Delta J. Sci. 20 (1) 1996, 206-226

WATER QUALITY CRITERIA UNDER TWO TILAPIEA (*ORECHROMIS NILOTICUS*) CULTURE METHODS, SEMI-INTENSIVE EARTHEN PONDS AND AN INTENSIVE CIRCULAR METAL TANKS

BY

Nabila A. Hassan*, Mohamed A. Essa** and Mohamed E. Salama***

* Soil Salinity Laboratory, Alexandria, Soil and Water Research Institute, Agricultural Research Center.

** National Institute of Oceanography and Fish., Alex., Egypt.

*** Dept. of Animal and Fish Production, Fac. of Agric., Saba Basha, Alexandria University, Alexandria.

Received: 27-1-1996

ABSTRACT

The present work aimed to study the relative effects of two tilapia (Oreochroims niloticus) culture methods, semi-intensive earthen ponds and an intensive circular metal tanks, on water quality. The study was conducted in two commercial fish farms in Egypt: El-Amal Semi-Intensive Fish Farm at Kafr El-Sheikh Governorate and Nawa Intensive Fish Farm at El-Qualuobia Governorate.

The results showed that the water quality under the two culture methods studied was suitable for fish raising and production. The dissolved oxygen ranged between 5.0 to 9.6 pmm. The pH values were always on the alkaline side. Total alkalinity was high (over 190 ppm). Moreover, ammonia concentrations did not exceed 0.41 ppm. These values lie beyond the critical degrees.

However, under intensive method the water quality criteria was better than that of semi-intensive earthen ponds. Thus under semi-intensive earthen ponds the rate of water exchange should be increased.

INTRODUCTION

Fish are aquatic animals that live and feed within a water environment. so bor For best growth, survival and good yield, rearing environment has to meet the requirements of the fish (Krom et al., 1985 ; Essa etal., 1989). Water temperature, oxygen content, salinity and other environmental factors greatly affect fish growth and production (Alabaster and Lloyd, 1984; Siddiqui et al., 1991; and Abdel-Raheem, 1994). Therefore, good fish culture practice, or system is that which could produce a favorable environment.

In tilapia culture, methods of production may be classified according to their objectives into three categories: extensive, semi-intensive and intensive farming, (Spotts, 1983; and Simon, 1992). The first two are usualy practiced in earthen ponds. Intensive systems include culture in artificially constructed water tanks made of wood, plastic, metal, fiberglass, cement etc. with varying shapes and sizes according to the design requirements of the species. Productivity is therefore ultimately dependent upon the skillful manipulation of the system and management operation particularly water quality (Huet, 1972; Balarin and Haller, 1982; Mires, 1983 ; Otubusin, 1987)-

In fish culture, generally, water quality is usually defined as the suitability of water for fish growth and survival, and normally governed by the chemical, physical and biological water parametrs And since these parameters are greatly influenced by the culture methods (Jana and Chakrabarti, 1990 ; Rosa and De Assuncao, 1990; Diana et al ., 1991; and Yadava and Garg, 1992), therefore, the present work aimed to study the relative effects of two tilapia culture methods, semi-intensive production ponds and an intensive circular metal tanks, on the chemical and physical parameters of the water of experimental tilapia farms.

MATERIALS AND METHODS

This study was carried out at two commercial fish farms dealing with tilapia culture (Oreochromis niloticus) as follows:

1-El-Amal Farm (fig 1) is a commercial fish farm located at El-Hamol town , kafr-El-Sheikh Governorate. The farm has a total area of 14.7 hectars. The and is spe cialized in raising mono-sex (male) tilapia (Oreochromis niloticus) and grey mullet (Mugil cephalus).

The fish were stocked at a rate of 9,500-11,900 fry tilapia and 1,400 fry mullet (M. cepalus) per hectare. The average body weights of fry tilapia and fry mullet were 0.19 g and 0.10g , respectively. The growing period started from March to November, 1992.

An identical fertilization program was applied weekly to all ponds (Table 1). The dosage were as follows: urea (46% nitrogen) 12 kg/ha , superphosphate (45% phosphorus) 24 kg/ha , and chicken manure 360 kg/ha. In addition artificial feeds (Table 2) containing 34.7%-protein were offered to pond fishes at a rate of 3% of the estimated fish body weight for six days a week throughout the experimental period.

Pond water was renewed when needed, especially in summer to avoid sudden drop in dissolved oxygen. Water exchange rate varied from 10-20% per day.

2-Nawa Intensive Fish Farm: The farm is located 25 km north to Cairo and was constructed with German Technology in 1986. The fish culture systems consisted of eight circular galvanized steel tanks (each 150 m^3) with concrete foundations (Fig 1). Submersible pumps were used at 35 m depth to supply water from two wells which delivered 30-50 m^3 water/h . Each tank was provided with irrigation and drainage pipes with control valves . All tanks are drained into a drain canal (by a pump) across the main drain pipe (underground) and connected with the drain collecting room The water was aerated by three blowers, two of 2.2 KW and one of 0.6 KW . Air was distributed in each tank through two airlift devices. The farm is specialized in hatching and raising tilapia to fingerlings. Also, the farm completely depended upon artificial diets containg 27% protein.

Water quality criteria (temperature, dissolved oxygen, pH, Salinity, total alkalinity, and un-ionized ammonia) were recorded bi-weekly at 12:OO h noon, in both farms , according to the methods described by The American Public Health Association , 1965.

The analyses of variable water quality parameters were compared by one-way analyses of variance (ANOVA) for both farms according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Of great importance is the adaptation of fish to the water quality environmental conditions. The types and amounts of dissolved gases and suspended solids in the habitat must be non-toxic and harmful to fish (Abu-Tubikl, 1979). Furthermore, optimum conditions should be maintalned and the results were as follows:

1- Temperature:

Water temperature plays an important role in fish farming industry, since it affects survival, growth, and reproduction as well as other vital activities of fishes (Alabaster and Lloyd, 1984).

At the El-Amal Fish Farm, its values ranged from 25.5 29°C with an average of 27.5°C.The data in Table 4 show significant differences ($p \leq 0.01$) between desities. This may be attributed to water depth and primary productivity in ponds.

At Nawa Intensive Fish Farm (intensive culture method) the avarage water temperature was 22.6°C(12.3-29°C,range)Table 4.

Generally, water temperature was suitable for tiapia culture . Only at El-Nawa Fish Farm, the decreasing water temperatures during November and December influence tilapia growth rate. Behrends et al . (1985) stated that water temperature must be at least 22°C for O . niloticus growth and spawning. Other workers reported that tilapia ceased growing significatly at temperatures below 20°C, as the optimal temperature for tilapa culture ranged from 25 to 30°C.

2-Salinity:

The Salinity of farms water was measured since it affects growth, survival and reproduction of tilapia species. The results, summarized in Table 4, show that the average value of salinity in water ponds under the semi-intensive method was 3.6 ppt (range 2.7-5.4ppt). These levels are low and have no effect on tilapia (O. niloticus) growth and survivial. Oreeochromis niloticus could withstand salinities up to 35 ppt and thrive and reproduce at salinities of about 13.5 to 29 ppt (Balarin and Haller, 1982; Essa and Salama, 1994). Chervinski (1961)found that at 50% sea water O. niloticus growth rate showed insignificant differences than that grown in fresh water.

Under the intensive tank method , Salinity values ranged from 0.32 to 0.51 ppt with an average of 0.41 ppt. Moreover, the salinity concentration under the tank culture method was lower than that observed under the semi-intensive earthen ponds culture. This may be attributed to the source of water (water wells.).

3- pH

The pH of water under the two culture systems were recorded, since its values indicate the suitabilty of water quality, as it is a result of the interaction between many substances in the water column and many biological phenomina.

Undder the semi-intensive culture method the pH ran ged from 6.8- 8.4 with an average value of 7.75. The results showed insignifican differences between densities. While under the intensive culture method the pH levels were higher, and ranged from 7.2 to 8.2 with an average value of pH 7.8,(Tables 4 and 5). Swingle (1961) reported that the acid and alkaline death points for fish are about pH 4 and pH 11, respectively. Therefore, it could be concluded that the ph levels under the culture : systems studied were very suitable for tilapia culture and the higher pH values recorded in this study might be due to excessive photosyn thesis.

T' : results of pH in this work show also highly significant differences due to months ($P \leq 0.01$) and insignificant differences among dentites ($p > 0.01$).

4-Total alkalinity :

The total alkalinity under the two culture systems were determined . Under the semi-intensive method its values were 143.1 to 352.1 ppm Ca CO_3 with an average of 251.3 The results in Table 4 show increased values deuring July and August. This increase may be explained by the increased photosynthetic activity during that period.

Under the intensive method total alkalinity levels were less than the above semi-intensive method. Total alkalinity values under the intensive method were 190.0-248.6 ppm with an average of 218.6ppm (Table 5).

Although significant differences were found among months and between stocking densities ($P \leq 0.01$) under the semi-intensive method , the corresponding data under the intensive method were insignificant. Boyd and Walley (1975) reported that in fertilized ponds, total alkalinity values in the range range of 20-120mg/1 have little effect on fish production, while ponds with total alkalinity of 200-300mg/1 had better effect on fish production and growth (Boyd,1982). Thus the present results could be considered more suitable for fish farming.

<u>5-Dissolved oxygen:</u>

Dissolved oxygen is considered as one of the most important environmental factors. It is a limiting factor for success or failure in fish culture . The results summarized in Thable 4 and Fig 3 show that its values under the semi-culture method ranged from 5.0 to 9.0ppm with an average value of 6.9ppm. The results show highly significant ($P \leq 0.01$) differences among months and between stocking densities. The dissolved oxygen content in earthen ponds depends on pond water temperature, quantity of organic matter, aquatic vegetation or phytoplankton (Huet,1972), fish biomass (Essa <u>et</u> <u>al</u>, 1988) and a rate of water exchang (Essa <u>et</u> <u>al</u> ., 1988).

Under the intensive tank method the results in Table 5 and Fig 4 reveal that, dissolved oxygen ranged between 6.1-9.6ppm with an average of 7.7ppm . The oxygen content under the intensive method was higher than that under the semi-intensiv method due to the artificial aeration and water exchange .

Generally, the dissolved oxygen content under the two culture methods could be considered reasonable compared to the critical level for oxygen concentration (Zohar <u>et</u> <u>al</u> ., 1985). The results also showed high values of oxygen content in both methods occured during cold seasons. This phenomenon was reported by other workers (Sarig,1971; George,1975).

6-Un-ionized ammonia (NH_3)

The accumulation of toxic inhibitory metabolites has become a limiting factor in the process of intensification of ponds (Rimor and Shilo, 1982). Un-ionized ammonia is one of fish poisons. It is a major excretory oroduct of fish. It is also produced by the bacterial ammonification process of organic nitrogenous matter in the pond (Shilo and Rimon, 1982). Ammonia is highly toxic and greatly affect fish growth (Boyd, 1982), and its toxcicty increases by other factors as oxygen concentration (Colt and Armestrong, 1979). So , in the present study ammonia concentration was reccorded.

Under the semi-intensive method the ammonia levels varied from 0.009 to 0.408 ppm with an average of 0.147ppm. Moreover, ammonia concentration increased during July and August. This may be attributed to increasing water temperatures (Boyd, 1982; Krom et al., 1985). The results presented in Table 4 and Fig 3 showed also highly significant differences in ammonia concentration among months and densities ($P \leq 0.01$) This might be due to high excret ory fish product and other organic matter.

On the other hand, under the intensive tank method the ammonia levels were often less than 0.1 ppm with highly significant differences ($p \leq 0.01$) between months and desities (Table 5 and Fig4). Its levels varied between 0.02 and 0.13 ppm with an average value of 0.087 ppm. This may be attributed to excesisve feeding and/or inadequate cleaning of tanks. Ernst et al. (1989) found that total ammonia varied from 0.01 to 0.40 ppm in fed sea water pools stocked with florida red tilapia without any harmful effect on fish.

ACKNOWEDGMENT

The authors wishes to express thir appreciation and sincere gratitude to the members of El-Emal Fish Farm and Nawa Intensive Fish Farm for their help and plentiful facilites offered to us throughout this work.

REFERENCES

Abdel-Raheem,M.M. (1994): Evaluation of tilapia culture methods practiced in some Egyptian commercial fish farms M.Sc. Thesis, Fac. of Agriculture, Univ. of Alexanderia. Sc. Thesis, Fac of Agriculture, Univ. of Alexanderia, Saba Basha, Egypt.

Abu-tubikh, N. A. S. (1979): Studies on fish production: Effect of different culture methods on growth of tilapia and mullet. M. Sc. Thesis, Fac. of Agriclture, Alex. Univ.

Alabaster, J.S. and LIoyd,R. (1984). Water quality criteria for freshwater fish. Publ. Butterworths, Arrangement with the FAO. Printed in Great Britain, Univ. Press, Cambridge.

American Public Health Association (1965): Standard methods for the examination of water and waste water. 12th eddition, Inc., New york. 769 pp.

Balarin, J.D. aand Haller, R.D. (1982): The intensive culture of tilapia in tanks, raceways and cages. In: J.F. Muir and R.J. Roberts (eds). Recent Advances in Aquaculture. Croom Helm,London.pp.256-356.

Barash, H. (1984): Growth rates of young tilapia fingerlings fed on commerical eel and trout diets. Bamidgeh, 36 (3):70-79.

Behrends, L.L.,KinGaley, J. B.; Maddox, J.J.; & Wadell, E.L. (1983) Fish production and community in an organically fertilized fish ponds. J. of the World Mariculture Society, 14: 510-522.

Boyd,C.E. (1982) .Water quality management for pond fish culture. Elsevier, Amsterdam, 318pp.

Chervinski, J (1961). Laboratory experiments on the growth of tilapia nilotica in various saline concentrations Bamidgeh 13(1) : 8-13.

Colt, and Armstrong (1979). Nitrogen toxicity to fish, crustaceans and molluscus Dept. of Engineering univ. of California Davis, California .

Diana, J.S., Lin, C.K., and Schneeberger, P.J. (1991). Relationships among nutrient inputs, water nutrient concentrations, primary production and yield of Oreochromis niloticus in ponds . Aquaclture,92:32-341.

Ernst, D. H.;Ellingson, L,J.; Olla,B.L.;Wicklund, R.I.;W atanabe, O.W.&Grover, J.J. (1989). Production of Florida red tilapia in seawater pools: nursey rearing with chicken manure and grow - out with prepared feed. Aquaculture, 80: 247 - 260.

Essa,M.A., El-Sherif,Z.M., Abdel-Moati., A.R. ;& Aboul-Ezz,S.M. (1988). An experiment for scientific monagewent of El-Khashaa Fish Farm/ Kafr El-shiekh governorate. Proc. the first Scient. Conf.on the Role of Science Research in the Development of fish resources. 6-8 Aug ., Aug., Fac . of Agtic. Alex. Univ. pp. 55-62.

Essa, M.A.; El-Sherif, Z.M.; Aboul-Ezz, S.M.; & Abdel - M oati, A.R (1989). Ellect of water quality, food availability and crowding on rearing condition and growth of some economical fish species grown under poylculture. systems. Bull.Nat. Inst. Oceanogr. and Fish. ARE, 15 (1): 125-134.

Essa,M.A, and Salama, M.E. (1994): Salinity tolerance and reproductive performance of nile tilapia, Oreochromis niloticus, Delta J. Sci. 18(1): 239-261, Tanta Univ.

George, T.T. (1975): Observations on the growth of Tilapia nilotica in tropical freshwater fish ponds treated with different fertizers. FAO/CIFA Symp. on Aquaculture in Africa, 30 Sept- 20 Accra, Ghana. FAO, Rome.

Huet, M. (1972): Textbook of Fish culture: breeding and cultivation of fish. Fishing news Books Ltd., West Byfleet, Surrey, England.

Jackson, M.L. (1958)- Soil chemical analysis. Prentice-Hall, Englewood Cliffs, NJ, 498 pp.

Jana, B.B., & Chakrabarti, R. (1990): Exogenous introduction of live plankton better approch to carp growth than the direct-manure system. Prog-Fish-Cult., 52(4): 252-260.

Krom, M.D., Porter, C.;& Gordin, H. (1985): Description of the water quality condition in a semi-intensively cultured marine fishpond in Eilat, Israel. Aquaculture, 49: 141-157.

Lin, Ch and Lin, Ch. (1990): Test for ammonia toxicity of cultured hybrid tilapia. Asian Fisheries Society, Manila, philippines, pp.457-460.

Mires, D. (1983): A technical evalution of tilapia cultures. In: L. Fishelson and Z. Yaron (compilers) Intern. Symp. on Tilapia in Aquaculture Proc., Tel Aviv Univ. Tel Aviv, Israel, PP. 600-610.

Otubusin, S.O. (1987): Effect of different levels of blood meal in pelleted feed on Tilaia (O niloticus) production in floating bamboo net-cages. Aquaculture, 65:263-266.

Rimon, A. and Shilo, M. (1982). Factors which affect intensification of fish breeding in Israel: 1-physical, chemical and biological characteristics of the intensive fish ponds in Israel. Bamidgeh, 34 (2) : 87 - 100

Rosa, P.V., and De Assuncao, P.m. (1990) . physicochemical and biological parameters of pond water with tilapias fed swine excrements. Rev Soc Bras Zootes, 19(6) : 523-529.

Sarig, S. (1971). The preventation and treatment of diseases of warmwater fishes under subtropical conditions, with special emphassis on intensive fish farming. In: S.F. Snieszko and H.R. Axelrod (eds.) Diseases of Fishes, BooK3.T.F.H. Publications, Hong kong, 127 pp.

Shilo, M. and Rimon, A. (1982). Factors which affect the intensification of fish breeding in Israel : 2-Ammoina transformation in the intensive fish ponds. Bamidgeh, 34(3) : 101 - 133 .

Spotts, D. (1983) High density tilapia culture - Japan Aquacult. Mang. 9:20 - 23.

Steel, R.G.D. and Torrie, J.H. (1980). Principales and procedures of Statistios. Mc-Graw-h ill Book Company/Now york, NY, 633 pp.

Swingle, H.S. (1961) Relationship of pH of pond waters to their suitability for fish culture. Proc.Pac. Sci Con fr., 9: 1-4.

Van Rijin,J., Stutz, S.R., Diab, S.& Shilo,M. (986). Chemical physical and biological parameters of superintensive concrete fish ponds Bamidgeh, 38 (2) : 35-43.

Yadava, N.K. and Garg, S.K. (1992). Relative efficiency different doses of organic fertilizer and supplement feed utilization under intensive fish farming. Bioresour. Tech 42 (1) : 61 - 65

Zohar, G., Rappaport, U. & Sarig,S. (1985) .Intensive culture of tilapia in concrete tanks. Bamidgeh. 37 : 103 - 111.

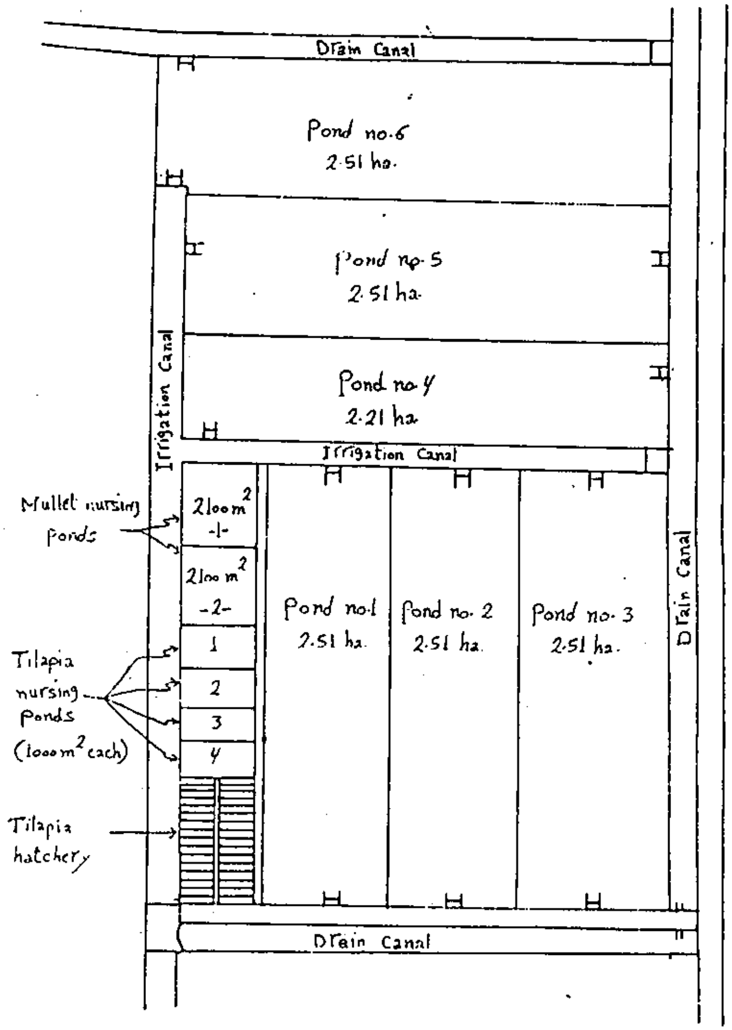

Fig.(1) Diagram for, El-Amal comercial Fish Farm

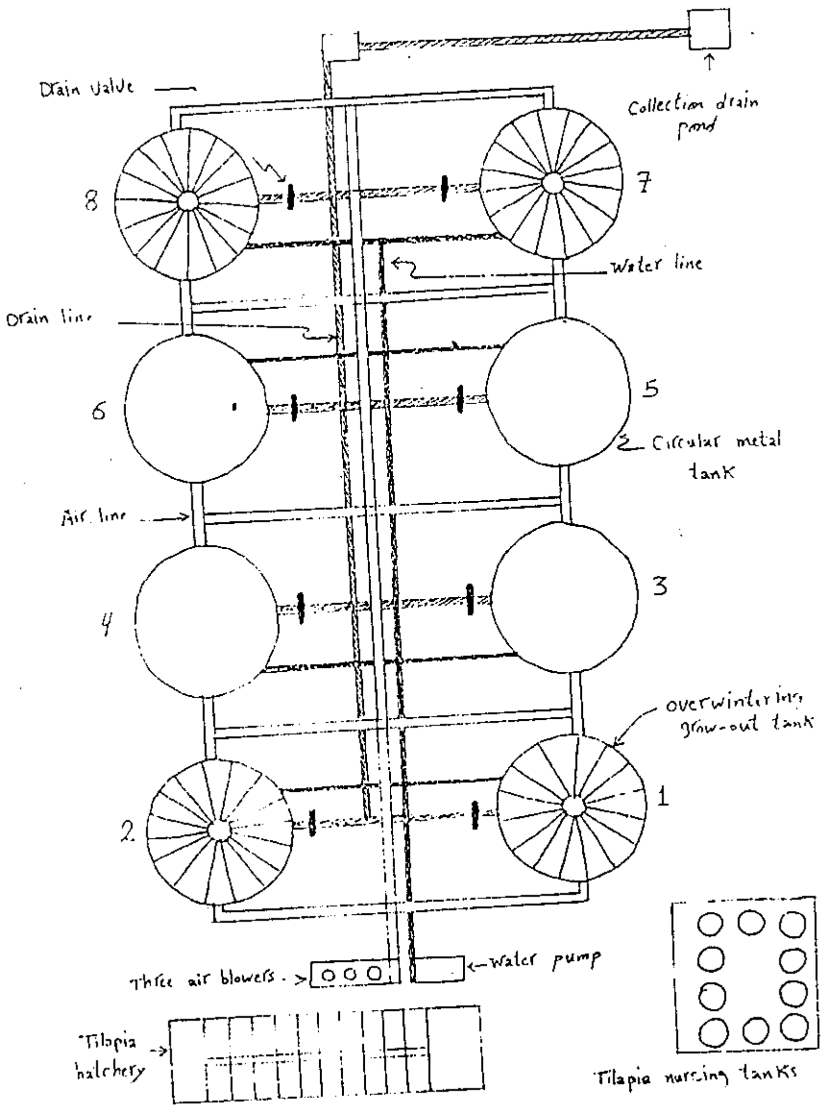

Fig.(2) Diagram for Nawa Intensive Fish Farm.

Table 1. Fertilization and manuring program

Month	Weekly Dose of fertilizers (kg) per ha.per week			Data of adding fertilizer
	Urea Kg/ha	Superphosphate Kg/ha	Poultry manure Kg/ha	
May	- - 12 12	- - 24 24	- - 360 360	Started from 15/5/92
June	12 12 12 12	24 24 24 24	360 360 360 360	Applied weekly
July	- - - -	24 24 24 24	360 360 360 360	Applied weekly
August	- - - -	24 24 24 24	360 360 360 360	Applied Weekly
Septembe r	- - - -	24 24 - -	360 360 - -	Ended on 15/9/92
Total	72	384	5,760	

Table 1: Chemical Composition of diets used for tilapia Culture in earthen ponds at El-Amal Commercial Fish Farm.

Month	moisture (%)	Protein (%)	Fat (%)	Fiber (%)
July	11.73	34.73	13.97	6.19
August	10.13	24.38	13.32	5.83
September	10.92	22.47	15.4	4.62
October	9.54	23.06	14.16	5.30
November	11.38	21.95	16.07	4.50

Table 3 : Chemical composition of diets used for tilapia Culture in tanks at Nawa Intensive Fish Farm.

Culture Stage	Moisture (%)	Protein (%)	Fat (%)	Fiber
Spawning	10.82	26.50	14.06	6.28
Nursing A	11.38	51.70	15.05	5.84
	8.12	28.60	14.39	6.20
Nursing B	11.95	29.41	15.62	5.69
Grow-out	11.10	26.70	15.97	6.26

Table (4): Water quality parameters (Mean x ± Standard error S.E) of the growing ponds under two densities of 13,300 fish/ha (D1) and 10,900 fish/ha (D2) at El-Amal Fish Farm. presented data are averages of four readings each.

Period (Months)		Temperature (°C)	Salinity (ppt)	PH	Total alkalinity (ppm)	Dissolved Oxygen (ppm)	Un-ionized ammonia (ppm)
May	D1	26.5±0.126	3.4±0.021	6.8±0.005	147.3±4.3	5.4±0.102	0.009+0.00
	D2	25.5±0.125	3.4±0.081	6.9±0.001	143.1±5.6	7.1±0.060	0.010+0.00
	X	26.0	3.4	6.9	145.3	6.3	0.010
June	D1	26.8±0.044	3.2±0.007	7.4±0.004	200.5±22.3	5.0±0.012	0.148+0.00
	D2	26.0±0.006	3.6±0.060	7.6±0.005	187.5±10.8	6.4±0.096	0.073+0.00
	X	26.4	3.4	7.5	194.0	5.8	0.110
July	D1	29.4±0.034	3.5±0.015	8.4±0.002	327.1±8.9	8.2±0.093	0.408+0.00
	D2	28.2±0.025	4.1±0.044	8.3±0.006	303.6±39.9	9.0±0.144	0.276+0.00
	X	28.9	3.8	8.4	315.4	8.6	0.342
August	D1	29.3±0.207	4.2±0.034	8.2±0.005	352.1±1.2	7.4±0.038	0.270+0.00
	D2	28.2±0.073	5.4±0.005	7.8±0.030	328±8.7	7.4±0.014	0.080+0.00
	X	28.8	4.8	8.0	340.1	7.4	0.175
Sept.	D1	29.5±0.172	2.7±0.036	8.0±0.001	232.3±3.2	7.3±0.034	0.234+0.00
	D2	28.5±0.042	3.3±0.011	7.9±0.012	237.5±2.6	7.5±0.005	0.188+0.00
	X	29.0	3.0	8.0	234.9	7.4	0.211
October	D1	27.0±0.168	3.2±0.000	7.3±0.016	278.3±10.9	6.1±0.026	0.115+0.00
	D2	26.0± 0.207	3.1±0.021	7.5±0.014	269.8±18.9	6.4±0.021	0.048+0.00
	X	26.5	3.2	7.4	274.0	6.3	0.081
Mean+S.E	D1	28.1±0.35	3.3±0.040	7.7±0.060	256.3±8.5	6.6±0.260	0.181+0.00
	D2	27.2±0.32	3.9±0.120	7.6±0.040	242.7±14.4	7.3±0.140	0.113+0.00

Table (5): The water quality parameters (mean ± S.E)of the grow-out tanks at three stocking densities at Nawa. Intensive Fish Farm. presented data are averages of four readings each.

Period(1) (Months)	Temperature (°C)	Salinity (ppt)	PH	Total alkalinity (ppm)	Dissolved Oxygen (ppm)	Un-ionized ammonia (ppm)
September D1(2)	25.8± 1.27	0.32±0.00	7.5±0.00	208.0±110.6	7.4±1.40	0.039±0.00
D2	25.5±0.38	0.35±0.00	7.4±0.00	196.1±291.1	8.3±1.16	0.030±0.00
D3	26.3±0.86	0.41±0.00	7.4±0.00	190.0±443.4	7.4±0.62	0.029±0.00
October D1	23.8±0.02	0.42±0.00	7.5±0.01	219.3±88.6	7.6±0.67	0.130±0.00
D2	23.1±0.02	0.45±0.00	7.3±0.04	222.9±2.59	7.1±0.49	0.101±0.00
D3	23.5±0.02	0.42±0.00	7.2±0.02	206.7±354.1	6.1±0.77	0.020±0.00
November D1	21.3±0.15	0.35±0.02	8.1±0.01	227.3±55.5	9.6±0.13	0.123±0.00
D2	20.5±0.45	0.38±0.00	8.1±0.00	211.7±4.9	9.1±0.07	0.079±0.00
D3	20.6±0.56	0.38±0.00	8.0±0.00	248.6±5.7	8.1±0.04	0.135±0.00
December D1	12.7±0.03	0.51±0.00	8.2±0.00	221.4±6.5	8.8±0.06	0.12±0.00
D2	12.3±0.03	0.45±0.00	8.1±0.01	211.9±8.2	8.4±0.09	0.076±0.00
D3	12.5±0.02	0.51±0.00	8.1±0.00	215.9±6.1	7.3±0.02	0.097±0.00
Mean D1	20.9±0.37	0.40±0.00	7.8±0.01	219.0±65.3	8.3±0.56	0.105±0.00
D2	20.3±0.22	0.41±0.00	7.7±0.01	210.6±76.7	8.2±0.45	0.071±0.00
D3	20.7±0.37	0.43±0.00	7.7±0.01	215.3±202.3	7.3±0.36	0.070±0.00

(1) All samples were collected during the period at 14:00 to 15:00 p.m.

(2) D1, D2 and D3 are stocking densities of 30. 40 and 50 fish/m^2,respectively.

(20)

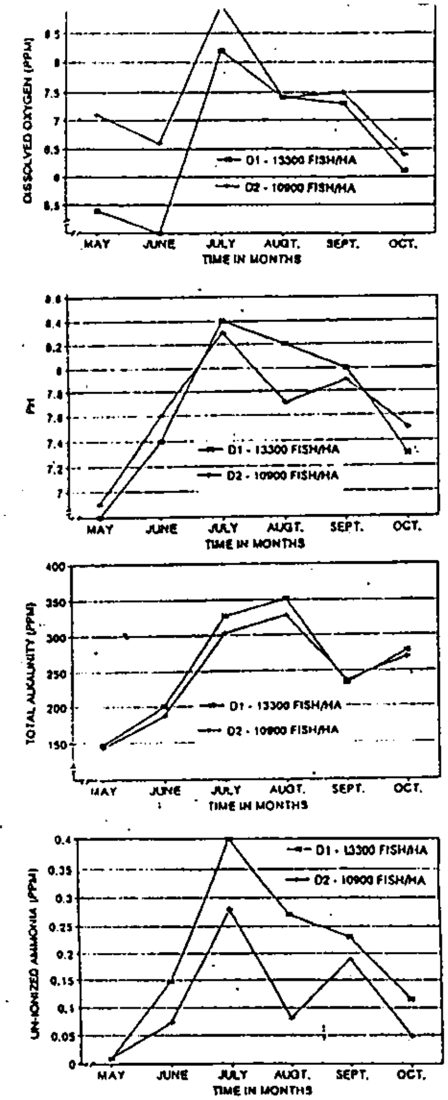

Fig (3): Water dissolved oxygen , pH , total alkalinity and un-ionized ammonia (NH_3) in the water column of earthen ponds at two stocking densities during the rearing period .

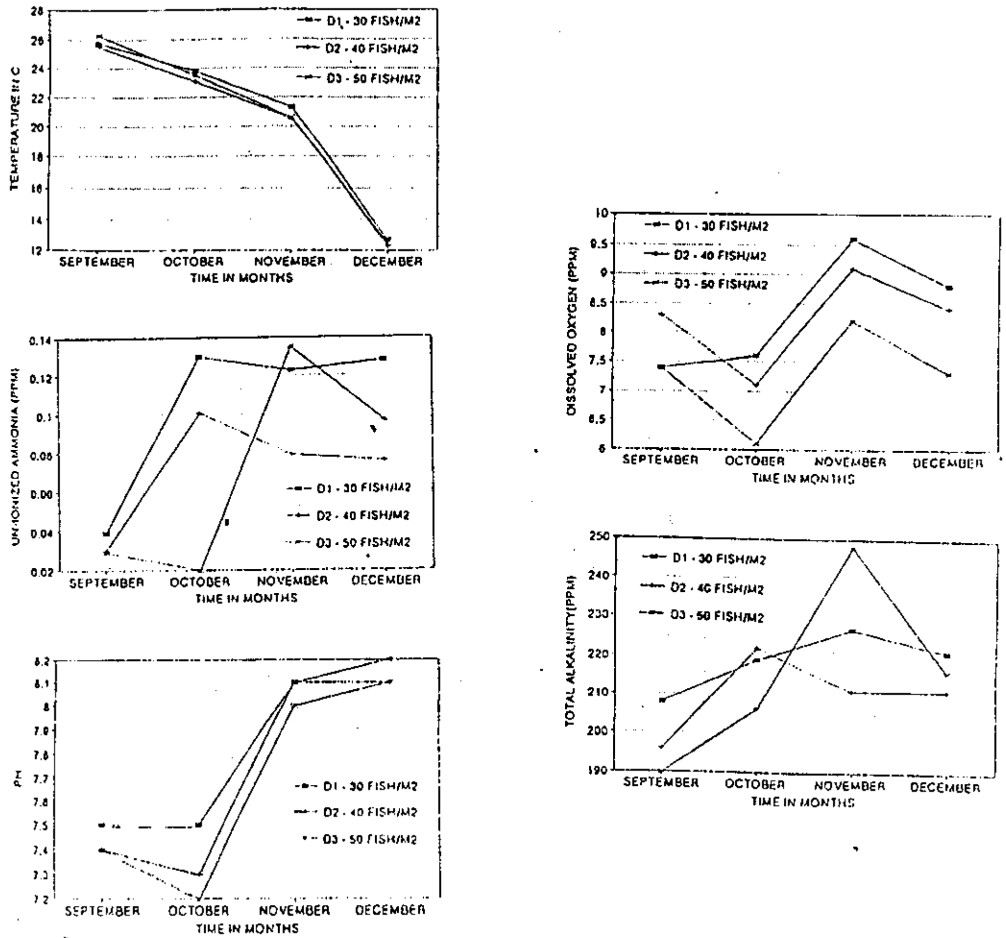

Fig.(4) Water temperature, dissolved oxygen, pH, total alkalinity, and un-ionized ammonia (NH3) in the water column of the grow-out tanks at three stocking densities and biomasses during the study period (Septemper-December) at the Nawa Farm.

Delta J. Sci. 20 (1) 1996.

أثر الطرق المختلفة للأستزراع السمكى على صفات الماء فى أحواض تربية البلطى النيلى

د. نبيلة أحمد حسن　　　　د. محمد عبد الرازق عيسى
د. محمد السيد سلامة

يشمل البحث دراسة بعض التغيرات فى المعايير الطبيعية (درجة الحرارة) والكيميائية (كمية الأكسجين المذاب -درجة الحموضة والقلوية - القلويةالكلية - الأمونيا -الملوحة) لمياه أحاض تربية أسماك البلطى النيلى المرباه تحت نظم استزراع مختلفة :الاستزراع المكثف فى تنكات من الصلب المجلفن بمزرعة نوى السمكية بمحافظة القليوبية.

ولقد أظهرت النتائج أن الوسط المائى للمزرعتين ذو صفات طبيعية وكيماوية ملائمة للأستزراع السمكى . فبالنسبة لدرجات الحرارة كانت أعلى من ٢٢م فى المتوسط ومحتوى الماء من الاكسجين المذاب كان عاليا وانحصر بين ٥-٦و٩ جزء فى المليون .

أما درجة الحموضة والقلوية (pH) فأنها كانت دائما فى الجانب القلوى فالماء فى المزرعتين كان ذو قلوية كلية عالية (أكثر من ١٩٠جزء فى المليون) وهذا دليل على زيادة أنتاجيه . اما المحتوى المائى من الامونيا فلم يزد عن ٤١و. جزء فى المليون . كل هذه التقديرات كانت بعيدة تماما عن الدرجات الحرجة والمؤثرة على نمو ومعيشة الاسماك .

وعموما كانت صفات الماء الكيميائية فى أحواض الستزراع المكثف افضل منها فى نظيرها فى الاستزراع النصف مكثف فى احواض ترابية فيما عدا فى حالة القلوية الكلية التى كانت اعلى قليلا فى الاحواض الترابية نتيجة لزيادة كفاءة عملية التمثيل الضوئى .

ولقد اظهرت الدراسة ايضا انه فى حالة الاستزراع النصف مكثف فى احواض ترابية ونتيجة لاستخدام اسمدة عضوية وكيماوية لابد من زيادة معدلات تغيير مياه الاحواض لرفع محتوى الماء من الاكسجين بدرجة تقلل من التاثير الضار للأمونيا على معايير النمو والعيشة لاسماك البلطى المرباه خلال هذه الدراسة .