sharkia Governorate, Egypt. The experiment started during the period of 20 weeks ,from 1$^{st}$ of June to 18$^{th}$ of October 2004. Concrete ponds irrigated with fresh water it were stocked with different stocking densities of common carp *(Cyprinus carpio)* fingerlings to evaluated the possibility on growth.

**Experimental design:** Nine concrete ponds with 20 $m^3$ water volume were stocked with experimental fish in triplicate and randomly designed to three treatments as the follows: $T_1$ = 3 ponds stocked with 25 fish /$m^3$ ,$T_2$ = 3 ponds stocked with 50 fish /$m^3$and $T_3$ = 3 ponds stocked with 75 fish / $m^3$.Experimental ponds were drained and cleaned from any procipttimes and wild life fish. Water supplied by PVC pipes fixed on the pond to pure water and then help full to aeration the rearing ponds, water was pumped directly from fresh water canals.

**Experimental fish and sampling:** Common carp *(Cyprinus carpio L)* fingerlings were obtained from artificial hatchery belonging to Central Laboratory of Aquaculture Research (CLAR) located in Abbassa.An average initial body weight of fingerlings per all experimental ponds was 1.45 g and total body length was 1.4 cm. Number of fingerlings stocked in treatments were 25 , 50 and 75 fingerlings /$m^3$ in the first, second and third treatments, respectively. At the beginning of the experiment , 100 experimental fingerlings as a random sample were used to determine individual body weight and body length. After 21 days post-stocking , random sample of 50 fish were take by seining nets from each treatment to record individual body weight, body length and to estimate the periodical growth of fish during the whole experimental period 20 weeks. All fish samples were returned to their ponds after recording the individual body weight (g) and body length (cm) for each fish. At the end of the experimental period , ponds were drained from water and all fish for each pond were harvested by seining nets , put in fiberglass tanks and carried to the processing center where they washed and weighed. Whole fish from each pond were taken to determine the weight, length and condition factor for each fish and the total weight of all fish in each pond was considered as fish production of that pond. The experimental ponds were aerated using compressor of a 10 hp an blower aeration 24 h a day.

**Experimental diet formulation and preparing:** Results of the feed Ingredients, approximate chemical composition, and gross energy of the experimental diet calculated on dry matter basis are shown in (Table 1).In preparing the diet, dry ingredients were first ground to a small particle size (approximately 250 µ. m) in a Wiley mill. Ingredients were thoroughly mixed and water adds to obtain a 30 % moisture level. Diet was passed through a mincer with die into 0.4 mm diameter ' spaghetti - like ' strands and were dried (20$^o$C) for 16 h using a convection oven. After drying, the diet was broken up and sieved into appropriate pellet sizes. Approximate chemical analysis of diet was determined according by (AOAC 1990).

**Table (1): Approximate chemical composition and gross energy of the ingredients used in the experimental diet.**

| Ingredient | DM % | CP % | EE % | CF % | Ash % | NFE % | GE Kcal/kg |
|---|---|---|---|---|---|---|---|
| Rice bran | 91.18 | 12.8 | 14.0 | 11 | 11.3 | 50.9 | 4522.2 |
| Yellow corn | 87.3 | 7.7 | 4.1 | 2.5 | 1.3 | 84.4 | 4298.5 |
| Soybean meal | 90.57 | 44.0 | 2.1 | 7.4 | 6.5 | 40.0 | 4580.95 |
| Fish meal | 92.21 | 72.0 | 12.8 | - | 15.2 | - | 527.8 |
| Meat meal | - | 68.8 | 8.2 | - | 23 | - | 466.2 |
| Molass | 75.0 | 4.4 | 0.1 | - | 9.8 | 60.7 | 285 |

*** GE Kcal /g = Gross energy based on 5.65 Kcal/g for protein 9.45 Kcal/g for Fat, 4.1 Kcal/g for carbohydrate. (Jobling , 1983)**

**Table (2): Ingredients, approximate chemical composition, and gross energy of the experimental diet (25 % crude protein)**

| Items | Diet 25 % CP |
|---|---|
| Rice bran | 34 |
| Yellow corn | 26 |
| Soybean meal (44% cp) | 18 |
| Fish meal | 7 |
| Meat meal | 12 |
| Molass | 3 |
| Total | 100 |
| **Nutrients analyzed (on dry matter basis)** | |
| Dry matter | 92.98 |
| Crude protein (C.P) | 25.92 |
| Ether extract (E.E) | 10.54 |
| Nitrogen free extract | 39.48 |
| Ash | 17.21 |
| Crude fibers | 6.85 |
| *GE Kcal/g | 4079.19 |
| **GE/P ratio | 157.376 |

*** GE Kcal /g = Gross energy based on 5.65 Kcal/g for protein 9.45 Kcal/g for Fat, 4.1 Kcal/g for carbohydrate. (Jobling , 1983)**

**** Caloric/ protein ratio expressed as kcal GE/ 100 g crude protein.**

Fish were fed prepared pelleted feeds25% crude protein 6 days a week at a rate of 4 % of total fresh fish body weigh two times a day at 9 a.m. and 4 p.m untile the end of the experimental period, and the amount of feed was re-adjested every three weeks according to fish samples.

**Growth parameters:**

-Total weight gain =Final weight - Initial weight

- weight gain per day = $\frac{\text{Total weight gain (g)}}{\text{Period (days)}}$

Feed conversion ratio (FCR) was calculated according to the following equation:

$$FCR = \frac{\text{Feed consumed (g)}}{\text{Gain in live weight (g)}}$$

Condition factor (K) was estimated according to Bagenal (1978) as:

$$K = \frac{W\ X100}{L^3}\ ,$$

Where k =condition factors, w = weight in (g) , L = length in cm

Specific growth rate (SGR%) was calculated according to Jauncey and Rouse (1982) by using: SGR % = [ Ln W2 -Ln$W_I$ / period in days] x 100

Relative growth Rate (RGR) was measured as following equation :

$$\frac{\text{Final Wt (g) - Initial Wt (g)} \quad \text{x 100}}{\text{Initial weight (g)}}$$

**Water quality parameters** :from each pond was tested daily to determine temperature (°C) and concentration of dissolved oxygen (DO) and at biweekly intervals to estimate pH , total ammonia ($NH4^+$, $NH_3$), nitrite, total hardness, total alkalinity according to Boyd(1990). Temperature and Dissolved oxygen vlues were measured at 9- 10 am using yellow spring Instrument (YSI MODEL 58). pH was measured by using a glass electrode pH-meter(Digital Mini-pH-meter model55). Total ammonia ($NH4^+$) concentration was measured by using a Hach spectrophotometer apparatus (model, DR 2010), then de-ionized ammonia ($NH_3$-N) was calculated from total ammonia according to Boyd (1990).Water samples were taken by water sampler from each ponds at 9 a m at depth of 80 cm below the water surface. The water sample was placed in a clean 1000- ml sampling glass bottle according to Boyd (1990).

**Economical evaluation:** At the end of the experiment an economical study has been conducted to determine the cost of feed to produce one Kg fish weight. The input and returns from experimental culture were calculated.The cost of feed to raise unit biomass of fish was estimated by a simple economic analysis.The estimation was based on local retail sale market price of all the dietary ingredients at the time of the study.Statistical analysis: All statistics were run on the computer using the SAS program (SAS 1996). The analysis of variance(ANOVA) and Duncons (1955) Multiple Range test to determine differs between treatment mean at significance level of P<0.05 standard errors were also estimated .

## RESULTS AND DISCUSSION

Growth performance: Summarized data presented in table (3) showed that the growth performance parameters during the rearing of *Cyprinus carpio* fingerlings to produce the restocking fingerlings in the next production season. Initial weight (W) and length (L) were showed insignificant differences indicating the complete randomization of data at the start of the experiment. The initial values of weight were an average 1.45 g/fish and length was ranged 3.5 cm/fish for the three stocking densities tested in the present study. Data an average final body weight and body weight gain were 224.65±0.65, 188.7±0.31 and 121.28±0.6 g/fish; 223.2±0.82, 181.28±0.31 and 119.83±3.1g/fish for the stocking density of 25, 50 and 75 fish/$m^3$ respectively. While, the final body length were 23.8, 22.6 and 20.1cm /fish for the stocking density 25, 50 and 75 fish/$m^3$, respectively. Significant differences ($p<0.05$) were found between the values of individual weight, body weight gain and body length under the three stocking density used through the experiment.

These results may due to the fact the companion among individual fish and space which resulted on growth depression. These results are in accordance with those reported by Hussein (1986) and Prithwirag and Sudip Bart (2005) they found that the optimal growth was for the lowest stocking density. Watanab *et al* (1990) noticed that the increasing of stocking density may affect the living space for the fish which increase the competaion on food and oxygen that result in decreased growth and consequently length. Significant differences ($p <0.05$) were found between an average of total lengths of fishes under the three stocking densities were applied.

Condition factor (K): Table (3) showed that an average values of condition factor (k) for stocking densities 25 , 50 ,75 fish / $m^3$*,* were 1.85 , 1.60 and 1.49 , respectively , and the statistical evaluation of results indicate that K values decreased significantly ($p <0.05$) with each increase in the stocking density.This may due to the fact that at higher density of stocking the competition of fish in food and oxygen is several increased than at lower stocking densities.

These results are in agreement with the findings of Hussein (1986) and Osman (1991) they reported that common carp increase in weight more than in length at lower stocking densities. Results of specific growth rate (SGR%) was influenced directly by stocking density tested during the experiment.Results of SGR% are illustrated in table (3). These values indicating that fish stocked at lower density showed better SGR% values as compared than those stocked at higher densities. Differences between the SGR% values were significant ($p<0.05$) decreased ending from the stocking density 25 fish/m3 to the stocking density of 75fish/$m^3$.

Data of relative growth rate included in table (3). Highly significant ($p<0.05$) were found between the ratio of relative growth rate of *Cyprinus carpio* fingerlings under different stocking density. Generally, values of relative growth rate (RGR%) of reared fish were decreased significantly with each increase of the stocking density that applied through out the experimental period (140 days). The results obtained from Table (3) agreement of the finding of Refstie (1977) who found that the growth curves for the different density groups clearly showed that fish held at low densities grow better than those at higher densities.

**Table (3): Growth performance of common carp *C. carpio* fingerlings reared in concrete ponds under different stocking densities (mean + SE)**

| Item / Treatment | T 1 25 fish/$m^3$ | T2 50 fish/$m^3$ | T3 75 fish/$m^3$ |
|---|---|---|---|
| No. of fish at start of exp./pond | 1500 | 3000 | 4500 |
| An av. Initial fish weight g./fish | 1.45+.29 | 1.45+ 0.32 | 1.45 + 0.3 |
| An av. Initial total fish weight (kg fish/ pond) | 0.725+.47a | 1.45.+ 0.78 b | 2.175 + 0.2b |
| Daily weight gain (g/fish/day) | 1.59+0.26a | 1.3+ 0.015 b | 0.68 + 0.03c |
| An av. Final fish weight g/fish | 224.65+0.65a | 188.7+ 0.31b | 121.28 +0.6c |
| An av. Final fish gain g/pond | 223.2+0.82a | 181.28+ 0.31b | 119.83+ 3.1a |
| An av. Initial fish length (cm)/fish | 3.5 + 0.35a | 3.5+ 0.35a | 3.5 + 0.35a |
| An av. Final fish length(cm)/fish | 23.8 + 0.58a | 22.6+ 0.64 b | 20.1 + 0.81 c |
| Survival rate % | 90 + 0.58 a | 81 + 0.61b | 68 + 0.51 a |
| Total fish production /pond (kg/poud) | 101.09+6.99c | 148.02+ 3.26b | 123.80 + 3a |
| Food conversion ration (FCR) | 1.69 + 0.32 c | 1.94+ 0.46b | 2.24 + 0.37c |
| Condition Factor (K) | 1.85 +0.15 a | 1.60+ 0.17b | 1.49 + 0.13 |
| Specific growth rate (SGR)% | 1.55 +0.14 a | 1.36+ 0.12b | 0.94 +0.07c |
| Relative growth rate (RGR)% | 24.24+2.16 c | 20.94+ 1.79b | 14.14+ 1.17b |
| Total yield/$m^3$ (kg/$m^3$) | 5.05 + 0.3c | 7.40+ 0.49b | 6.18 + 0.3b |

*** Means with the same litters in the same row are not significantly difference ($P < 0.05$)**

Significant increase in total weight produced and total weight gain per pond with each increase of stocking density of reared fishes. Al-Zahaby *et al.* (2004) found that the growth curves for the different density groups clearly showed that fish held at low densities grew better than those at high densities.

Data of daily weight gain of *Cyprinus carpio* were presented in table *(3)* 1.59±0.26, 1.3±0.01 and 0.68±0.03 g/fish/day for the stocking density of 25, 50 and 75 fish/$m^3$ respectively. The result showed significant decrease of daily weight gain per day with each increase of stocking density. These results are in agreement of AL- Zahaby et al (2004).

The highast value of FCR wasfound in group stocked at 75 fish/$m^3$ while the best FCR (lowest)was for the stocking density of25fish/$m^3$,so, significant increase of FCR was observed with each increase of stocking density according to the findings of Al- *Zahaby et al.,* 2004 , who showed that the lowest stocking density leads to the better feed conversion ratio.

Survival rate (%): which presented in table (3) indicated that the effect of stocking density on the rate of survival of reared Common carp.Significant ($p < 0.05$) decrease of survival rate (%) with each increase of stocking density. In completely are agreement with finding of Sharma and Chakrabarti ,1999 , Al-Zahaby *et al.*,2004 and Prithwiraj and Sudip Barat , 2005 , who explained that there was a significant differences in survival rates of Koi-carp

Generally, an average final body weight, individual weight gain, survival rate and an average daily weight gain were inversely affected with each increase of stocking density.However , total production per pond, total weight gain per pond, food conversion ratio and total yield per cubic meter was positively and / or directly influenced by increasing the stocking density. The results presented in table ,(3) and discussed above were completely agreement with finding of Zhang *et al.,* (1999) who cited that the effectiveness of carp cultured under various densities (35, 40, 45,50 fish/$m^3$)

in the small cages were studied. The results showed that the rearing densities had significant affect on net production. As well as mean of body weights and feed conversion ratio In this respect also, this result is in completely agreement with Sharma and Chakrabarti (1999) who found that the Common carp (Cyprinus carpio) larvae were cultured under three stocking densities 25, 50 and 100 larvae /15 L, aquarium. Significantly higher survival (91 %) were observed in the low stocking density 25 larvae /15 L. Survival and growth of Common carp larvae arc influenced by both stocking density and type of feed.

Concerning to total production per cubic meter is in partialy agreement with finding of AL- Zahaby *et al.*,(2004) who indicated that the total yield for each cubic meter was affected directly with each increase stocking density. As well as finding Eid and EL-Gamal(1997) in agreement with this result where they explained that the maximum weight gain, survival rate were obtained at stocking densities of 50 and 75 fish/m3 in the three culture system examined and the mean fish size and unite value of the yield decreased as density increase. Corazon *et al.*, (1983) who also found that stocking rate had a significant effect on survival with the respect to the effect of stocking density on the feed conversion ratio (F.C.R).

**water quality parameters:**

observation on physico - chemical characteristics of water quality are shown in Table (4). The values of temperature observed through out the experiment was in the agreement findings of Jhingran and Pullin (1985)who stated that the optimum growth temperature for carp ranges from 23 to 30°Cfor common carp and recently Tiwari *et al*(2006)found that the maximum mean of ambient and green house air temperature of20-34and24-26were observed in the month

**Table(4): water quality parameters in the concrete ponds during experimental period from first of May to 6$^{th}$ of September , 2004 (mean ± SE)**

| Water parameters | TI | | T2 | | T3 | |
|---|---|---|---|---|---|---|
| | Irrigation | Drainage | Irrigation | Drainage | Irrigation | Drainage |
| Temperature (Co) | 28.7± 0.40 | 28.9 ±0.55 | 28.7 ±0.40 | 29.4 ±0.81 | 28.7 ±0.40 | 30.1±0.64 |
| PH | 7.44±0.31 | 8.1±0.32 | 7.44±0.31 | 8.7±0.36 | 7.44±0.31 | 8.9±0.55 |
| Dissolved Oxygen (mg/L) | 11.5±0.87 | 5.5 ±0.76 | 11.5 ±0.87 | 4.9±0.61 | 11.5 ±0.87 | 4.4 ±0.32 |
| Ammonia (NH4) | 0.0l±0.0l | 0.3±0.12 | 0.01±0.01 | 0.4±0.23 | 0.01±0.01 | 0.6±0.58 |
| Hardness (mg/L) | 144 ±0.31 | 148 ±1.15 | 144 ±0.31 | 160 ±2.65 | 144 ±0.31 | 160 ±2.0 |
| Total alkalinity(mg/L) | 100.25±2.8 | 220±2.31 | 100.25±2.8 | 245±3.61 | 100.25±2.8 | 350 ±2.52 |

All statements was in the partially, agreement of the observed results that detected pH values concluded in the table (4).It was highest in the higher stocking density and lower concentration within the lower stocking density and ranged from (8.1 to 8.9) in drainage water while in irrigation water was 7.44. This results was in the agreement of Boyd and Lichkoppler(1979) who demonstrated that, water with pH values of about 6.5 to 9.0 at day break are considered best for fish production.

Data combined in table (4) showed that the values of dissolved oxygen (DO) in irrigated water was11.5mg/L. However, values of dissolved oxygen through out the experimental periods were 5.5, 4.9 and 4.4 mg/L for the stocking density 25, 50 and 75 fish/m3 respectively. DO is the most important factors for fish growth was observed by Boyd and Lichkoppler (1979)who found that fishes don't or grow as well when dissolved oxygen concentration remain continuously below 4 or 5 mg/L and Piper et al (1982) who pointed out that fish grow well at concentration of 4.0 mg/L during this study and still in suitable range 4.4 to 5.5 mg/L in stocking density of 75 and 25 fish/m3 , respectively. Concentration of ammonia ($NH_3$ —N) presented in Table (4) were 0.3, 0.4 and 0.6mg/L for $T_l$, $T_2$ and $T_3$ , respectively. While it was in range of 0.01 mg/1 in irrigation water sources for the three stocking density tested through out the experiment. Ammonia is the principle compound excreted by aquatic animals (Colt and Armostrong , 1981).Total alkalinity of irrigated water as shown in table (4) was 100.25 for the three stocking densities tested through the experimental periods. Whilst the concentration of alkalinity in draining water raining the stocking density of 25, 50 and 75fish/$m^3$ were 220, 245 and 350 respectively. Table (4) showed the concentration of hardness in drainage water through three treatment applied , it were 148, 160 and 160 mg/L stocking density of 25, 50 and 75 fish/$m^3$ respectively. Meanwhile it was 144 for the three stocking density tested through the experimental period. Observations on total alkalinity and hardness was highest 350 mg/1 and 160 mg/1 for the 75 fish/$m^3$ while the lowest reading was 220and 148 mg/1 for the 25 fish/m3 respectively. Where the term of total alkalinity refers to the total concentration of bases in water expressed as mg/1 of equivalent calcium carbonate (Boyd and Lichkoppler 1979). While , Boyd (1990) reported that the optimum total hardness of water for hatching silver carp was 300-500 mg/1 as $CaCo_3$.

**Economical efficiency**

The economic parameters of the inputs and outputs of the experimental treatments are presented in table (5). Price of experimental diets based on feed ingredients in the local market during the experiment was 1.1 LE. Total feed cost during the whole experimental period was 277.19 LE. Total variable costs (feed + fingerlings) were found to be 81.9 , 132.3 and 182.99 LE for Tl , T2 and T3 , respectively (total 397.19 LE) and the differences had due to differences in total amount of feed intake (Kg) and price of the fingerlings. As presented in the same table , total gains in weight per experiment was 1118.38 Kg (total fish weight gain / treatment were 303.28 , 444.1 and 371.00 Kg for $T_1$ , $T_2$ and $T_3$, respectively), and total income as fish weight gain per treatment were 758.2 , 1110.25 and 927.5 LE for $T_1$ , $T_2$ and $T_3$, respectively (total income was 2795.95 LE) , thus the sale price during the experimental period was 2.5 LE / Kg. But the total income as live fish number was 3078 LE , thus the sale price of 1000 living fish for second rearing season was 450 LE.

Economic efficiency (calculated as percentage of revenue to total costs) for treatments as fish weight was 110.09 percent, but the economic efficiency for experiment as living fish number was 114.92 percent. These results indicated that, when comparing between treatments on basis of net return , it was found that the high and low stocking density show significant difference to produce living fish (net return was the highest by treatment 3 , 1377 LE , and treatment 2 was 1093.5 LE as living fish , while the lowest net return by treatment was 607.5 LE (T1).From the previous results of this study, we can say that, when rearing common carp *C. carpio L* during the first season,the highest stocking density per $m^3$ is economically efficiency.

**Table(9): The economical efficiency of the experimental treatments**

| Item | T, | $T_2$ | $T_3$ |
|---|---|---|---|
| Total No. of stocked fish at the start of exp. | 1500 | 3000 | 4500 |
| Survival rate % | 90 | 81 | 68 |
| Total No. offish at the end of exp. /treat. | 1350 | 2430 | 3060 |
| Av. final body weight (g/fish) | 224.65 | 182.74 | 121.23 |
| Total amount of feed intake / treat, (kg) | 54.00 | 93.01 | 104.99 |
| Price of one kg feed intake / treat. (LE) | 1.1 | 1.1 | 1.1 |
| Variable costs LE per treatment | 15 | 15 | 15 |
| Total feed cost (LE) | 59.4 | 102.3 | 115.49 |
| Cost of the fingerlings per treatment (LE) | 22.5 | 30 | 67.5 |
| Total variable costs (LE) | 81.9 | 132.3 | 182.99 |
| Total fish weight gain / treatment (Kg) | 303.28 | 444.1 | 376.00 |
| Total fish weight / experiment (Kg) | 1118.28 | - | |
| Sale price Kg fish (LE) | 205 | 250 | 250 |
| - Sale price 1 000 living fish (LE) | 450 | 450 | 450 |
| Total income / treat. Fish weight gain (LE) | 758.2 | 1110.25 | 927.5 |
| Total income / exper. (LE) | 2795.95 | - | |
| Total income for living fish (LE) | 607.5 | 1093.5 | 1377 |
| Total incom / exper. (LE) | 3078 | - | - |
| Revenuse / treat. For fish weight gain (LE) | 676.3 | 977.95 | 744.51 |
| Total revenuse / exper. „„ ,„„ ,, „„ (EL) | 2398.76 | - | |
| Total revenuse / exper. For living fish (LE) | 2680.81 | - | |
| Economical efficiency % for fish weight(LE) | 110.56 | | - |
| Economical efficiency % for living fish (LE) | 114.92 | - | - |

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## الإنتاج المكثف لإصبعيات سمك المبروك العادي المربي في أحواض أسمنتية

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أجريت هذه الدراسة في الأحواض الأسمنتية بالمزرعة البحثية التابعة للمعمل المركزي لبحوث الثروة السمكية بالعباسة أبو حماد شرقية لدراسة تأثير كثافات تخزينية مختلفة (25 و 50 و 75 سمكة/ م3) على معدلات نمو اصبعيات اسماك المبروك العادي المرباه في أحواض أسمنتية. وذلك لإنتاج أسماك المبروك اللازمة للاستزراع في الأحواض الأرضية الإنتاجية.

لقد أجريت هذه التجربة في عدد 9 أحواض أسمنتية حجم كل حوض 20متر مكعب مع ثلاثة مكررات/معاملة كما يلي:

**المعاملة الأولى:** عدد 3 أحواض خزنت بمعدل 25 سمكة للمتر المكعب.
**المعاملة الثانية:** عدد 3 أحواض خزنت بمعدل 50 سمكة للمتر المكعب.
**المعاملة الثالثة:** عدد 3 أحواض خزنت بمعدل 75 سمكة للمتر المكعب.

غذيت هذه الأسماك على عليقة أسماك صناعية محببة تحتوى على 25% بروتين خام بمعدل 4% من الوزن الحي/ يوم وأعيد حساب كمية العليقة كل ثلاثة أسابيع على أساس الوزن الحي للأسماك المرباة في كل معاملة على حده. و لقد بدأت هذه الدراسة في أول شهر يونيو 2004 وحتى الثامن عشر من شهر أكتوبر من نفس العام ولمدة عشرون أسبوعًا.

أسفرت النتائج النهائية لدراسة تأثير الكثافات التخزينية المختلفة (25 و 50 و 75 سمكة/ متر مكعب) لإصبعيات أسماك المبروك العادي المرباه في أحواض أسمنتية على أن متوسط وزن الأسماك (224.65 و 182.74 و 121.23 جم/ سمكة) والطول الكلي للأسماك (23 و 22.5 و 20.1 سم/سمكة) ومعدل النمو النسبي (% RGR) (24.24 و 20.94 و 14.14%) ومعدل النمو النوعي (% SGR) (1.55 و 1.36 و 0.94 %) ومعامل الحالة (K) (1.85 و 1.6 و 1.49)، و معدل البقاء (90% و 81% و 68%)، الوزن اليومي المكتسب لكل سمكة (1.59 و 1.3 و 0.86 جم / سمكة) على وجود تناقصًا معنويًا (تحت مستوى معنوية 0.05 ($P < 0.05$) تدريجيًا مع كل زيادة في الكثافات التخزينية عند نهاية التجربة.

وقد وجد أيضا أن الإنتاج الكلي النهائي للأسماك لكل حوض (101.09 و 148.02 و 123.65 كجم/ حوض)، و معدل التحول الغذائي (% FCR) (1.69 و 1.94 و 2.25) تحت الكثافات التخزينية المختلفة للأسماك (25 و 50 و 75 سمكة/ م على التوالي) قد أظهرت زيادة معنوية تدريجيًا مع كل زيادة في الكثافات التخزينية تحت مستوى معنوية ($P < 0.05$).قياسات عناصر جودة المياه ظلت خلال مدة التجربة في الحدود الملائمة لتربية أسماك الميروك في الأحواض الأسمنتية.

مما سبق يتضح التأثير المباشر لمستوى كثافة التخزين على معدلات النمو لإصبعيات أسماك المبروك العادي في أحواض أسمنتية ويتضح أيضًا إمكانية تحضين ورعاية زريعة أسماك المبروك العادي لتصل إلى أحجام الأصبعيات (استزراع وسيط) اللازمة ليعاد تخزينها في أحواض الإنتاج التسويقي وذلك في نفس موسم إنتاج الزريعة للحصول على أعلى إنتاج ممكن بدلا من التحضين المعتاد والذي يمكن أن يستغرق موسمًا أخر.

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