EFFECT OF MEAGRE (*Argyrosomus regius*) STOCKING RATE ON NILE TILAPIA AND GREY MULLET PRODUCTION THAT REARED IN EARTHEN PONDS UNDER POLYCULTURE SYSTEM

Abou Zied, R.M. and M. M. E. Hassouna,
Animal Production Department, Faculty of Agriculture, Fayoum University, Fayoum, Egypt.

ABSTRACT:

This experiment was conducted, for 180 days (started on 17/5/2006) to evaluate the effect of two stocking rates of meagre with Nile tilapia and grey mullet fish (in polyculture earthen ponds rearing systems), on their growth performance, production and economic efficiency. Stocking rates were 0, 150 and 300 meagre along with (15000 Nile tilapia & 750 grey mullet)/feddan (fdn.). Twelve ponds (4 ponds/treatment) each of 1 fdn area (4200 m^2), 1.2 m depth were supplied with drainage water. Fish were fed twice daily on a diet (25.74% CP, 4.455 kcal/g, GE, Joe trade product) at a rate of 3% from their biomass.

The results revealed that; water quality parameters were insignificantly different among treatments and they were within the acceptable limits. Harvesting body weight, total gain, daily gain and specific growth rate of fish were affected significantly by meagre culture. So for meagre, there growth of T_2 fish was twice that of T_3. Mullets showed significant improvement in it weight when meagre was stocked at a rate of 300 fingerling/fdn. The culture of meagre resulted in increasing grade one tilapia in the expense of the lower grades, with no effect on mullet. As tilapia is the dominant fish in the pond, the net returns were in favour ponds containing meagre. Survival rates of tilapia were not affected greatly when meagre was cultured (about 5% differences), mullet were not affected.

In conclusion the presence of meagre at a rates of 150 or 300

fish/fdn had better effect on tilapia cultured and the polyculture system (where tilapia is the abundant fish) used regarding production and economic efficiencies

Key words: Nile tilapia, grey mullet, meagre, polycuture, growth performance, production and economic efficiency.

INTRODUCTION:

Aquaculture is currently the largest single source of fish supply in Egypt accounting for more than 50 percent of the total fish production of the country, where 98 percent of such production is from privet sector.

Total aquaculture production in 2003 in Egypt reached 445 100 tonnes with a total market value of US$ 584 662 000 (1 USD = 5.78 Egyptian pounds) (GAFRD, 2004).

Polyculture is the practice of culturing more than one specie of aquatic organisms in the same pond. The motivating principles is that fish production in ponds may be maximized by raising a combination of species having different food habits to utilize effectively the available food in a pond and improves its water quality (Hepher and Pruginin, 1981; Naylor *et al*., 2000; McVey *et al.*, 2002 and Davenport *et al*., 2003). Also, Milstein and Svirsky (1996) reported that the appropriate combination of fish species at adequate densities will utilize the available resources efficiently, maximize the synergistic fish-fish and fish environment relationships and minimize the antagonistic ones. So in recent years it has begun to regain attention as a possible mean to increase production efficiency in aquaculture systems, and to reduce environment impacts (Greglutz, 2003).

The expansion in Nile tilapia was associated with the production of all male fry so that it become the most important aquaculture species with a total harvest of about 200 000 tonnes, equivalent to 45 percent of the

total aquaculture harvest in 2003 (GAFRD, 2004). Meanwhile, the annual production of farmed mullet is approximately 136 000 tonnes accounting for approximately 30 percent of the total aquaculture production in 2003. The farming of marine species such as European seabass, gilthead seabream, sole, meagre and penaeid shrimp began in the late 1980s and early 1990s. The majority of farming of marine fish still depends on the collection of seed from the wild.

The use of monosex tilapia doesn't mean that all fry produced are males. This means that some of its adults spawn so that it can reduce fish marketable size and its production (Khater *et al.*, 2000). On the other hand, meagre (*Argyrosomus regius*) is a potential new species for Mediterranean marine aquaculture, particularly for its good breeding performance and body low adiposity (Poli *et al*., 2003).

So, the present work aimed to investigate the effect of meager stocking rate on tilapia-mullet polyculture production and economics.

MATERIALS AND METHODS:

This study was conducted for a period of 180 days started on 17/5/2006 in twelve rectangle-shaped earthen ponds each of 1 feddan (fdn.) area (4200 m^2) with a water level of 1.2 m depth. Ponds were located in a commercial farm at Shakshouk village, Fayoum Governorate, ARE. Ponds were supplied with drainage water from El-Wadi drain endings, water turnover rate was 1/3 from water volume/week.

Monosex Nile tilapia fingerlings of 7.24 ± 0.13 g, grey mullet fingerlings of 5.81 ± 0.11 g and meagre fingerlings of 5.94 ± 0.25 g live body weight were assigned randomly to ponds. Treatments were arranged to contain 15000 tilapia + 750 mullet/fdn, (treatment 1, T_1); 15000 tilapia + 750 mullet + 150 meagre/fdn (T_2); and 15000 tilapia + 750 mullet + 300 meagre/fdn (T_3) where 4 ponds represented one of the evaluated

stocking rates. Accordingly the stocking rates of meager were 0, 150 and 300/fdn for treatments 1, 2 and 3 respectively. Fish were fed on commercial diet (Joe trade products) at a rate of 3% from their body weight, twice daily at 9.0 h and 15.0 h in addition to the available natural food in the ponds. The chemical analysis of diet is shown in Table (1).

Table (1). Chemical analysis of used diet, on DM basis.

Items	%
Crude protein, CP	25.74
Ether extract, EE	6.83
Ash	8.43
Crude fiber, CF	6.98
Nitrogen free extract. NFE[1]	52.02
GE, kcal/g*	4.455
GE, kcal/g without CF	4.169

1, Calculated by differences * Calculated according to energy value presented by Omar, 1984.

Cultured fish were sampled and their body weight was determined at start and at monthly intervals and the feeding rate was adjusted accordingly. At harvesting fish were weighed and counted gravimetrically to determine survival rate, growth rates and feed conversion, then tilapia fish were classified into three grades.

Chemical analysis of diet was conducted according to AOAC (1984) methods. Regarding water quality parameters during the experimental period; water temperature, pH, dissolved oxygen and total ammonia-N were obtained through centigrade thermometer, Orion digital pH meter model 201, Col Parmer oxygen meter model 5946 and Hanna instruments ammonia test kit (HI 4829), respectively. Gross energy of the diet was calculated according to Omar (1984).

Analysis of variance and LSD range test were used to compare treatment means. Data were analyzed using Statgraphic Package Software (SPSS, 1997).

RESULTS AND DISCUSSIONS:

Water quality:

Water quality parameters as affected by meagre culture are presented in Table (2).

Table (2). Water quality parameters as affected by meagre culture.

Item	Treatments*			SE
	T_1	T_2	T_3	
Water temperature, C°	28.5	28.5	28.5	0.95
pH	7.8	7.7	8.1	0.08
NH_3- N, mg/l	Nil	Nil	Nil	0.00
Dissolved oxygen, mg/l	6.8	7.0	7.1	1.02

* T_1, T_2 and T_3 were 15000 tilapia + 750 mullet in each pond + (0.0, 150 and 300 meagre, respectively.
SE, standard error

Parameters showed insignificant differences among treatments. They were within the acceptable limits for tilapia and grey mullet as indicated by Miranda-Filho *et al*. (1995); Milstein and Svirsky (1996); El-Sayed *et al.* (1996) and Abd El-Maksoud *et al.* (1999 a,b) and Abou Zied *et al.* (2005).

Growth performance:

Fish growth performance parameters as affected by meagre culture are shown in Table (3).

Regarding Nile tilapia final weight, total gain, and daily gain were affected significantly by culturing meagre than control (T_1). The effect of meager stocking rate on such parameters nearly similar.

As for grey mullet, final weight, total gain, daily gain were affected significantly with the highest meager stocking rate T_3. However, the improvement was less than 3%.

The meager cultured of a rate of 150 one/fdn (T_2) showed significant final weight, weight gain, daily gain and specific growth rate compared to the rate of 300 fish/fdn. As the stocking rate of tilapia is

Table (3). Growth performance of fish as affected by meagre culture in polyculture earthen ponds.

Item	Treatment			SED
	T_1	T_2	T_3	
Nile tilapia:				
Initial weight/fish, g.	7.05	7.04	7.10	0.304
Final weight/fish, g.	214.25[b]	238.34[a]	235.71[a]	4.40
Weight gain[1]/fish, g.	207.20[b]	231.30[a]	228.61[a]	4.54
Daily gain[2]/fish, g.	1.15[b]	1.29[a]	1.27[a]	0.03
SGR[3], %.	1.90	1.96	1.95	0.03
Grey mullet :				
Initial weight/fish, g.	7.5	8.0	8.0	0.28
Final weight/fish, g.	333.33[b]	333.81[b]	341.00[a]	2.01
Weight gain/fish, g.	325.83[b]	325.81[b]	333.00[a]	1.91
Daily gain/fish, g.	1.81[b]	1.81[b]	1.85[a]	0.01
SGR, %.	2.11	2.07	2.08	0.02
Meagre:				
Initial weight/fish, g.	0.00	5.83	6.04	0.43
Final weight/fish, g.	0.00	894.82[a]	448.33[b]	18.00
Weight gain/fish, g.	0.00	888.99[a]	442.29[b]	18.28
Daily gain/fish, g.	0.00	4.94[a]	2.46[b]	0.10
SGR, %.	0.00	2.80[a]	2.39[b]	0.05

* T_1, T_2 and T_3 were 15000 tilapia + 750 mullet in each pond + (0.0, 150 and 300 meagre/fdn, respectively.
- Averages in the same row having different superscripts are significantly different ($P \leq 0.01$).
- SED, standard error of differences.

1, Final weight – initial weight

2, weight gain/period, day (180) 3, $\{(\ln W_2 - \ln W_1) \times 100/\text{days number}\}$

nearly similar in all ponds, it is expected that the spawning rate in all ponds would be similar. So, as meagre is carnivore fish, its projected feed (Nile tilapia progeny) would be higher with the lower stocking rate. Accordingly the higher growth performance of meager with the lower stocking rate could be interpreted.

Based on results obtained in this study, it could be concluded that growth rate of tilapia, mullet and meager was affected positively by culturing meagre for the expected consumption of tilapia progeny in pond by meagre fish. Also, T_2 had more final weight than T_3 for the higher expected consumption of meager, in T_2, on tilapia progeny than in T_3.

Feed utilization:

The effect of meagre culture on feed conversion ratio (FCR) of fish is presented in Table (4).

The presence of meager fish improved final fish weight and resulted in lowering feed introduced in ponds leading to a significant improvement in FCR. The two stocking rates of meager showed nearly similar results.

Table (4). Feed utilization of fish as affected by meagre culture in polyculture earthen ponds.

Item	Treatments *			SED
	T_1	T_2	T_3	
Initial weight, kg/pond	111.38	111.60	114.31	4.67
Final weight, kg/pond	3238.5[b]	3486.5[a]	3492.0[a]	30.68
Feed intake, kg/pond	7131[a]	6906[b]	6850[b]	27.32
FCR	2.28[a]	2.05[b]	2.03[b]	0.02

* T_1, T_2 and T_3 were 15000 tilapia + 750 mullet in each pond + (0.0, 150 and 300 meagre/fdn, respectively.

Averages in the same row having different superscripts are significantly different ($P \leq 0.01$). SED, standard error of differences.

The presence of tilapia progeny in T_1 (where no meager in the pond) resulted in increasing feeding rate to face the increase in tilapia fry population and to eliminate the reduction in fish final weight. Such trend in better FCR with the presence of meager in the pond.

Production efficiency:

Table (5) shows the production efficiency of fish as affected by meagre culture. Survival rates of Nile tilapia ranged between 88.69 and 93.49%. These values are in the normal ranges as indicated by Teichert-Coddington and Green (1993), Knud-Hansen and Batterson (1994), Hassouna *et al.*, (1998) and Abd El-Maksoud *et al.*, (1999 a,b), who reported values ranged between 87 and 95%. The survival rates of grey mullet ranged between 92 and 96%. In this connection, Abd El-Maksoud *et al.*, (1999 a,b) found that the survival rate of grey mullet were 93.64 %.

Body mass of Nile tilapia at harvesting and the net production per feddan were higher significantly when meagre was included in the farm. Also, both meagre stocked showed nearly similar results with tilapia. Tilapia graded were improved significantly by culturing meagre, the best 1st grade ranged between 93 and 94% (with T_2 and T_3 respectively) compared to the control (78%, T_1). In contrast, the 2nd and 3rd grades were higher with T_1 compared to T_2 and T_3 (Table 5). These results showed that meagre fish consumed small tilapia fries and produced good chance to improved tilapia growth performance, grades and feed utilization (T_2 and T_3 ponds).

As for body mass of grey mullet at harvesting and the net production per feddan were not affected by the presence of meagre.

Regarding ponds stocked with meagre (T_1&T_3), insignificant difference were obtained regarding the tested parameters. However, T_2 showed better response as its stocking rate was lower than T_3 but the total fish biomass was nearly similar for both treatments (T_1&T_3). Looking at

Table (5). Production efficiency of fish as affected by meagre culture in polyculture earthen ponds

Item	Treatments *			SED
	T_1	T_2	T_3	
Nile tilapia				
Fish No/feddan				
At start	15000	15000	15000	----
At harvesting	14024[a]	13304[b]	13470[b]	206
Survival rate[1] %	93.49[a]	88.69[b]	89.90[b]	1.37
Fish biomass, kg/feddan				
At start	105.75	105.60	106.50	4.56
At harvesting;	3005[b]	3170[a]	3172[a]	33.92
1st grade[2]	2342[b]	2949[a]	2995[a]	34.96
2nd grade[3]	320[a]	164[b]	134[b]	25.48
3rd grade[4]	343[a]	57[b]	43[b]	14.57
Net production[5]	2899.25[b]	3064.40[a]	3065.5[a]	34.71
Relative % of net production	100	105.70	105.73	----
Grey mullet				
Fish No/feddan				
At start	750	750	750	----
At harvesting	701	703	702	7.27
Survival rate[1] %	93.47	93.73	93.60	0.97
Fish biomass, kg/feddan				
At start	5.625	6.000	6.000	0.19
At harvesting;	233.75	234.50	239.50	2.82
Net production	228.125	228.5	233.5	2.62
Relative % of net production	100	100.1	102.35	----
Meagre				
Fish No/feddan				
At start	-----	150	300	----
At harvesting	-----	92	180	----
Survival rate[1] %	-----	61.33	60.00	3.02
Fish biomass, kg/feddan				
At start	-----	0.875	1.81	----
At harvesting;	-----	82.0	80.5	3.88
Total biomass, kg/feddan				
At start	111.38	111.60	114.31	4.68
At harvesting;	3238.50[b]	3486.50[a]	3492.0[a]	30.68
Net production[2]	3127.12[b]	3374.90[a]	3378.19[a]	31.17
Relative % of net production	100	107.92	108.03	----

* T_1, T_2 and T_3 were 15000 tilapia + 750 mullet in each pond + (0.0, 150 and 300 meagre, respectively.

SED, standard error of differences. 1, Survival rate = (fish No at harvesting/fish No at start) 100

2, 3-4 fish/kg 3, 5-6 fish/kg 4, 7-10 fish/kg

5, body mass of fish at harvesting, kg – body mass of fish at start, kg

the total biomass, the presence of meagre at both stocking rates tested improved fish production and grades more than the control (T_1).

Economical evaluation:

The economical analysis (Table 6) showed that the income from T_3 and T_2 were higher than that of T_1 by about 15%, where T_2 and T_3 had nearly similar income. On the other hand the total costs of T_2 were nearly similar. Meanwhile, they were lower than the control (T_1) by about 2%. This is due to the higher quantity of feed offered to the control (T_1), avoid the effect of tilapia progeny. Accordingly the net returns were in favour of T_2 and T_3 compared to the control (T_1). The increase in grade one tilapia in the expense of other lower grades with T_2 and T_3 was behind such result. It was observed that T_3 tended to respond better than T_2 by about 2%.

In conclusion the presence of meagre at a rates of 150 or 300 fish/fdn had better effect on tilapia cultured and the polyculture system (where tilapia is the abundant fish) used regarding production and economic efficiencies

Therefore, it could be recommend the rearing of meagre fish with Nile tilapia and grey mullet together in polyculture earthen ponds at a density of 300 fingerlings/fed. for the better net income.

Table (6). Effect meagre culture on economical efficiency of fish in polyculture system.

Item	Treatments *		
	T_1	T_2	T_3
Income, L.E/fed			
Nile tilapia	26536	29559	29694
Grey mullet	3974	3987	4072
Meagre	----	1640	1610
Total	30509	35186	35376
Relative % of total income	100	115.33	115.95
Variable costs, L.E/fed.			
Fingerlings including transport			
Nile tilapia	4125	4125	4125
Grey mullet	1000	1000	1000
Meagre	----	98	195
Labors	225	225	225
Irrigation	450	450	450
Feeds	15403	14917	14796
Others	250	250	250
Total variable costs	21453	21065	21041
Fixed costs, L.E/fed.	1050	1050	1050
Total costs	22503	22115	22091
Relative % of total costs	100	98.28	98.16
Net returns, L.E/fed.	8006	13071	13285
Relative % of net returns	100	163.27	165.95
Net returns/total costs, %	35.58	59.10	60.14

* T_1, T_2 and T_3 were 15000 tilapia + 750 mullet in each pond + (0.0, 150 and 300 meagre, respectively.

- The average of price of 1 kg fish × the fish yield, kg/ fed.
- CV%, coefficient of variability
- Selling price of one kg of tilapia was 9.5, 7.5 and 5.5 L.E. for 1st grade, 2nd grade and 3rd grade, respectively and for mullet and meagre was 17 and 20 L.E. respectively and the price of kg feed was 2.160 L.E.

REFERENCES:

A.O.A.C (1984). Official Methods of Analysis. S. Williams (Ed). Association of Official Analytical Chemists, Inc. Arlington, Virg., U.S.A.

Abou Zied, R.M; A.M.S. Abd El-Maksoud and A.A.A. Ali (2005). Effect of stocking rates of Nile tilapia (*Oreochromis niloticus* L.) and grey mullet (*Mugil cephalus* L.) on their performance in polyculture earthen ponds. Annals Agric. Sc., Moshtohor, 43: 1057-1066.

Abd El-Maksoud, A.M.S; M.M.E. Hassouna; S.M. Allam; G.E. Aboul-Fotouh and M.Z.Y. El-Shandaweily. (1999 a). Effect of feeding regime on the performance of Nile tilapia (*Oreochromis niloticus* L.) and grey mullet (*Mugil cephalus* L.) reared in polyculture earthen ponds. Egyptian J. Nutr. and Feeds 2: 111-121.

Abd El-Maksoud, A.M.S; M.M.E. Hassouna; S.M. Allam; G.E. Aboul-Fotouh and M.Z.Y. El-Shandaweily. (1999 b). Effect of fertilization with chicken manure on performance of Nile tilapia (*Oreochromis niloticus* L.) and grey mullet (*Mugil cephalus* L.) reared in polyculture earthen ponds. Egyptian J. Nutr. And Feeds 2: 123-133.

Davenport, J; K. Black; G. Burnell; T. Cross; S. Culloty; S. Ekaratne; B. Furness; M. Mulcahy and H. Thetmeyer (2003). Aquaculture: the ecological issues. British Ecological Society. Blackwell Pub.

El-Sayed A.F.M.; A. El-Ghobashy and M. Al-Amoudy (1996). Effects of pond depth and water temperature on the growth, mortality and body composition of Nile tilapia, *O. niloticus* (L.). Aquacult. Res., 27:681-687.

GAFRD (2004). Fish Production Statistics. General Authority for Fish Resources Development, Ministry of Agric & Land Reclamation, ARE.

Greglutz, C. (2003). Polyculture: principles, practices, problems and promise. Aquaculture magazine March/April 1-5.

Hassouna, M.M.E; A.M.S. Abd El-Maksoud; M.S.R. Radwan and A.A. Abd El-Rahman (1998). Evaluation of three commercial feeding regimes for Nile tilapia, *Oreochromis niloticus* L., reared in earthen ponds. The 10th Conf. Egyptian Soc., Anim. Prod. Assiut., Egypt, 13-15 December, 35: 267-277.

Hepher, B. and Y. Pruginin (1981). Commercial fish farming. John Wiley, New York.

Khater, A.M.; H.A. Elghobashy and G. Abdel Nasser (2000). Comparisons of mass and individual spawning for different strains of Nile tilapia (*Oreochromis niloticus*) in Egypt. The International Conference on Biological Sciences. 1: 493-500.

Knud-Hansen, C.F. and T.R. Batterson (1994). Effect of fertilization frequency on the production of nile tilapia (*Oreochromis nitolicus*). Aquaculture, 123: 271-280.

Martin S K. and S. Michael (2003). Integrated wastewater treatment and aquaculture production. A report for the Rural Industries Research and Development Corporation. RIRDC Publication No 03/026

McVey, J.P; R.R. Stickney; C. Yarish, and T. Choppin (2002). Aquatic polyculture and balanced ecosystem management: new paradigms for seafood production. In: *Responsible marine aquaculture*. Edited by: Stickney, R.R. and J.P. McVey. CABI Publishing.

Milstein, A. and F. Svirsky (1996). Effect of fish species combinations on water chemistry and plankton composition in earthen fish ponds. Aquacult. Res., 27: 79-90.

Milstein, A; A. Alkon; I. Karplusm; M. Kochba and Y. Avnimelech (1995). Combined effects of fertilization rate, manuring and feed pellet application of fish performance and water quality in polyculture ponds. Aquaculture Research, 26: 55-65.

Miranda-Filho, K.C; W. Jr. Wasielesky and A.P. Macada (1995). The effect of ammonia and nitrit on the growth of mullet, mugil platanus (Pisces, Mugilidae). Rev. Bras. Biol., 55: 45-50.

Nagdi, Z.A. (1998). Yield and performance of two species of tilapia under different pond environments. Egypt. J. Agric. Res. 76: 875-882.

Naylor, R.L; R.J. Goldburg, and J.H. Primavera (2000). Effect of aquaculture on world fish supplies. Nature, 405:1017-1024.

Omar, E.A. (1984). Effect of type of feed, level and frequency of feeding on growth performance and feed utilization by mirror carp (*Cyprinus carpio*, L). Ph D dissertation, George-August Univ. Gottingen, Germany.

Poli B.M; G. Parisi; G. Zampacavallo; F. Iurzan; M. Mecatti; P. Lupi and Bonelli (2003). Preliminary results on quality and quality changes in reared meagre (*Argyrosomus regius)*: body and fillet traits and freshness changes in refrigerated commercial-size fish. Aquaculture International, 11: 301-311.

SPSS. (1997). Statistical Package For Social Science (for Windows). Release 8.0 Copyright (C), SPSS Inc., Chicago, USA.

Teichert-Coddington, D. and B.W. Green (1993). Tilapias yield improvement through maintenance of minimal oxygen concentrations in experimental grow-out ponds in Honduras. Aquaculture, 118: 63-71.

ARABIC SUMMARY:

تأثير استزراع اسماك اللوت على إنتاج البلطى النيلى والبورى المرباة في الاحواض الأرضية بنظام الزراعة المختلطة.

رمضان محمد أبوزيد و محمد محمد السعيد حسونة

قسم الإنتاج الحيواني- كلية الزراعة- جامعة الفيوم –الفيوم – مصر.

أجريت هذه التجربة لمدة ١٨٠ يوم بدأت فى ٢٠٠٦/٥/١٧ وذلك لتقييم تاثير معدلين تخزين لأسماك اللوت في الزراعة المختلطة لأسماك البلطى النيلى والبورى المرباة معا بنظام الزراعة المختلطة فى أحواض أرضية على مظاهر النمو والكفاءة الإنتاجيـة والاقتصـادية، وكانت معدلات التخزين المختبرة هى: ١٥٠ و ٣٠٠ سمكة لوت + (١٥٠٠٠ بلطى + ٧٥٠ بورى)/فدان. وقد تم استخدام ١٢ حوض (٤ أحواض/معاملة)، مسـاحة الحـوض ١ فـدان وارتفاع عمود الماء به ١,٢ م، و كانت تمد بمياة الصرف الزراعى، وغذيت الأسماك علـى عليقة تجارية (جوتريد) (٢٥% بروتين، ٤,٤٥٥ كيلوكالورى/جم طاقة كلية) بمعدل ٣% من وزنها وذلك على مرتين يوميا وقد أظهرت النتائج أن:-

مقاييس نوعية الماء لم تتأثر معنويا بالمعاملات وكانت فى الحدود المناسبة لأسـماك البلطى والبورى، وبالنسبة للوزن النهائى للبلطى عند الحصاد ومعدل الزيادة الكلية واليوميـة تأثرت معنويا بزراعة اسماك اللوت. كذلك تضاعف وزن اسماك اللوت في المعاملـة الثانيـة عن الثالثة وتحسن وزن البورى معنويا بزراعة اللوت بمعدل ٣٠٠ سـمكة/فـدان. زراعـة اسماك اللوت أدت إلى زيادة الدرجة الأولى للبلطى على حساب بـاقى الـدرجات. وتحسـن صافى العائد لأحواض اسماك البلطى المحتوية على اسماك اللوت. معـدل إعاشـة اسـماك البلطى لم تتأثر كثيرا بزراعة اللوت أما البورى لم يتأثر.

وجود اسماك اللوت بمعدل ١٥٠ و ٣٠٠ سمكة/فدان له تأثير جيد في نظام الزراعـة المختلطة وذلك بالنظر للكفاءة الإنتاجية والاقتصادية.

الكلمات الدالة: البلطى- البورى- اللوت-معدل التخزين – الزراعة المختلطة- مظاهر النمو- الكفاءة الإنتاجية والاقتصادية