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A COMPARATIVE STUDY ON PRODUCTION AND ECONOMIC OF INTEGRATED DUCK-FISH AND INORGANIC FERTILIZER-SUPPLEMENTARY FEED FISH CULTURE SYSTEMS.

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ABSTRACT

The integration of fish culture with livestock rearing holds great potential for augmenting production of animal protein and betterment of economy. A trial on duck-fish farming is described and the results are compared with those of an inorganic fertilizer-supplementary feed fish culture system. Fish yield from the integrated ponds (where no supplementary feeds of fertilizers) was higher (1041.02 kg/feddan/yr) than that of the control ponds (Fish only, 968.08 kg/feddan/yr). The net profit as a percentage of total variable costs in the integrated ponds was better (57.70 %) than that of control ponds (33.03 %). Therfore the high construction and operation costs can be recovered earlier.

INTRODUCTION

The rising cost of the high protein fish feeds and inorganic fertilizers have brought about increased interest in lowering cost of fish production.

Application of organic and inorganic fertilizers in fish ponds in warm climates produced a fish yield of 15-35 kg/ha/day without supplementary feeds (Moav et al., 1977 and wohlfarth, 1978). However, considerable fish production could be obtained when animal manure was properly applied to fish polyculture systems. Moav et al., 1977 reported a daily gain of 35 kg/ha (8 tons/ha/240 days) from a fish polyculture system which received a liquified cowshed manure.

Duck-cum-fish culture has been practiced for many years in Far East and Hungary (Sin and Cheng, 1976; Buck, 1977). A daily yield of 32 kg/ha (7.6 tons/ ha/240 days) was acheived in ponds received only duck dropping (Wohlfarth, 1978). Moreover, Rappaport and Sarig (1978) reported that a supplementary addition of chicken droppings under conditions of intensive fish culture resulted in an increase of fish yield by 21% and a decrease of food conversion ratio by 0.4 unit.

Due to increase prices of high protein fish feeds concomitant with low productivity of Egyptian ponds, the present investigation was conducted to determine the value of duck-cum-fish culture from both production and economic viewpoints.

MATERIALS AND METHODS

Place of study

The present study was conducted at Alexandria Governorate fish farm located at Moharram Bek, Alexandria, Egypt.

Ponds

Four ponds of 13.3 feedans each (one feddan = 4200 m^2 = 0.4 ha) with 1.6 m depth were used. In the first two ponds ducks were integrated with fish whereas the other two received inorganic fertilizer and supplementary feed, serve as controls. Ponds were filled by siphone from a fresh water aqueduct supplying the city of Alexandria, but drained by pumping.

Experimental Animals

Fish

All ponds were stocked with equal numbers of three fish species reared in polyculture system as follows:

a) Tilapia, F_1 hybrid: **Orecchormis niloticus** female x O. **aureus** male (3.0 cm standard length with an average body weight Of 3.4 g and stocked at 4500 fish/feddan).

b) **Mugil cephalus** (6.1 cm standard length with an average body weight of 3.7 g and stocked at 2100 fish /feddan).

c) Common carp, **Cyprinus carpio** (7.8 cm standard length with an average body weight of 3.4 g and stocked at 250 fish/feddan).

The fish were initially stocked in October and November 1986 and were harvested twice during experimental period: partial harvesting after 8 months by decreasing the water level to 60-80 cm and final harvesting was made after 382 days for tilapia and carp and 336 days for mullet by draining the ponds.

Ducks

Ducks employed in the prresent study were of the Cherry Valley Super

M (Cherry Valley Farm Limited Livestock Division Rothwell, Lincoln LN7 6BR England). Twenty one day-old ducklings were raised in floating cage houses. Six floating cage houses (each cage has 5 x 6 m indoor area and 5 x 4 m outer area) accomodate 600 ducks for fattening per pond and they were removed every 40 days and new 21 day-old ducklings were introduced (six duck cycles were used during the experiment, 270 ducks/ feddan/ year. Ducks were fed commercial diet which contains 18 % crude protein at the rate of 100-150 g/ duck, three times daily.

Experimental Methodology

Ponds feeding and chemical fertilizers

Fish in the control ponds were given a supplementary feed (53 % bread crumps, 25 % soyabeans meal, 8% powdered milk, 8% blood meal and 6% fish meal) which contains 22.7% crude protein at the rate of 3% of fish body weight per day for six days a week and the amount of daily feed required was adjusted accordingly. The same ponds were fertilized every two weeks with 10 kg of superphosphate per feddan and 15 kg of urea per feddan. Fish in the integrated ponds received neither supplementary feeds nor chemical fertilizers.

Data collection and water quality determinations

At different periods random samples of 30 to 40 fish of each species were taken from each pond and the individual body weight was recorded to calculate the feeding rates.

Daily dissolved oxygen, pH and water temperature were determined at 7:00 a.m, while ammonia, nitrate, nitrite and phosphate were monitored once a week according to the American Public Health Assoication (Anon., 1965). The quantitative evaluation of phytoplankton in pond water was determined as chlorolphyll while zooplankton was determined by the sedimentation counting method (Sharma and Olah, 1986).

RESULTS AND DISCUSSION

Water quality and plankton status

Water quality was rather stable in all ponds (Table 1) whereas little differences in these criteria were detected between the integrated and control ponds. Sharma and Olah (1986) reported that a dissolved oxygen level of at least 3 mg/l and an ammonia level not exceeding 2.1 mg/l were suitable for fish farming. The results of Sharma and Olah (1986) and those of water quality analyses presented in Table 1 suggest that raising ducks with fish did not deteriorate the pond water quality if proper number of ducks is employed (e.g. 270 ducks/ feddan/ year).

The quantity of phytoplankton and zooplankton in the integrated ponds

TABLE 1
Water quality criteria and plankton determinations of integrated and control ponds.

Item	Annual Ranges	
	Integrated Pond	Control Pond
Water temperature-C°	14.8 - 28.0	15.2 - 28.0
Dissolved oxygen-ppm	4.8 - 6.3	5.1 - 6.9
pH	6.7 - 7.8	6.9 - 7.9
NH_3-N - mg/l	0.15 - 0.67	0.12 - 0.61
NO_3-N - mg/l	0.002 - 0.357	0.002 - 0.021
NO_2-N - mg/l	0.007 - 0.010	0.003 - 0.004
PO_4-P - mg/l	0.039 - 0.208	0.034 - 0.175
Phytoplankton (as chlorophyll mg/l)	1.804 - 6.449	0.818 - 4.988
Zooplankton-number/m^3	8000 - 14000	8000 - 10000

were higher than that of control ponds (Table 1). Woynarovich (1980) and Brash et al. (1982) reported that phytoplankton and zooplankton production increased significantly due to duck manure which provides a continuous supply of organic matter containing importants elements (carbon, nitrogen and phosphorus) required for increasing the natural food supply.

Fish production

Fish performance parmeters of integrated and control ponds are presented in Table 2. The daily body weight gain and yield per feddan were 4.69 g and 1041.02 kg respectively for fish reared in the integrated ponds but were 4.0 g and 968.08 kg for fish reared in the control ponds. Delmendo (1980) reported that raising 1000-2000 ducks/ ha on ponds increased the average yield to 5.0 tons/ ha/ year compared to 1.0 ton/ ha/ year without duks. The results of the present study and those of Delmendo (1980) could be explained according to Jhingran and Sharma (1980) and Barash et al. (1982) as follows: a) 10-15% of the food may be dropped by ducks into the pond and consumed directly by fish and ,b) 30% of the duck food is excreted into the pond as duck manure.

Food conversion ratio for fish in the integrated ponds were better than that of fish in the control ponds (Table 2) which suggests better utilization of both duck food dropped into the ponds and the natural food in it. However a little difference was found in survival rates for reared in both culture methods (Table 2).

TABLE 2

Performance parameters of fish and ducks raised in integrated and control ponds

Species	Average initial weight (g)	Stocking rate (Fish/Fed.)	Growth period (day)	Average weight at harvest (g)	Total weight at harvest (Kg Fish Fed.)	FCR*	Survival (%)	Average daily gain (g/day)
I. Integrated Pond								
Tilapia hybrid	3.40	4500	382	233.72	607.90	0.8	57.80	0.60
M. cephalus	3.70	2100	336	212.84	215.61		48.20	0.62
Common carp	6.80	250	382	1334.43	217.51		67.90	3.47
Average (Total)	4.63	(6,850)		547.34	(1041.02)	0.82	57.97	(4.09)
II. Control Pond								
Tilapia hybrid	3.40	4500	382	222.46	574.61		57.40	0.57
M. cephalus	3.70	2100	336	205.58	221.61		51.30	0.60
Common carp	6.80	250	382	1087.74	171.86		65.80	2.83
Average (Total)	4.63	(6,850)		479.17	(986.08)	4.06	58.20	(4.00)

2. Ducks

No. of ducklings raised/cycle/pond.**	Average initial weight (g)	Growth period per cycle (days)**	Final average weight (g)	Survival rate (%)	Total weight (kg/ year)
600	450 - 550	40	2200-2600	90 - 96	8035.20

* FCR: Food conversion ratio (dry food/fish live gain (g). In case of the integrated pond, FCR was calculated according to Barach et al., (1982).

** No. of cycle per year = 6

Economic analysis

Details of the input costs and returns for fish culture and ducks in both culture methods were shown in Tables 3 and 4. The total income and net profit made from the integrated ponds are more impressive to assess economic profitablility when compared with those of control ponds. The expenditure incurred by raising ducks was largely offset by the sales value of duck meat (Table 3). The percentage returns of total variable cost of

TABLE 3
Economic analysis of the integrated pond with an area of 13.3 feddans.

Item 1. Input costs	Rate/fed	Quantity per pond	Value LE*	Total value LE
Depreciation cost of pond construction; life expectancy 20 years (5%)	-	-	-	10272.22
Depreciation cost of floating duck cages; life expectancy 5 years (10%)	-	-	-	1650.00
Fingerlings	6.850	91105	-	367.74
Labor (security, fish and duck hanling).	-	-	-	3195.00
Ducklings	270.67	3600	1.85/head	6660.00
Poultry feed	-	18.00 ton	389/ton	7002.00
Medication and other administrative costs	-		-	630.00
Fishing expenses**	-	-	-	9512.72
			Total	39289.68
2. Returns				
Fish sales	1041.02 Kg	13845.56 Kg	3.12LE/kg	43239.66
Duck for meat	-	8035.20	2.33LE/kg	18722.03
Total				61961.69

Total variable costs = LE 39289.68
Total returns = LE 61961.69
Net profit = LE 22672.01
Net pro fit as a% of total variable costs = 57.70%

* LE: Egyptian pound
**Boats, Net and private fishermen represent about 22% from the value of the total fish harvesting.

TABLE 4
Econmic analysis of the control pond with an area of 13.3 faddans.

Item 1. Input costs	Rate/fed.	Quantity/ pond	Value LE	Total value LE*
Depreciation cost of pond construction; life expectancy 20 years (5%).	-	-	-	10272.22
Fingerlings	6,850	91105	-	367.74
Fertilizers:				
Superphosphate	200 Kg.	2660 Kg.	0.060/kg	159.60
Urea	300 kg.	3990 kg.	0.150/kg	598.50
Supplementary feeds	3.93 ton	52.32 ton	135/ton	7063.20
Labor Bsecurity and fish handling)	-	-	-	2415.00
Other administrative costs	-	-	-	483.00
Fishing expenses**	-	-	-	8837.71
			Total	30197.27
2. Returns				
Fish sales	968.08 kg	12875.46kg	3.12/kg	40171/43
Net profit	= LE 9974.16			
Net profit as a % of total variable costs = 33.03%				

* Egyptian
**Boats, Nets and private fishermen represent about 22% from the value of total fish harvesting.

57.70% in the integrated ponds would give enough income not only to cut down the cost of fish culture operations but the rather high construction cost of fish pond also can be recovered earlier. Therefore it can be concluded that the duckcum-fish culture not noly increased fish production but also reduced the input cost of fish culture operations considerably.

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