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STUDIES ON INTEGRATED FISH/DUCK PRODUCTION SYSTEM:
II- On DUCK PRODUCTION

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ABCTRACT

In a study on 8 earthen ponds as a try to reduce feeding costs in fish production under semi-intensive system by integration with duck production. One-day Peking ducklings were purchased and reared for 2 weeks in a closed pen before swimming learning. Thereafter, they were divided onto special pens on the banks of 6 ponds only at 80, 40, and 20 duck/pond No. 1-2, 3-4, and 5-6, respectively. Pond No. 7 was offered artificial feed only for its fish, whereas pond No. 8 was manured only by fish duck droppings. Ducks were fed twice daily in their pens and spent most of day hours on the fish ponds. Ducks were bought at 2 Kg average weight (ca. 2.5 month old). The obtained results revealed the superiority of the integrated ducks on most of the fish ponds, concerning final weight, weight gain, dressing weight, boneless meat weight than the control (non integrated) ducks. Protein content decreased but fat content increased in thigh, breast, and livers of ducks on ponds No. 3 to 6 than the control and ducks on ponds No. 1 and 2. The return reduced by decreasing the stocking rate of ducks on the ponds; therefore, the total return from fish and ducks reduced too by decreasing stocking rate of the ducks. The first 2 treatments (250 duck / feddan) were the best concerning total return from an integrated farm, with lowest working rate and highest % for return / outputs and % of outputs / inputs (except the manure treatment, without ducks).

Keywords: Peking duck – Integration system – Production – Economy.

INTRODUCTION

Men (1995) mentioned that duck and fish production has been expanding and contributes to increased income and improved living standards of the farmers, especially for poor farmers in the remote rural areas. The A.O.A.D. (1999) recommended the necessity of studding means of integration systems between fish culture and other agricultural activities, whether plant or animal, and how the environment will be affected by this integration, as well as its effects on fish production and fish quality. However, Ducks are integrated not only with fish culture but also with rice production (Valdivié, 2004). Currently waterfowl account for 7.2% of world poultry meat production, of which the majority is duck meat. Duck farming is dominated by the Peking breed and its different varieties that have been successfully crossed with local breeds and Muscovy ducks. Egypt produced 39, 130 thousand tons of duck meat year 2003 (Van der Sluis, 2004).

Moreover, Rakocy and Mc Ginty (1989) added that fresh manure is better than dry manure. Finely – divided manures provide more surface area for the growth of microorganisms and produce better results than large clumps of manure. Feeding costs per pound of production are two to twenty times higher for fish fed the commercial diet compared to fish receiving manure. They said also that collection, transport, storage and distribution of manure involve considerable expense and are major obstacles to manure systems. These problems can be overcome by locating the animal production unit adjacent to or over the fish pond (integrated systems), so that fresh manure can easily be delivered to the pond on a continuous basis. Effective and safe manure loading rates are maintained by having the correct number of animals per pond surface area. Ducks are grown on ponds at a density of 300 to 600/acre. Also, by raising ducks on ponds, feed wasted by the ducks is consumed directly by the fish. Therefore, the present research aimed to evaluate the effect of integration system of mono-sex Nile tilapia fish – cum – Pekin duck from the view points of duck performance, duck quality (chemically), economy of duck production, and economy of fish – cum – duck integrated production system.

MATERIALS AND METHODS

This field experiment was conducted during season 2004/2005 in a private farm in Tolombat 7 at Al-Reiad belonging to Kafr El-Sheikh governorate. It aimed to reduce feed costs of fish production under semi-intensive production system via fish/duck integration.

Experimental Animals:

Three hundred and fifty one-day old Peking ducklings (each of ca. 90 g body weight) were purchased from a private duck hatchery at Al-Reiad (Kafr El-Sheikh governorate) at a price of 2 LE/duckling. The ducklings were reared for 2 weeks in a closed pen before learning the swimming. Thereafter, they were divided (when reached ca. 225 g each) onto the earthen ponds at variable stocking densities (being 80, 40, 20 and zero on ponds No. 1-2, 3-4, 5-6 and 7-8, respectively). The rest of the ducklings (350 – 280 = 70) were reared in the previous pen as a control and for replacing the death cases from pond’s ducklings. Hormone-sex reversed (mono-sex) Nile tilapia (*Oreochromis niloticus*) fry (4-5 g) from the hatchery of the same private fish farm were distributed onto the experimental earthen ponds at a stocking rate of 4 fish/m^2.

Experimental Rearing System:

Eight earthen ponds were sun dried, reformed, and watered. Six pens were constructed on one hand, each on a bank of ponds No. 1, 2, 3, 4, 5, and 6; whereas ponds No. 7 and 8 were offered artificial diet and fresh duckling droppings (from the control ducklings pen abroad of the fish ponds), respectively. The ducks were offered their feed in their pens, two times daily (2/3 morning and 1/3 evening) the morning meal was moisten, rough sand was offered once every 2 days. Ducks spent most of the day time on the fish ponds. The ducks were offered 50% of their initial body weight as daily feeding rate, which gradually reduced thereafter. Their diets (starter, grower and finisher 21 – 17% crude protein) were mash and bought from Cairo Co. for Poultry. At finishing, their feed was mixed with trash fish from the same farm. Thirty two ducks were lost (died) throughout the experimental period. At 2.5 months age, the ducks reached ca. 2 Kg final body weight, on average and sold for 14 LE / duck.

Chemical and statistical analyses:

Proximate chemical analysis for ducks was carried out using the standard methods of analysis (A.O.A.C.,2000). All numerical collected data were statistically analyzed using S.A.S. (2001) and Duncan (1955) for analysis of variance and least significant differences, respectively.

RESULTS AND DISCUSSION

Duck performance:

Table 1 shows some performance parameter of the experimented ducks on the first six ponds in the integration system with fish in comparison with the control ducks in the dry pen. Ducks on water ponds performed more better ($P \leq 0.05$) than the ducks in the closed pen (control), particularly on ponds No.5, 1 and 2, respectively. Ducks on these three ponds gave significantly heavier final body weight. Also, ducks on ponds No. 1 and 5 realized the highest ($P \leq 0.05$) dressing weight comparing with the control ducks. However, ducks of pond No. 5 gave also, higher ($P \leq 0.05$) weights of feathers, bone and inedible parts comparing with the control ducks. Ducks on pond No. 1 reflected the highest ($P \leq 0.05$) boneless meat weight and liver weight (as in ducks of pond No. 5); whereas, ducks of pond No. 5 presented the heaviest ($P \leq 0.05$) weight gain of ducks comparing with the control.

However, the best gizzard weight was given by ducks of integrated system on pond No. 1 (Table 1 cont.). Men (1995) mentioned that duck and fish production has been expanding and contributes to increased income and improved living standards of the farmers, especially for poor farmers in the remote reveal areas. In some regions, farmers raise fish on animal manure and obtained good results with fast growth of the fish. But duck slurry is also another source of money in duck production system. Since duck slurry is utilized as an organic fertilizer and as a renewable energy source (Murray, 2005)

Moreover, Africa and Sub-Saharan Africa have 16.4 and 6.8 millions of ducks at 2003 (Guéye, 2006). The duck meat market has grown significantly in recent years and is likely to continue with genetic and husbandry advances, making duck increasingly competitive to other poultry and meat products (Hall, 2006**).**

Duck chemical analysis:

Proximate chemical analysis of duck tissues proved that the integration system at highest stocking rate of ducks (80 duck/pond, ponds No. 1 and 2) increased thigh muscle protein content and decreased its fat and ash contents significantly comparing with the other two stocking rates of 40 and 20 duck/pond, i.e. ponds No. 3 – 4 and 5 – 6, respectively (Table 2). So, ducks on ponds No. 1 and 2 had similar thigh composition to that of the control ducks. The breast (Table 3) of ducks had naturally lower fat content than the thigh. Yet, the same trend of the significantly better composition of thigh of ducks at the highest stocking rate, being 80 ducks/pond, was repeated again in the breast composition.

Table 1: Data of ducks out (control) and in water system (ponds No. 1 to 6) at the end of the experiment (2.5 month).

Treat-ment	Means + standard errors					
	W_0	W_1	W_2	W_3	W_4	W_5
Control	91.63^{a} ± 0.427	1543.30^{c} ± 38.485	210.00^{b} ± 23.121	463.33^{b} ± 3.335	870.00^{b} ± 15.289	240.00^{b} ± 5.780
System 1	91.75^{a} ± 0.664	2016.70^{ab} ± 109.416	300.00^{ab} ± 50.057	530.00^{ab} ± 5.780	1186.67^{a} ± 82.626	248.33^{b} ± 4.410
2	91.64^{a} ± 0.329	1866.70^{abc} ± 216.919	340.00^{ab} ± 78.190	486.67^{ab} ± 18.578	1090.00^{ab} ± 37.901	238.33^{b} ± 7.271
3	91.85^{a} ± 0.329	1866.70^{abc} ± 0.041	266.67^{ab} ± 44.144	508.33^{ab} ± 66.632	1091.67^{ab} ± 142.537	231.67^{b} ± 22.445
4	91.68^{a} ± 0.578	1716.70^{bc} ± 66.754	200.00^{cd} ± 50.057	463.33^{b} ± 8.826	1053.33^{ab} ± 8.826	241.00^{b} ± 7.641
5	91.47^{a} ± 0.537	2133.30^{a} ± 16.682	400.00^{a} ± 0.000	573.33^{a} ± 14.543	1160.00^{a} ± 20.838	288.33^{a} ± 7.271
6	91.71^{a} ± 0.543	1750.00^{bc} ± 28.901	266.67^{ab} ± 44.144	513.33^{d} ± 13.346	970.00^{ab} ± 47.312	256.67^{b} ± 3.335

W_0 = Initial weight, g. W_1 = Final weight, g.
W_2 = Feathers weight, g. W_3 = Inedible parts, g.
W_4 = Dressing weight, g. W_5 = Bone weight.

Table 1: Cont.

Treat-ment	Means + standard errors			
	W_6	W_7	W_8	W_9
Control	630.00^{c} ± 10.011	35.69^{b}±0.514	64.37^{abc} ± 3.138	1451.70^{c} ± 38.057
System 1	938.33^{a} ± 79.187	62.80^{a} ±2.618	77.67^{a} ±3.919	1924.90^{ab} ± 110.028
2	851.67^{ab} ± 33.242	51.53^{ab} ±3.815	51.77^{c} ±2.600	1825.00^{ab} ± 83.005
3	860.00^{ab} ± 120.173	52.92^{ab} ± 10.618	50.75^{c} ±7.000	1774.80^{abc} ± 217.248
4	813.33^{abc} ± 15.913	54.13^{ab} ± 5.710	58.79^{bc} ± 5.566	1625.00^{bc} ± 67.300
5	871.67^{ab} ± 26.849	56.58^{a} ±4.023	68.68^{ab} ±3.381	2041.90^{a} ± 16.219
6	713.33^{bc} ± 46.716	50.43^{ab} ± 5.745	62.16^{bc} ± 1.450	1658.30^{c} ± 28.612

W_6 = Boneless meat weight, g. W_7 = Liver weight, g.
W_8 = Gizzard weight, g W_9 = Weight gain, g.
a – c: Means in the same column superscripted with different letters significantly ($P \leq 0.05$) differ.

Table 2: Data of chemical analysis of thigh muscles of the ducks as affected by the integration system (means ± standard errors).

Treatment	DM %	On DM basis (%)		
		CP	EE	Ash
Control	80.33^{a} ± 0.248	81.80^{a} ± 2.205	10.87^{c} ± 1.156	7.33^{b} ± 0.737
System 1	72.92^{ab}± 0.099	82.35^{a} ± 0.553	9.82^{c} ± 0.148	7.83^{b} ± 0.397
2	75.18^{a} ± 0.978	80.54^{a} ± 0.276	9.84^{c} ± 0.113	9.62^{b} ± 0.390
3	63.27^{b} ± 8.744	68.88^{b} ± 1.581	16.41^{b} ± 0.326	14.71^{a} ± 1.248
4	73.84^{ab}± 0.106	67.65^{bc}± 2.404	16.96^{b} ± 0.148	15.39^{a} ± 1.546
5	78.57^{a} ± 0.446	62.18^{c} ± 3.042	21.49^{a} ± 0.226	16.33^{a} ± 1.397
6	77.91^{a} ± 0.340	63.84^{bc}± 0.148	22.51^{a} ± 0.404	13.65^{a} ± 0.439

a – c: Means in the same column superscripted with different letters significantly ($P \leq 0.05$) differ.

Table 3: Data of chemical analysis of ducks' breast muscles as affected by the integration system (means + standard errors).

Treatment	DM %	On DM basis (%)		
		CP	EE	Ash
Control	$82.11^{a} \pm 0.397$	$85.04^{a} \pm 0.290$	$6.30^{de} \pm 0.028$	$8.66^{b} \pm 0.326$
System 1	$75.82^{b} \pm 0.517$	$88.57^{a} \pm 0.510$	$3.83^{e} \pm 0.042$	$7.60^{b} \pm 0.468$
2	$76.56^{b} \pm 0.088$	$81.67^{ab} \pm 5.304$	$7.89^{cd} \pm 2.702$	$10.44^{b} \pm 0.602$
3	$75.31^{b} \pm 0.843$	$76.15^{bc} \pm 1.652$	$9.34^{bcd} \pm 0.829$	$14.51^{a} \pm 0.829$
4	$63.93^{c} \pm 0.709$	$75.20^{bc} \pm 1.191$	$10.88^{bc} \pm 0.631$	$14.92^{a} \pm 0.560$
5	$67.71^{b} \pm 0.000$	$72.14^{c} \pm 0.219$	$12.73^{b} \pm 0.978$	$15.13^{a} \pm 0.056$
6	$67.48^{b} \pm 0.170$	$69.63^{c} \pm 0.028$	$20.12^{a} \pm 0.028$	$10.25^{b} \pm 0.000$

a – e: Means in the same column superscripted with different letters significantly ($P \leq 0.05$) differ.

Where the significantly ($P \leq 0.05$) higher protein percentage and lower ether extract and ash percentages were found in ducks of the integration system on ponds No. 1 and 2 similar to the control ducks but better than the breast muscle composition of ducks on the ponds No. 3 to 6. Also, liver analysis (Table 4) revealed that liver of ducks from ponds No. 1 and 2 contained more ($P \leq 0.05$) crude protein and less ($P \leq 0.05$) ether extract and ash than liver of ducks on the other ponds. Anyhow, the negative relation between crude protein and ether extract percentages are often reported in tissues of different animal species (Abdelhamid, 1982 and Abdelhamid *et al*., 2002).

Table 4: Data of chemical analysis of ducks liver as affected by the integration system (means + standard errors).

Treatment	DM %	On dry matter (DM) basis (%)		
		CP	EE	Ash
Control	$79.45^{a} \pm 0.787$	$77.87^{a} \pm 4.950$	$12.05^{d} \pm 2.212$	$10.08^{d} \pm 0.482$
System 1	$76.50^{c} \pm 0.488$	$70.60^{b} \pm 0.730$	$14.08^{cd} \pm 0.595$	$15.32^{bc} \pm 0.134$
2	$79.87^{a} \pm 0.184$	$72.02^{b} \pm 3.063$	$14.37^{bcd} \pm 1.780$	$13.61^{c} \pm 1.283$
3	$78.71^{ab} \pm 0.276$	$60.91^{c} \pm 2.191$	$17.39^{b} \pm 0.184$	$21.70^{a} \pm 0.262$
4	$76.93^{c} \pm 0.028$	$62.78^{c} \pm 0.007$	$17.09^{bc} \pm 0.198$	$20.13^{a} \pm 0.205$
5	$77.43^{bc} \pm 0.425$	$59.45^{c} \pm 0.255$	$23.22^{a} \pm 0.368$	$17.33^{b} \pm 0.609$
6	$77.50^{bc} \pm 0.695$	$62.23^{c} \pm 1.709$	$21.87^{a} \pm 1.248$	$15.90^{b} \pm 0.460$

a–d: Means in the same column superscripted with different letters significantly ($P \leq 0.05$) differ.

Duck production economy:

Thirty two ducks died during the experiment, being 7, 7, 7, 2, 2, 2, and 5 ducks from ponds No. 1, 2, 3, 4, 5 and 6 and the control pen, respectively. However, the return due to duck selling (Table 5) depended on the stocking rate of ducks on the fish earthen ponds. So, it was better from ponds No. 1 and 2 than from ponds No. 3 and 4 than from ponds No. 5 and 6, where the stocking rates were 80, 40, and 20 duck/pond, respectively. In general, this return from duck selling is an additional value to the main product, being fish.

Moreover, duck excreta are a price valuable for its use as direct droppings in the integrated ponds and as fresh manure for pond No. 8. Since recycling of animal wastes is beneficial for the primary productivity (natural food) in ponds' water (Abdelhamid, 2003), as well as in animal feeding (Abdelhamid *et al*., 2001).

Table 5: Duck rearing economy as affected by the integration with fish, in L.E/pond.

System No.	Ducklings price	Duck feed price	Duck selling* price	Labor and other costs	Return
1	160	510.7	1217.5	113.2	433.6
2	160	510.7	1217.5	113.2	433.6
3	80	255.3	608.8	56.6	216.9
4	80	255.3	608.8	56.6	216.9
5	40	127.7	304.4	28.3	108.4
6	40	127.7	304.4	28.3	108.4
Control	140	242.6	606.1	53.8	169.7
Total	700	2030	4867.5	450.0	1687.5

*** including manure price as 130 LE/m^3 , average manure quantity 150 g/duck/day (FAO, 1981) for 2 months, and 1 m^3 = 600 kg (Abdelhamid, 1991).**

Fish – cum – duck production economy:

Table 6 illustrates some economic evaluations of the integrated production system (fish – cum – duck) tested herein in LE/feddan/4 months. It is clear from total return from selling both fish and duck production that the best treatment was the 1st followed by the 4th, 2nd, 8th, 3rd, 6th, and 5th, being 5771.5, 5566.9, 5555.1, 3720.2, 3597.8, 2949.4 and 472.4, respectively. Whereas, the 7th treatment realized loss of 2635.4 LE/feddan/4 months. The 7th was the worst treatment for its dependence totally on the artificial feed for fish without integration with duck, since fish marketing in this case is a sole source of return. So, it realized the highest working rate (1.278) and the lowest percentages of return/outputs (-27.5) and outputs/inputs (78.3). The 8th treatment also was not integrated with duck, so there is no return from duck marketing; yet, its total return (from fish selling only) was higher than treatments No. 3, 5, 6 and 7 because there was no feeding costs (manure only), thus it was very economic, with lowest working rate (0.258) and highest percentages of return/outputs (74.19) and outputs/inputs (387.4), among the 8 tested treatments (ponds). So, organic manure only for earthen ponds is economic beneficial, but artificial feed only for ponds fish is undesirable and even caused loss of money, at least, under the experimental conditions of this experiment. Meanwhile, 250 duck/feddan in integration system (ponds No. 1 and 2) was a good treatment, not only in total return, but also in return/outputs % and outputs/inputs %.

However, ducks are grown on ponds at a density of 300-600 / acre. Ducks that are raised on ponds remain healthier than land-raised ducks. Also, by raising ducks on ponds, feed wasted by the ducks is consumed directly by the fish (Rakocy and Mc Ginty, 1989). Jian (1985) raised ducks in common carp fish ponds and found that 0.9-1.7 kg of fish could be increased by raising one duck. El-Sayed (2006) cited that farming tilapia with ducks is the most successful integrated culture. He added that the type and density of ducks significantly affect fish growth and yield as well as water quality. Moreover, feed costs in the aquaculture are about 30 – 60% of the total changeable costs, according to the degree of intensification (Shiau, 2002) or 30 – 85% (Wet and Linde, 2007).

Table 6: Fish – cum – duck farming profitability per feddan in LE.

System/Pond No.	Return from fish	Return from duck	Fish – duck return*	Working rate(1)	Return x 100/out-puts	Outputs x 100/ inputs
1	4848.3	923.2	5771.5	0.632	36.77	158.2
2	4542.5	1012.6	5555.1	0.573	42.70	174.5
3	2972.5	625.3	3597.8	0.795	19.07	125.7
4	4971.6	595.3	5566.9	0.660	34.04	151.6
5	244.3	228.1	472.4	0.956	4.367	104.6
6	2737.1	212.3	2949.4	0.730	26.98	137.0
7	-2635.4	-	-2635.4	1.278	-27.50	78.3
8	3720.2	-	3720.2	0.258	74.19	387.4
Total	21181.1	3596.8	24997.9	0.748	24.95	133.7

(1) Working rate = Total inputs/Total outputs.

- **without duck manure price which may be added to duck and subtracted from fish.**

It is estimated that 20 ducks produce one ton of manure per year. Although washings from chicken pens used to be applied directly into ponds, the present practice in most areas is to ferment them for 10 to 15 days before application. A major objective of integrated fish culture is to reduce operating costs and maximize the farmer’s income. The farm has increased its fish production almost nine times and the production of ducks three to five times in Ho Le Commune in Wuxi, the People’s Republic of China (FAO, 1981).

Jian (1985) identified the so-called “integrated fish farming” as diversification, overall rural development and comprehensive utilization of fisheries, agriculture, forestry and commerce, with emphasis being placed on fisheries. It is a model farming system for full utilization of local resources, for waste recycling and energy saving, and for maintaining ecological balance and circulation. Besides increasing the supply of fish, meat and eggs, and employment opportunities it also reduces the cost of fish production through utilization of local farm products as fish feeds and fertilizers and reorganization of farm labor for effective output. Moreover, feed supplementation to manure ponds led to significant increased in fish weight and yield (Abdel-Gawad *et al*., 2003), the increase was improved too by increasing feeding rate of supplement (Middendorp, 1995).

Rakocy and Mc Ginty (1989) cited that although yields of mouth brooding tilapia are not as high as those obtained with feed, fertilizers and animal manures can be used to reduce the quantity and expense of supplemental feeds. An increase in natural food has a much greater effect on tilapia production at densities less than 4,000/acre. Manuring may have application in the production of tilapia as a source of fish meal for animal feeds. Abdel-Halim *et al*. (1998) reported superiority of tilapia growth in complete feed ponds. However, they registered maximum net return from chemical fertilizers plus duck droppings treatment. They recommended the latter system for extensive local fish farming. Also, Abdel-Hakim *et al*. (1999) reported that duck manure with supplementary feed produced heavier fish of Nile tilapia as well as higher total fish production than in ponds treated only with duck manure. Yet, the last group (duck manure) had higher net return than duck manure plus supplementary feed.

Abdel-Hakim *et al*. (2000a) found that total fish (Nile tilapia) production for duck manure (DM) and DM + artificial feed (DM + F) treatments were 1273.3 and 1485.3 Kg, respectively. The DM + F treatment reduced the net returns over costs because of the fish feed which did not enhance the growth of fish to cover the feed costs. Payer (2001) mentioned that ducks and goose are bred with fish since thousands of years in subtropics such as Egypt in its Nile and Nile Delta as an old tradition. He added that there are 9 million ducks in Egypt at 1999. Concerning integrated agriculture – aquaculture technology (duck – fish culture), the same author cited that benefits of ducks include high fish production, producing valuable eggs and meat, loosen the pond bottom, releasing nutrients which increase pond productivity without labor for spreading manure, and get 50 – 75% of their feed from the pond in the form of aquatic weeds or insects and mollusks. Each feddan requires 84 – 126 ducks.

Nile tilapia yields in organic fertilization plus formulated feed treatments were significantly greater than the yield from chemical fertilization ponds. A larger percentage of harvested tilapia in the organic fertilization plus feed treatments were classified in the first and second class size categories compared with the traditional Egyptian system. Organic fertilization plus formulated feed ponds management strategies had the highest net returns, average rate of return on capital and the highest margin between average price and break – even prices to cover total variable costs or total costs (Green *et al*., 2002). Recently, Abou-Zied (2007) farmed Peking ducks with tilapia fish (0.38 g initial weight, at 15000/feddan) for 200 days in integrated system with 2 cycles of ducks, each of 2 months during one cycle of fish growth. He realized total return of 23721 and 35245 LE /feddan by stocking 1000 and 1500 duck /feddan, respectively.

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دراسات على نظام تكامل إنتاج الأسماك/البط :
٢ – على إنتاج البط

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أفردت دراسة على ٨ أحواض ترابية ، وذلك كمحاولة لخفض تكاليف التغذية فى إنتاج الأسماك تحت نظام شبه مكثف بإخضاعه لنظام التكامل مع إنتاج البط٠ فتم شراء كتاكيت بط بكينى عمر يوم وتم رعاية الكتاكيت لأسبوعين فى حظيرة مغلقة قبل تعلم العوم٠ ثم قسمت بكثافات مختلفة على حظائر تم بنائها خصيصاً للبط على جسور ٦ أحواض الأولى (حيث سكنت بكثافات ٨٠، ٤٠، ٢٠ بطة على الأحواض ١ – ٢، ٣ – ٤، ٥ – ٦، على الترتيب) وتركت الأحواض ٧، ٨ بدون بط٠ فكان البط يسمد الأحواض ١ – ٦ بجانب التغذية الصناعية للأسماك، بينما أسماك الحوض ٧ تغذت صناعياً فقط، والحوض ٨ سمد بزرق بط طازج من حظيرة البط البعيدة عن الأحواض التجريبية ٠وقد تم تغذية البط فى حظائره مرتان يومياً، وقضى البط معظم النهار فى أحواض السمك٠ وتم تسويق البط عمر ٢,٥ شهر ببلوغه حوالى ٢ كجم وزن نهائى. وقد خلصت نتائج التجربة الى تفوق البط المحمل على معظم أحواض السمك فى كل من الوزن النهائى، والزيادة فالوزن، والوزن الصافى، ووزن اللحم عن بط المقارنة (غير المحمل على أحواض السمك). وقد انخفض بروتين أفخاذ وصدور وأكباد البط وزاد دهنها فى المعاملات أرقام ٣ الى ٦ عن المقارنة والمعاملتين رقمى ١ و ٢. وقد انخفض كذلك العائد الاقتصادى بانخفاض معدل تسكين البط على الأحواض، ومن ثم انخفض العائد الكلى من البط والأسماك معا بانخفاض معدل تسكين البط. وتعد المعاملتان الأولتان (٢٥٠ بطة / فدان) هما الأكفأ من حيث العائد الكلى من المزرعة المتكاملة مع أقل معدل تشغيل وأعلى نسب مئوية للعائد على الإيرادات والإيرادات على المصروفات (باستثناء معاملة التسميد فقط- بدون بط).