Technical and economical feasibility of integrated fish-duck culture in Egypt.

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ABSTRACT

An experiment carried out in El- Abase, Aquculture Research center, sharkiai governorate, Egypt during one growing for 120 days in earth ponds. The objective of the study is to determine technical and economical feasibility of integrated fish – duck in Egypt in monoculture system. The two treatments used were duck manure(DM) and duck manure with artificial food (DM+ F). Each treatment was performed in triplicate each in an earthen pond of an area of 2000 m^2. Each pond was stocked with 4000 Nile tilapia (*Oriochromis niloticus*) Resultus obtained can be summarized in the following.

- Percentage of net returns to total costs for DM and DM+ f treatments were 70.4 and 64%, respectively, indicating that the highest returns over costs were obtained by the DM. The lower net returns over costs obtained by thee DM+F group had attributed mainly to the fish feeds which did not enhance the growth of fish to over the feed costs.
- The integration of ducks to tilapia culture with artificial feeds (DM+F) increased significantly ($p<0.05$) the final weight compared to duck manure alone.

Total fish production at the end of the experimental period for DM and DM+F treatments were 1273.3 and 1485.3 KG, repectively, indicating that supplying tilapia reared with ducks, with artificial feeds increased the total fish production by 16.65% compared to tilapia reared with duck without artificial feeding. Other results are discussed in the study.

INTRODUCTION

However, despite the expansion of Aquaculture in Egypt, which is already above the world average, there is still a great potential to increase fish production above the present 26%of total production (545593 ton 1998). Fish farming may provide 20% of the required animal protein in Egypt (GAFRD, 1999). Abdel-Hakim et al (2000). Who worked with polyculture system reported that water temperature in treatment ponds

receiving duck manure plus artificial feeds was found to be higher than treatments without artificial feeds and pond received artificial feeds showed decreases in pH and alkalinity values in water compared to the other ponds. Sinha, (1986) reported that the integration system increases the production of animals and decrease the cost of fish culture operations considerably, the duck droppings acting as substitute of supplementary feed and fertilizers which otherwise form over 60%of the input cost in fish culture.

There has been a recent, marked decline in the number of fish caught due to over fishing, which is associated with an increase in population and environmental pollution. The result is an increase in the incidence of protein-energy malnutrition (PEM), particularly among pre-school children, who have a relatively high demand for protein for growth and brain development. The seriousness of the situation is illustrated in Thailand where approximately50% of pre-school children suffer from(PEM). The incidence of (PEM) may be considerably higher in other developing. Countries (Edwards et al, 1983). Plavink et al, (1983) reported that fish ponds could be integrated with duck helping in the removal and recycling of animal wastes which contaminate the environment to useful protein of high value. This may improve the biological diversity in rural areas. Schroeder (1974) found that animal manure beside their nitrogen and phosphorus contents stimulate heterotrophic production, which increases tilapia production in ponds. He added that Fish is a traditional source of animal protein in developing countries and the amount of manure that can be added depends on three main factors: the biochemical oxygen demand (BOD) of the system after addition of manure, the temperature and the available oxygen supply. The BOD was found to be highly correlated with the amount of dry matter present in the manure. Fish has a high protein content and is easily digestible. Fish could play an important rule in populations suffering from malnutrition because of its high nutritive value and cheaper price (Borgstrom, 1961;Guha, 1962).

The aim of the present study was to determine technical and economical feasibility of integrated fish –duck culture in Egypt.

MATERIALS AND METHODS

The present study was conducted during on growing season for 120days in 6 rectangular freshwater earthen ponds (about 2000M²) with a depth of 120 cm each.

a) Experimental fish

Ponds were stocked in a monoculture system with Nile tilapia species *Oreochromis niloticus* representing the detritophagic specie (fed on zooplankton, plant detritus and zoobenthos) .Fish used in this study and their stocking rates are shown in the table(1)

Table (1) Fish specie and stocking rate of the experimental ponds.

Common name	Scientific name	Stocking rate Individ./pond	Initial body Weight(g)
Nile tilapia	*Oreochromis niloticus*	4000	2.3

The experimental design is illustrated in table (2)

Table (2) Experimental Design and treatments applied.

Stocking rate (indiv./2000M²)	Treatment	Treatment	Number of ponds
4000	Duck Manure	T1 (DM)	3
4000	Duck Manure+Artificial food	T2 (DM+F)	3

b) Experimental ponds:

Sex earthen ponds each of 2000 m² total area representing two treatments with three replicates each were used in the present study. The first three ponds (replicates) of the first treatment group were fertilized with 5 Kg/pond/day of duck manure released by 200 duck raised on a house built on a pond dike. The second group of ponds (treatment) received also the manure released by 200 duck raised on a another house built on a pond dike beside 3% of the fish biomes supplementary feed (17 % crude protein). 400ducks were used in the experiment. They were Moscovy ducklings 7 days of age (80 gm each). Ducks were divided between the two houses of the first and second treatment. Ducklings were grown for 80days. During the experimental period were supplied with artificial feed (20% crude protein) at a ratio of 10% body weight per day. Table3 (a, b and c) show the experimental Nile tilapia and Moscovy duck diets.

c) Samples and measurements:

Random samples of 150 fish were taken from each pond to determine body weight. Initial body weights to the nearest gram recorded at time of pond stocking and harvesting. Water temperature, dissolved oxygen and pH were measured daily at 10°°a.m.using temperature and dissolved

oxygen meter (YSI model 57) and pH meter (model Corning 345). Determination of ammonia was carried out every two weeks according to the methods of Boyd (1990) and A.P.H.A (1985). Samples were collected from different sites of the experimental ponds randomly to represent the water of the whole pond.

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d) Statistical analysis:

Applying the computer program Harvey (1990) carried out the statistical analysis of data.

Table (3) Experimental Nile tilapia and Moscovy ducks diets.

A. Analysis of Moscovy duck manure						
	Crude protein%	Organic carbon %	Nitrogen %	Phosphorus %	C:N ratio	N:P ratio
Duck Manure	28.2	39.28	3.80	1.4	10.3	2.7

B. Analysis of fish and Moscovy duck supplementary feed				
	Crude protein%	Crude Fat %	Crude Fiber %	ME K Cal/kg
Supplementary feed	17.0	8.1	8.0	2500
Moscovy duck feed	20.0	7.8	8.0	2500

C. Experimental Nile tilapia ducks diets		
	17% Crude protein Fish supplementary feed	20% Crude protein Moscovy duck feed
Yellow corn	40 %	43 %
Rice bran	20 %	20 %
Wheat bran	18 %	15 %
Decorticate cotton seed meal	10 %	10 %
Meat meal	3.5 %	5 %
Fish meal	3.5 %	5 %
Yeast	3. ٠%	___
Molas	2%	2 %

RESULTS AND DISCUSSION

Water quality:

As presented in table 4 averages of water pH during the experimental period were found to be 8.47 and 8.49 for the treatments DM and DM+F, respectively which indicate the suitability of water pH for fish growth. These pH values agree with that reported by Abdel-Hakim et al (2000) and EL-Gendy, M.U.(1998). Results of the same table show also that dissolved oxygen (DO); Ammonia (mg/l) and temperature (C°) in water of experimental ponds were within the permissible levels for fish growth and development. These results are in complete agreement with the findings of Mahmoud (1997) and Abdel-Hakim et al (1999), they reported that dissolved oxygen (DO); Ammonia (mg/l) and temperature (C°) in water of experimental ponds in monoculture and polyculture systems respectively were significantly higher in ponds received duck manure and artificial feeds compared to ponds with duck manure alone.

Table (4): Water quality of ponds during the experimental period.

Treatments	pH	D.O mg/l	Ammonia (mg/l)	Temperature C°
Tr1 DM	8.47±0.33	7.18±0.37	0.23±0.03	27.28±0.62
Tr2 DM + F	8.49±0.38	7.28±0.42	0.20±0.01	28.64±0.60

Table (5): The average performance of Nile tilapia.

Items	Treatments	
	Tr1 DM	Tr2 DM2 +F
Initial body weight(g)	2.23 ±0.88(b)	2.78 ±1.12 (a)
Final body weight (g)	117.9 ±12.3(b)	133.1 ±14.07(a)
Average daily gain (g)	0.9 ±0.23	1.09 ±0.18
Survival rate %	90%	93%
Total production kg	1273.3	1485.3
% of the smallest value	100%	116.65%

Growth performance:

a) body weight and daily gain

Results of growth performance of Nile tilapia are illustrated in table (5). At the start of the experiment averages of initial weights were 2.23 and 2.78 g for the DM and DM +F treatment ponds, respectively. As

presented in the same table averages of final weights were 117.9 and 133.1 g for the same treatments cited above, respectively. Analysis of variance of results indicate that integration of ducks to tilapia culture with artificial feeds (DM+F) increased significantly ($p<0.05$) the final fish weight compared to duck manure alone during a period of 120 days. The same trend was observed with the average daily gain where fish in the DM+F treatment showed higher daily gains compared to the DM treatment (tables). These results are in agreement with those reported by Hassouna et al., (1998), who found that, Nile tilapia raised in fertilized ponds supplied with artificial diet had the better growth performance than these raised in fertilized pons without supplemental feeds. Also results of table (5) are in complete accordance with the findings of Abdel-Hakim et al (1999), who reported that growth performances of Nile tilapia and common carp in polyculture system were significantly higher in ponds received duck manure and artificial feeds compared to ponds with duck manure alone or those received buffalo manure.

b) Survival Rate (SR):

Averages of (SR) for DM and DM+F treatments during the whole experimental period were found to be 90and 93%, respectively (tables). Results of SR showed that this parameter was within the normal range of Nile tilapia. These results are in agreement with results obtained by Coddington and green (1993) and Hansen and Batterson (1994) who reported that survival rates of Nile tilapia ranged between 87-91 % and 71-93 %, respectively. Also Abdel-Hakim et al (1999) reported survival rates for Nile tilapia and blue tilapia 92 to 95% and 90.5 to 95%, respectively.

c) Total fish production:

Total fish production (from the three replicates each treatment) at the end of the experimental period for DM and DM+F treatments were 1273.3 and 1485.3 kg, respectively (table 5). These results indicate that supplying tilapia reared with ducks, with artificial feeds increased the total fish production by 16.65% compared to tilapia reared with duck without artificial feeding. These results are in accordance with those reported by Hassouna et al.,(1998) , Schoonbee and prinsloo(1988)andAIT,(1986). Also these results are in complete agreement with the findings of Abdel-Hakim et al (1999), who reported that duck manure plus artificial feeds produced the highest fish yield compared to duck manure alone or buffalo manure with or with artificial feeds.

Table (6): Ducks yield.

Treatment number	Initial number of duck	Initial Body weight(g)	Survival ratio %	Number of duck	Average weight	Total Production (kg)
Tr1 DM	200	80	85	170	2.90	493
Tr2 DM+ F	200	80	84	168	3.00	504

d) Duck yield :

As presented in table 6 the initial number of ducks for treatment DM (three replicate ponds) and for the treatment DM+F (three replicate ponds) was 200 ducklings each with an average weight of 80 g. At the end of the experiment percentages of survived ducks were 85 and 84 % for DM and DM+F treatments, respectively. Percentages of duck survival for both treatment groups were within the permissible levels indicating that integration of ducks to fish ponds had no reverse effects on duck survival. These results are in complete agreement with the findings of Abdel-Hakim et al (1999), who reported that similar results with Peking ducks when integrated to fish ponds. At the end of the experimental period averages of duck weight were 2.9 and 3.0 kg for treatments DM and and DM+F treatments respectively (table 6). In the study of Abdel-Hakim et al., (1999) averages duck weight (Peking ducks) after 60days was 2.5 kg when ducks were raised at fish ponds. The differences in duck final weight (table 6) and that obtained by the later author may due to the fact that our fattening period of ducks in this experiment was 20 days longer compared to their fattening period (60 days). Total duck yields (table 6) for treatments DM and DM+F were found to be 493 and 504 kg, respectively, at the end of the experimental period. There results indicate that Moscovy ducks could be integrated to fish ponds under the Egyptian conditions to increase the income of fish former through a second crop beside the fish. These results are in accordance with the findings of Abdel-Hakim et al (1999), who reported that duck yield of about 307.5 to 302.0kg when peking ducks were raised at fish ponds after 60 day growing period.

Table (7): Economic efficiency for the Nile tilapia and Moscovy integration system.

Item	Tr1 DM	Tr2 DM + F
Costs LE		
Price of fingerlings	1200	1200
Price of ducklings	1000	1000
Price of feed(fish)	------	850
Price of feed(duck)	1200	1200
Labor (120 day,2 men)	1000	1000
Land renting	600	600
Depreciation of duck house	50	50
Others (lamps and Medicine and)	300	300
Total costs	5350	6200
% of the smallest value	100%	%115.8
Returns		
Fish	6012	7027.5
Duck	2958	3024
Extra duck manure 10 m x 30LE/m	150	150
Total returns	9120	10201.5
Net returns	3770	4001.5
%Net returns to operating costs	70.4%	64.5%

Price per kg fish = 5.0 LE
Price per kg duck = 6.0 LE

e) Economic Efficiency:

Results presented in table (7), show that the total operation inputs of DM and DM+F treatments were estimated by 5350 and 6200 LE during the whole experimental period, respectively. The differences in the total costs among both treatments had due to the price of fish feed applied in the DM+F treatment; thus other costs were equal in both treatments. As presented in table (7) the total costs of the DM+F treatment were 115.8 % compared to the DM treatment (100%) without fish feeds. The total returns of DM and DM+F treatments were estimated to be 9120 and 10201.5 LE, respectively. The net returns for the same experimental groups cited above were 3770 and 4001.5 LE, respectively (table 7). Percentages of net returns to total costs for DM and DM+F treatments were 70.4 and 64.5%, respectively, indicating that the highest returns over costs were obtained by the DM GROUP. The lower net returns over costs obtained by the DM+F group had attributed mainly to the fish feeds

which did not enhance the growth of fish to cover the feed costs. These results may led us to recommend the integration of Moscovy ducks with tilapia fish without any artificial fish feeds to achieve the highest returns. These results are in accordance with those reported by Abdel-Hakim et al (1999), who showed that raising Peking ducks on fish ponds without fish feeds resulted in a net return over costs of 65.3% while this value decreased to 40.5% when artificial fish feeds were applied to ponds.

REFRENCES

AIT. Asian Institute of Technology, (1986): Buffalo/fish and duck/fish integrated small-scale system at the family level. Researches report No. 198. Asia Institute of Technology, Bangkok, Thailand.

American Public Health Association A.P.H.A. (1985): Standard method for the examination of water and waste water. Ed. American Public Health Association . Washington. pp. 1268.

Abdel-Hakim,N.F **;**Bakeer,M.N and Soltan, M.A.,(1999): integrated fish culture with farm Animals. Annals of Agricultural Science, Moshtohor.Zagazig University (Banha- Branch). VoL.37 No. 2 June 1999.

Abdel-Hakim,N.F **;**Bakeer,M.N and Soltan, M.A.,(2000): Effect of integrated fish culture with farm Animals on water quality parameters and plankton communities.(in press)

Borgstrom,G. (1961): Fish as food. Vol. 1, Academic Pross, New York AND London.

Boyd, C. E. (1990): Water quality in ponds for Aquaculture Alabama Agriculture Experiment Station Auburn University, Alabama. P 462.

Coddington, D. T. and Green, B. W. (1993): Tilapia yields improvement through maintenance of minimal oxygen concentration in experimental growout ponds in Honduras. Aquaculture, 118:63-71.

EL-Gendy,M.U.(1998): Effect of Aquculture systems on pond productivity and economical efficiency. M.Sc.Thesis. Faculty of Agriculture. Al-Azhar University.

Edwards, P.K.E.; Weber, E.W.; McCoy, C.; Chantachaenge, C.; Pacharaprakiti, K.; Kaewpaitoon and S. Nitsmer (1983): Small-scale fishery project in path umthani Province, Central Thailand: a socio-economic and technological assessment of status and potential AIT Research report No. 158, Asian Institute of Technology, Bangkok, 256pp.

GAFRD. General Authority for fishes resources development (1999) Cairo, Egypt. Annual report.

Guha, B.C. (1962): The role of fish in human nutrition in fish in nutrition (E.Hoon and R. Krouzer, odls) 39-12, Fishing News (Books) LTD, England.

Harvey, W. R. (1990): User's guide for LSMLMW. Mixed model least-squares and maximum likelihood computer prog. Ohio states University, Columbus, USA.

Hansen, C. F. K. and Batterson, T.R. (1994): Effect of fertilization frequency on the production of Nile tilapia. Aquaculture, 123: 271-280.

Hassouna, M.M.; El-Maksoud, A.M.S.; Radwan, M.S.M. and Abd El-Rahman (1998): Evaluation of three commercial feeding regimes for Nile tilapia, *Oreochromis niloticus*., reared inearthen ponds E gyptian J. Anim. Prod., 35: 267-277.

Mahmoud, A.A. (1997): Effect of duck manure as organic fertilizer on productivity of slilver carp under Egyptian conditions M.Sc. Thesis. Faculty of Agriculture. Allzhar University.

Schoonbee, H.J. and Prensboo, J.F. (1988): polyculture in integrated agriculture Aquaculture production system aimed at rural community development. J. Of Aquatic Products 2(1): 99-123.

Plavnik, H.; Barash, H. and Schroeder, G. L. (1983): Utilization of ducks droppings in fish farming Nutrition reports international, 28:635-641.

Schroeder, G.L.(1974): Use of fluid cowshed manure in fish ponds. Bamidgeh. 26:84-96.

Sinha, M.(1986): Management of duck and its integration with fish farming. Integrated farming systems. Notes of lectures delivered at the training program organized for West Bengal Fisheries Officers, from September 9-23, 1986.

Central Inland Fisheries Research Inst., Barrackpore, India, 1986 no. 84, pp. 6. 1-8.

تقييم النواحي الفنية والاقتصادية

لتربية الأسماك مع حيوانات المزرعة (البط الموسكوفى) في مصر

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أجريت هذه الدراسة بالمعمل المركزي لبحوث الثروة السمكية بالعباسة–أبو حماد– محافظة الشرقية وكانت فترة الدراسة ١٢٠ يوم بهدف دراسة تأثير نظام التربية المشتركة بين البط الموسكوفى والأسماك على العناصر المختلفة لجودة المياه وكذلك دراسة معدل نمو الأسماك والإنتاجية الكلية وتقييم النواحي الأقتصادية المتعلقة بهذا النظام المتكامل (الأسماك والبط). وتم استخدام زريعة أسماك البلطي بمعدل ٤٠٠٠ سمكة بلطى نيلي في الحوض الواحد وقد أستخدم في هذه التجربة٦ أحوض من الأحواض الترابية مساحة الحوض ٢٠٠٠م^{٢} قسمت إلي ٢ مجموعة (معاملات) و تحتوى كل مجموعة على ٣ أحواض (مكررات) . وقد سمدت الأحواض الثلاثة للمعاملة الأولى باستخدام سماد البط فقط أما المعاملة الثانية فقد سمدت باستخدام سماد البط بالإضافة إلى إمداد الأسماك بعليقه اضافيه . وكان من أهم النتائج المتحصل عليها ما يلي :

- من الناحية الأقتصادية كانت نسبة العائد الصافي إلى رأس المال المستغل في الإنتاج كانت أفضل هذه النسب قد تم الحصول عليها من المعاملة الأولى التي أستخدم فيها زرق البط ٧٠.٤% بالمقارنة بالمعاملة الثانية ٦٤.٥% .
- أعطت المعاملة الثانية التي أستخدم فيها زرق البط +الأعلاف الإضافية مقاييس أكبر لوزن الجسم النهائي وكانت الاختلافات الراجعة إلى تأثير المعاملة على وزن الجسم اختلافات معنوية .
- أظهرت النتائج أن الأسماك المرباة في الأحواض التى سمدت بسماد البط بالإضافة إلى التغذية على علائق إضافية أعطت معدل نمو أعلى وإنتاجيه كليه عاليه مقارنة بتلك التى ربيت في الأحواض المسمدة بسماد البط فقط .
- أظهرت التحاليل أن متوسطات درجات الحرارة والpH والأكسجين الذائب وكذلك الأمونيا كانت اكبر نسبيا في المعاملة الثانية التي أستخدم فيها زرق البط +الأعلاف الإضافية وكانت النتائج في الحدود المناسبة للاستزراع السمكي.