EFFECT OF STOCKING RATIOS OF HYBRID RED TILAPIA AND STRIPED MULLET UNDER DIFFERENT CULTIVATION SYSTEMS ON GROWTH PERFORMANCE, FEED UTILIZATION AND CHEMICAL COMPOSITION OF BODY

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ABSTRACT

This experiment was carried out to determine the effect of different stocking ratios (SR) in both cultivation systems (monoculture and polyculture) of hybrid red tilapia (*O. niloticus* males × *O. mossambicus* females) and striped mullet (*Mugil cephalus*) on growth performance, feed utilization and body composition. Hybrid red tilapia (T) : mullet (M) were stocked at seven ratios or treatments were (1:0, 0:1, 1:2, 2:1, 1:1, 3:1 and 1:3), respectively. Hybrid red tilapia and striped mullet fingerlings with initial body weights of 5.37 and 5.45 g/fish, respectively. Fish fed at the start of experiment in all treatments at the rate of 6 % biomass weights then it was reduced gradually to 4% until the end of the experiment. The results showed that, hybrid red tilapia was higher than striped mullet in the most of growth performance parameters and feed efficiency under the monoculture system. Also, the results indicated that polyculture gave the highest growth performance (biomass weight or gains) compared with monoculture. The survival rate of hybrid red tilapia and striped mullet ranged between 95 – 100 and 80 – 90 %, respectively with no significant effect by different stocking ratios. The growth performance, biomass and feed efficiency increased with increasing of red tilapia ratio in each treatment. From these results it could be recommended that the polyculture system of red tilapia and striped mullet were better than the monoculture system for growth performance traits, in addition, the best stocking ratio was 3 red tilapia : 1 striped mullet in polyculture system at a density of 40 fish/m^3.

Keywords: Hybrid red tilapia, Striped mullet, Cultivation systems.

INTRODUCTION

Aquaculture plays an important role in the world fishery production. The total world fish production of aquaculture increased from about 35.5 million tones in 2000 year to about 47.8 million tones in 2005 year (FAO, 2006). In Egypt, according to (GAFRD, 2006) the production of tilapia fish was 303.31 thousand tons in 2004 year then it increased to 349.051 thousand tons in 2006 year.

Polyculture is the practice of culturing more than one species of aquatic organism in the same pond. The motivating principle is that fish production in ponds may be maximized by raising a combination of species having different food habits. The mixture of fish gives better utilization of available natural food productive in pond (El-Ebiary, 1998 and Greglutz, 2003)

Several studies indicated that polyculture system gave the highest growth performance and survival rate compared with monoculture system (El-

Dahhar *et al.,* 2006 and El-Sagheer, *et al.,* 2008). Tilapia fish produce high yields in monoculture systems because they can fill several feeding niches, compared to selective feeders such as carp. Tilapia are generally cultured with a number of freshwater or brackish-water species, including carp, mullets, catfish, prawns and shrimp (El Sayed, 2006).

Therefore, the present work aimed to study the effect of stocking ratios of hybrid red tilapia and striped mullet reared in mono and polyculture systems on their growth performance, feed utilization and chemical composition under different stocking density.

MATERIALS AND METHODS

The stock of hybrid red tilapia (*O. niloticus* males × *O. mossambicus* females) was originated from General Authority for Fish Resources Development, 21K Hatching, Alexandria. In the same time, the striped mullet (*Mugil cephalus*) were naturally collected from stations in Damietta, Damietta Governorate. Fish were transported to Fish Research Unit, Faculty of Agriculture, Mansoura University, El Mansoura City, Dakahlia Governorate, in aerated polyethylene bags, then stocked in two square plastic tank (1 m^3) (one tank for each species) to realize adaptation in indoor rearing conductions for about one week before the start of the present experiment.

Hybrid red tilapia fingerlings was 5.37 g/fish as the average weight and 7.56 cm for length, yet, mullet fingerlings was 5.45 g/fish of body weight and 6.44 cm for total length. The design of the experiment are presented in Table (1). Seven plastic tank (1 m^3) each were used. The stocking ratios (treatments) of hybrid red tilapia to mullet were 1:0, 0:1, 1:2, 2:1, 1:1, 3:1 and 1:3 respectively. Each tank supplemented with aeration by two air stones through air pump permit to reached suitable level of dissolved oxygen

Table (1): Design of the present experiment.

Treatment number	Stocking rate (fish/m^3)	Type of fish	Number of fish per treatment	Stocking ratios T : M
T_1	30	Tilapia	30	1 : 0
T_2	30	Mullet	30	0 : 1
T_3	30	Tilapia	10	1 : 2
		Mullet	20	
T_4	30	Tilapia	20	2 : 1
		Mullet	10	
T_5	40	Tilapia	20	1 : 1
		Mullet	20	
T_6	40	Tilapia	30	3 : 1
		Mullet	10	
T_7	40	Tilapia	10	1 : 3
		Mullet	30	

T: Hybrid red tilapia **M: Striped mullet**

The water salinity of each treatments reach 15 ppt by soluble dried crude natural salt obtained from sea water ponds belonging to El-Naser Saline Company, Damietta Government, Egypt. The change rate was about

20 % of the water volume per tank during the first and second month of the experimental period, while, the water changed at a rate of 30 % through the last period (January 2008 to February 2008). The experimental tanks were provided by thermo-heater, to keep the water temperature between 23 – 24 ^{o}c until the end of the experimental period.

The experimental diet contained 25.74 % crude protein and 486.1 Kcal as gross energy / 100 g DM and given twice daily at 9.00 A.M. and 15.00 P.M. for 6 days a week. Table (2) show the ingredients and chemical composition of the formulated diet. The diet prepared by mixing dry ingredients with oil, and used as pellets. The feeding rate was 6 % from the live body weight in the first month, then reduce gradually to 5% in the second month, then 4% until the end of the experiment.

Growth performance parameters were measured every bi-weekly. At the end of the experiments, fish samples were killed and kept in frozen at -10 ^{o}c to chemical analysis. The obtained data were statistically analyzed using general linear models procedure adapted by SAS (2006) for users guide, with a one-way ANOVA. Means were statistically compared for the significance ($P \leq 0.05$) using Duncan multiple range test, according to Duncan (1955).

Table (2): Formulation (%) of the experimental diet (on dry matter basis) and their chemical analysis.

Ingredients	Composition (%)
Feed ingredients	
Fish meal	20
Soybean meal	20
Wheat bran	28
Starch	20
Fish oil	5
Corn oil	3
Yeast	2
Vitamin mixture[1]	1
Mineral mixture[2]	1
Chemical composition(as DM basis):	
Dry matter (DM %)	91.84
Crude protein (CP %)	25.74
Ether extract (EE %)	11.97
Ash %	6.83
Carbohydrate	55.46
Gross energy (Kcal / 100 g DM) *	486.1
Protein / energy ratio (mg CP / Kcal GE)	52.95

[1]: vitamin mixture containing of vit. A (15 million I.U.), vit. E (15 mg), vit. B1 (1.0 mg), vit. B12 (5.0 mg), vit. K3 (2.5 mg), vit. B6 (2.0 mg), Pantothenic acid (10.0 mg), Folic acid (1.2 mg), Biotin (0.05 mg) and vit. D3 (3.0 million I.U.).

[2]: minerals mixture containing of Copper (7.0 mg), manganese (100.0 mg), iodine (0.4 mg), Iron (40.0 mg), Zinc (50.0 mg), Selenium (0.15 mg) and anti- oxidant (125.0 mg).

*** Gross energy (Kcal / 100 g DM) = (CP × 5.64) + (EE × 9.44) + (Carbohydrate × 4.11) were calculated according to (Macdonald *et al.,* 1973).**

RESULTS AND DISCUSSION

Table (3) shows the effects of stocking ratios on total biomass weight, biomass gain, feed conversion ratio and protein efficiency ratio of red tilapia and striped mullet reared under different culture systems at two stocking density (SD). In monoculture, total biomass, WG biomass, FCR and PER of hybrid red tilapia significantly ($P \leq 0.01$) higher than those of striped mullet. In polyculture system with (30 fish/m^3) stocking rate the differences between treatments T_3 (1 T: 2 M) and T_4 (2 T: 1 M) for all traits were not significant. However, in polyculture using (40 fish/m^3) it recorded significant difference between treatments T_5 (1 T: 1 M), T_6 (3 T: 1 M) and T_7 (1 T: 3 M) for all previous traits.

Total biomass, weight gain biomass and PER of stocking ratio T_6 (3 T: 1 M) showed the highest and best values ($P > 0.01$), compared with another stocking ratio T_5 (1 T: 1 M) and T_7 (1 T: 3 M). The FCR of T_7 (1 T: 3 M) stocking ratio was significantly ($P \leq 0.01$) higher than T_6 (3 T: 1 M) or T_5 (1 T: 1 M), respectively. This results agreement with Siddiqui *et al., (*1989) for growth or FCR of *O. niloticus* and with El-Dahhar *et al.,* (2006) on striped mullet and Nile tilapia fingerlings.

The highest values of total biomass weight and total gain were recorded in T_6 (3 T: 1 M), while the lowest values were in treatment (no. 2) in mullet monoculture. On the other hand, the poorest value of FCR found in treatment (no. 2) and the best was in treatment (no. 1) of hybrid red tilapia monoculture with significantly ($P \leq 0.01$) differ between these treatments. The results of FCR indicated that with increasing the red tilapia ratio FCR was improved but there were no significant difference between treatments (1, 5 and 6). The present results were in agreement with (El-Dahhar *et al.,* 2006 and El-Sagheer, *et al*., 2008) they showed that the relation weight gain of striped mullet improved by increasing tilapia stocking ratio in the same pond.

Table (3): Means ± SE of total weight biomass (TWB), total gain, feed conversion ratio (FCR) and protein efficiency ratio (PER) of red tilapia and mullet under different culture systems and two stocking density (SD).

SD (fish/m 3)	Treatments	SR T : M	TWB (g)	Total gain(g)	FCR	PER
30	**Monoculture**					
	T_1	1 : 0	1479.8 ±97.35^{A}	1316.5 ±97.35^{A}	1.96±0.13^{A}	2.02±0.15^{A}
	T_2	0 : 1	357.2 ±25.54^{B}	196.0 ±25.54^{B}	5.37±0.65^{B}	0.75±0.09^{B}
	Polyculture					
	T_3	1 : 2	682.5±34.04	520.5±34.05	2.77±0.17	1.43±0.09
	T_4	2 : 1	941.8±99.32	776.7±99.33	2.64±0.33	1.54±0.19
40	**Polyculture**					
	T_5	1 : 1	1337.0±27.57 ^{B}	1122.1±27.58 ^{B}	2.34±0.05^{B}	1.68 ±0.04^{A}
	T_6	3 : 1	1621.5±95.43 ^{A}	1404.9 ±95.43^{A}	2.12 ±0.13^{B}	1.87±0.12 ^{A}
	T_7	1 : 3	728.6 ±44.78^{C}	514.4 ±44.77^{C}	3.40 ±0.27^{A}	1.17±0.10^{B}

Means in the same column not followed by the capital letters differ significantly at the level 1 %.

Results in Table (3) showed that the stocking density (40 fish/m^3) was better than stocking density (30 fish/m^3) with high significant differences ($P \leq 0.01$) on growth performance and feed efficiency in polyculture under different stocking ratio (T_5, T_6 and T_7). The improvement of growth performance and feed efficiency with increasing stocking density from 30 to 40 fish/m^3 was due to the increasing hybrid red tilapia ratio in polyculture system. Similarly results obtained with (Watanabe *et al*., 1990; El-Shahat, 1998 and Balcazer *et al*., 2004). On the other hand, (Essa, 1996 and Helal, *et al*., 2004) indicated that the higher individual growth rate was found at the lower fish density.

Growth performance traits of hybrid red tilapia and striped mullet during the growing period are presented in Table (4). The FBW, WG, ADG, RGR and SGR of hybrid red tilapia and striped mullet increased significantly ($P \leq 0.01$) with increasing stocking ratio of hybrid red tilapia.

Table (4): Means ± SE of initial and final body weight (FBW), biomass, weight gain (WG), average daily gain (ADG), relative growth rate (RGR), specific growth rate (SGR) and survival rate of hybrid red tilapia (T) and striped mullet (M) reared under different stocking ratio (SR).

SR	Body weight (g)		Biomass	WG	ADG	RGR	SGR	Survival
T : M	Initial	Final	(g)	(g)	(mg)	(%)	(%)	(%)
Hybrid red tilapia (T)								
1 : 0	5.44	49.33 ^{a} ±3.24	1479.8 ^{A} ±97.35	43.88 ^{a} ±3.24	365.7 ^{a} ±27.05	806.2 ^{a} ±34.41	1.83^{A} ±0.05	96.6
1 : 2	5.17	38.35^{ab} ±4.19	383.5 ^{C} ±41.93	33.18^{ab} ±4.19	276.5^{ab} ±34.97	641.7 ^{a} ±46.84	1.66^{A} ±0.08	100.0
2 : 1	5.34	40.59^{a} ±4.92	811.8 ^{B} ±98.56	35.25 ^{a} ±4.92	293.7 ^{a} ±41.06	660.1 ^{a} ±53.29	1.67^{A} ±0.10	95.0
1 : 1	5.42	46.33^{a} ±1.27	926.6 ^{B} ±25.47	40.91 ^{a} ±1.27	340.9 ^{a} ±10.60	754.0 ^{a} ±13.54	1.79^{A} ±0.02	95.0
3 : 1	5.43	47.18^{a} ±2.93	1415.3^{A} ±88.04	41.75 ^{a} ±2.93	347.9 ^{a} ±24.46	768.3 ^{a} ±31.18	1.80^{A} ±0.05	96.6
1 : 3	5.47	29.39 ^{b} ±1.63	293.9 ^{C} ±16.3	23.92 ^{c} ±1.63	199.3 ^{b} ±13.6	437.3 ^{b} ±17.27	1.40^{B} ±0.04	100.0
Striped mullet (M)								
0 : 1	5.37	11.91 ^{B} ±0.85	357.2 ^{AB} ±25.54	6.534 ^{B} ±0.85	54.45 ^{B} ±7.09	121.6 ^{B} ±15.85	0.66^{B} ±0.05	83.3
1 : 2	5.51	14.95 ^{B} ±0.44	299.0 ^{B} ±8.888	9.437 ^{B} ±0.44	78.63 ^{B} ±3.70	171.1 ^{B} ±8.06	0.83^{B} ±0.02	80.0
2 : 1	5.83	13.01 ^{B} ±0.67	130.1 ^{C} ±6.710	7.177 ^{B} ±0.67	59.80 ^{B} ±5.59	123.1 ^{B} ±11.51	0.67^{B} ±0.04	80.0
1 : 1	5.32	20.52 ^{A} ±2.38	410.3 ^{A} ±47.61	15.20 ^{A} ±2.38	126.7 ^{A} ±19.8	285.6 ^{A} ±44.74	1.11^{A} ±0.09	85.0
3 : 1	5.36	20.62 ^{A} ±0.74	206.2 ^{C} ±7.418	15.26 ^{A} ±0.74	127.2 ^{A} ±6.16	284.6 ^{A} ±13.84	1.12^{A} ±0.03	90.0
1 : 3	5.31	14.49 ^{B} ±1.06	434.7 ^{A} ±31.81	9.172 ^{B} ±1.05	76.44 ^{B} ±8.83	172.5 ^{B} ±19.94	0.83^{B} ±0.06	80.0

Means in the same column not followed by the small or capital letters differ significantly at the levels 5 % and 1 %, respectively

Therefore, the FBW, WG and ADG were highest and differ significantly ($P \leq 0.01$) in stocking ratios (T_1 in monoculture 1 T: 0 M), T_4 (2 T: 1 M), T_5 (1 T: 1 M) and T_6 (3 T: 1 M)) in polyculture, respectively and compared with T_7 or polyculture (1 T: 3 M). Similar trend was found for, RGR and SGR under stocking ratios due to different culture systems. A nearly similar results were obtained by Papoutsoglou *et al*., (1992) using two polyculture systems (60% carp – 40% tilapia and 40% carp – 60% tilapia) reared under closed circulated system.

In striped mullet, the FWB, WG, ADG, RGR and SGR traits are presented in Table (4). The differences between stocking ratio T_5 (1 T: 1 M) and T_6 (3 T: 1 M) of striped mullet were significantly at ($P \leq 0.01$). However, the differences were not significant for T_2 ((0 T: 1 M), T_3 (1 T: 2 M), T_4 (2 T: 1 M) and T_7 (1 T: 3 M)) due to stocking ratios. These results was agreement with Sampaio *et al*., (2001) who reported that the stocking density was negatively related to apparent food conversion rate, growth and survival of *M. platanus.* Also, Abdel Hakim *et al.,* (2006) reported that the growth of grey mullet was influenced by the different stocking densities, fertilization of ponds and supplementary feeding which led to best growth of *M. cephalus*.

Means of the survival rate of hybrid red tilapia and striped mullet under different stocking ratio showed in Table (4). The survival rate of hybrid red tilapia and striped mullet in a range of 95 – 100 and 80 – 90 %, respectively. Nearly similar results were obtained by Bakeer, (2006) who found that the survival rate of *Mugil cephalus* was ranged between 83.5 – 85.7 % under monoculture system. However, other reports did not find any significant influence due to the stocking density on survival of many fish species (Essa 1996; Huang and chiu 1997 and Khattab *et al*, 2004).

Means of all feed utilization (FCR, FE %, PER, PPV % and EU %) parameters of red tilapia and striped mullet under different stocking ratios were presented in Table (5). In hybrid red tilapia, the FCR, FE, PER, PPV % and EU % were not significant within all stocking ratios. However, the compared to the same traits for striped mullet, it showed highly significant affected by the different stocking ratios or cultivation systems. The best stocking ratios in striped mullet were (1 T: 1 M) and (3 T: 1 M)) for all feed utilization. The present results a agreement with (El-Dahhar *et al.,* 2006 and El-Sagheer, *et al*., 2008) they showed that feed utilization parameters of striped mullet improved by increasing tilapia stocking ratio.

Means of Dry matter (DM), ash, fat and crude protein of hybrid red tilapia and striped mullet of all body composition under different stocking ratio were presented in Table (6). In hybrid red tilapia, there is significant ($P \leq 0.01$) difference between stocking ratios. The highest values of DM was in T_4 (2 T: 1 M) and T_6 (3 T: 1 M) stocking ratios (30 and 40 fish/m^3) for hybrid red tilapia and striped mullet, respectively. While, the highest values of ash, fat and crude protein were obtained in T_7 (1 T: 3 M), T_4 (2 T: 1 M) and T_3 (1 T: 2 M) stocking ratios (30, 30 and 40 fish/m^3, respectively) of hybrid red tilapia.

In striped mullet, there was significant ($P \leq 0.01$) difference in all stocking ratios (treatment no. T_2 to T_7). The highest values of DM were reflect that T_3 (1 T: 2 M), T_4 (2 T: 1 M) and T_7 (1 T: 3 M) according to stocking ratios. Yet, the highest values of ash and fat were found in T_2 (0 T: 1 M) and T_5 (1 T:

1 M), respectively. On the other hand, the highest values of crude protein were in T_6 (3 T: 1 M) and T_4 (2 T: 1 M) due to different stocking ratios.

Table (5): Means ± SE of feed conversion ratio (FCR), feed efficiency (FE), protein efficiency ratio (PER), protein productive values (PPV) and energy utilization (EU) of hybrid red tilapia (T) and striped mullet (M) reared under different stocking ratios.

Stocking ratio T : M	FCR	FE %	PER	PPV %	EU %
Hybrid red tilapia (T)					
1 : 0	2.14±0.15	47.30±3.50	2.00±0.15	32.06±2.31	16.32±0.67
1 : 2	2.27±0.27	45.33±5.73	1.92±0.24	31.70±3.87	15.76±1.09
2 : 1	2.61±0.34	39.81±5.56	1.68±0.24	27.57±3.72	14.83±1.13
1 : 1	2.43±0.08	41.17±1.34	1.74±0.06	25.30±0.81	13.01±0.24
3 : 1	2.22±0.15	45.43±3.19	1.92±0.14	27.54±1.91	13.89±0.55
1 : 3	2.78±0.19	36.28±2.48	1.53±0.10	25.05±1.63	13.16±0.48
Striped mullet (M)					
0 : 1	5.86±0.71^{A}	17.64±2.30^{B}	0.75±0.10^{B}	14.83±1.47^{B}	9.58±0.85^{C}
1 : 2	4.39±0.20^{AB}	22.88±1.08^{B}	0.97±0.04^{B}	19.70±0.74^{B}	12.78±0.44^{BC}
2 : 1	5.59±0.49^{A}	18.20±1.70^{B}	0.77±0.07^{B}	17.78±1.22^{B}	11.36±0.71^{C}
1 : 1	2.99±0.43^{B}	34.97±5.48^{A}	1.48±0.23^{A}	26.49±3.64^{A}	16.95±2.19^{A}
3 : 1	3.05±0.14^{B}	32.94±1.60^{A}	1.39±0.07^{A}	25.73±1.09^{A}	15.22±0.61^{AB}
1 : 3	4.55±0.50^{A}	22.54±2.60^{B}	0.95±0.11^{B}	18.57±1.74^{B}	12.46±1.06^{BC}

Means in the same column not followed by the capital letters differ significantly at the 1 %

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Table (6): Means± SE of chemical composition of whole body on dry matter basis of hybrid red tilapia (T) and striped mullet (M) under different stocking ratios.

Stocking ratio T : M	DM %	Ash %	Fat %	Protein %
Hybrid red tilapia (T)				
1 : 0	24.47±0.06^{B}	10.24 ±0.47^{CD}	25.96±0.13^{B}	63.80 ±0.64^{B}
1 : 2	24.40±0.12^{B}	9.587±0.19^{D}	25.01±0.08^{CD}	65.41±0.14^{A}
2 : 1	25.52 ±0.11^{A}	9.637 ±0.06^{D}	28.30±0.29^{A}	62.06±0.34^{C}
1 : 1	22.64 ±0.47^{C}	10.91±0.20^{C}	26.07 ±0.21^{B}	63.01±0.05^{BC}
3 : 1	22.52±0.05^{C}	12.64±0.52^{B}	24.77 ±0.36^{D}	62.60 ±0.23^{C}
1 : 3	25.81±0.09	14.05±0.12^{A}	25.61 ±0.33^{BC}	60.34 ±0.28^{D}
Striped mullet (M)				
1 : 0	27.09±0.24^{B}	13.09±0.10^{A}	30.96±0.48^{D}	55.95 ±0.55^{B}
2 : 1	29.61±0.01^{A}	12.28 ±0.32^{B}	32.62 ±0.49^{C}	55.10±0.72^{BC}
1 : 2	28.99±0.12^{A}	8.817 ±0.12^{E}	32.69±0.30^{BC}	58.49 ±0.26^{A}
1 : 1	27.96±0.07^{B}	9.787 ±0.12^{D}	34.05 ±0.29^{A}	56.16±0.30^{B}
3 : 1	27.68 ±0.04^{B}	11.17 ±0.13^{C}	30.63 ±0.08^{D}	58.20 ±0.05^{A}
1 : 3	29.12±0.59^{A}	12.04 ±0.35^{B}	33.77 ±0.29^{AB}	54.19±0.61^{C}

Means in the same column not followed by the capital letters differ significantly at the level 1 %.

The present obtained results were agreement with Bakeer, (2006) he found that the different stocking ratios markedly affected the chemical composition of *M. cephalus*. The lipid content was higher in the highest

density, while protein content was lowest. In the same respect, El-Shahat, (1998) showed no significant effect of stocking density on the carcass composition. However, Khattab *et al*, (2004) found that moisture content in body fish was significantly affected by protein level in dietary only, without stocking density effect, but the other components (crude protein, total lipid and ash) were significantly affected by protein level and by stocking density.

Conclusion

Finally, from the present results it could be concluded that the polyculture system of red tilapia and striped mullet reflected that higher mean of all growth performance parameters and body composition than the monoculture condition. In addition, the best stocking ratio between two species was 3 red tilapia : 1 striped mullet as gross production.

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تـأثير نسـب التخـزين لأسـماك هجـين البلطـى الأحمـر والبـورى المخطـط تحـت نظـم استزراع مختلفة على أداء النمو والاستفادة الغذائية والتركيب الكيماوى للجسم.

فتحـــى فتـــوح محمـــد خليـــل[١]، فـــايق حســـنى فـــراج[١] ، عمـــرو منيـــر هـــلال[٢] و محمد معاذ على رفاعى[١]

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أجريت هذه الدراسة لتقييم أداء النمو لأسماك البلطى الأحمر(نـاتج تهجين ذكور البلطى النيلى مع إنـاث البلطـى الموزمبيقى) والبورى المخطط تحت سبعة معاملات (نسب تخزين) من النوعين وهى (١:٠ , ١:٠ , ٢:١, ١:٢ , ١:١ , ١:٣ , ٣:١) على الترتيب. وكان متوسط الوزن الابتدائي لأسماك لبلطى الأحمر ٥,٣٧ جم والبورى ٥,٤٥ جم , ثم غذيت الأسماك مرتين يوميا بمعدل ٦ % من الكتلة الحيوية للأسماك عند بداية التجربة ثم خفض معدل التغذية تدريجيا حتى وصل الى ٤ % حتى نهاية التجربة.

أظهرت النتائج ما يلى :

1. كانت اسماك البلطى الأحمر أفضل من اسماك البورى فى مقاييس النمو والكفاءة الغذائية تحت نظام أحادى الاستزراع.
2. أعلى مقاييس للنمو لوحظت فى نظام التربية المتعدد عن أحادى الاستزراع.
3. لم تتأثر نسبة الإعاشة فى كل من البلطى الأحمر والبورى بنسب التخزين المختلفة عند استزراعها سواء بالنظام الاحادى او المتعدد حيث تراوحت بين ٩٥ – ١٠٠ % و ٨٠ – ٩٠ % على الترتيب.
4. معايير أداء النمو والكتلة الحيوية و الكفاءة الغذائية تحسنت فى كلا النوعين بزيادة نسبة تخزين البلطى الأحمر مع ثبات معدل التخزين.

وتوصى الدراسة بان استزراع هجين البلطى الأحمر مع اسماك البورى فى النظام التربية المتعدد الأنواع (بلطى + بورى) أفضل من استزراع كل منهما على حده , وأفضل نسبة تخزين بينهما ٣ هجين بلطى احمر : ١ بورى مخطط فى نظام التربية المتعددة وبمعدل تخزين ٤٠ سمكة / م٣ حيث حققت هذة الظروف أفضل معايير النمو والاستفادة من الغذاء والإعاشة.