A study on duck cum fish integrated farming at Gaffor Goan Upazila in Mymensingh district

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Abstract

Context: Determination of performance of ducks and fishes, and cost-benefit analysis in an integrated farming system of duck cum fish culture.

Materials and Methods: An investigation was carried out in an integrated duck cum fish farming for a 6 months period from 1st January to 30th June, 2010 at Gaffor Goan Upazila in Mymensingh district. After preparing the ponds there Khaki Campbell breed of duck and four fish species fishes were stocked in the three ponds for finding out the performance of ducks offering prepared supplement feed with natural feed like aquatic weeds, insects, mollusks etc. in the ponds and fish production without given any food to fishes, but depended only on duck excreta, waste feed from ducks and naturally grown fish feed like Phytoplankton and Zooplankton. Finally all collecting data was tabulated, processed and recorded in computer Microsoft Excel sheet and finally it was analyzed by using Statistical Program for Social Science (SPSS, Version 22.0) computer program.

Results: The egg production/year/female observed 245±14.21 was significantly ($p<0.05$) higher in Pond 3 than those produced 210±09.42 and 180±10.50 eggs/year/female in Pond 2 and Pond 1, respectively. Moreover, the matured body weight of duck obtained 2234±85.47g in Pond 3 was also heavier ($p<0.05$) than the duck in Pond 2 and Pond 1 had the matured weight of 1975±78.25 and 1850±87.44g, respectively. The average weight at six months period of various fishes in different ponds varied markedly amongst themselves. The average weight observed 550, 250, 200 and 120g in Pond 3 for Silver carp, Grass carp, Mrigal and Rajpunti, respectively was heavier than those fishes in Pond 1 having 480, 200, 100 and 80g for Silver carp, Grass carp, Mrigal and Rajpunti, respectively and in Pond 2 having 430, 150, 80 and 80g for Silver carp, Grass carp, Mrigal and Rajpunti, respectively. It was evidently established that the silver carp in each pond showed highest growth amongst to all other species of fishes. The net profit from duck cum fishes obtained 346200 Tk. was desirable and the maximum return of Tk. 135700 having from Pond 3, and then Tk. 108500 and 102000 from Pond 2 and Pond 1, respectively.

Conclusion: It was concluded that an integrated duck cum fish farming was more desirable and profitable than the duck or fish farming alone.

Key words: Duck, Dropping, Egg, Excreta, Farming, Feed, Fish, Integrated and Pond.

Introduction

Bangladesh is one of the most densely populated countries in the world, where more than 110 million of people are living in 1, 43, 999 sq. km area only. As a result, she has to feed her 110 million people by food crops produced from 9.45 million hectares of land only (FAO, 1994). The people of this country have been suffering from malnutrition especially due to shortage of animal protein. According to the national health strategy an adult people need 250 ml milk and 120g of meat every day and however, presently the availability is only 43.44 and 67.17%, respectively (DLS., 2015). Fish is the core source of animal protein contributes 80% of the total animal protein consumption (BBS, 1993), and the rest coming from livestock and poultry is 20%. The demand for fish is increasing rapidly due to the increased population growth those results in shortage of livestock and poultry where man is competing with animals for land to grow their fodder and food grains.

Having the least resource facility, most of the farmers of Bangladesh depend on mono-commodity farming either poultry or crop or fish, which is mostly due to lack of financial support, skill and technical knowledge. Diversification of farm production into multi-commodity pattern, could not only give diversified products from a unit area, but also would give higher economic returns at a very low investment. It is the most common view in Bangladesh that aside from crop production. But most of the small and marginal farmers have such livestock as a few heads of cattle or buffaloes, three to five sheep or goats and a small flock of duck and/or chicken. Moreover, where there is adequate water supply, a small fish pond is maintained. So, it is clear that the farmers of Bangladesh have been sustaining themselves by practicing various kinds of crop diversification but are not following any integrated farming management system. Integrated farming system has a great role to play in bringing about reduction in the cost of production. The aim of integration of fish farming with livestock was at increased efficiency of resource utilization, reduced investment risks through diversification and additional sources of food and income to farmers. The system is ideally suitable for social and economic upliftment of small farmers and rural people who have small land holding and low input resources; but surplus family labour and domestic farmyard having a few heads of cattle, ducks, chicken etc. Fish and livestock are "thermodynamic machines" and must "compete" for prominence in human food supply. Depending on the situation, the integration could be of tri-commodity like fish-livestock-crop farming, or bi-commodity such as, rice-fish, livestock-fish or livestock-crop etc. At present, tri-commodity integration really be impossible in the country due to lack of technical knowledge as well as financial support. In view of economic condition and availability of cultivatable land, there is no possible of buffalo, cattle, sheep, goat raising as a part of bi-commodity farming system. Adverse climatic condition and scarcity of land for fodder production is also a great obligation of bi-commodity farming system with large and small ruminant. In lieu of those the potential advantages & benefits of a completely duck cum fish farming system. No additional land is required for duckery activities and ducks get 50-75% of their total feed from the scavenging in the pond. High production of fish, egg and

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meat is possible in a unit time in a unit water area and healthy & fleshy fish was produced with duck cum fish farming. Scientists found in their experiment that the integrated farming system ensures high profit through less investment & risk. Thus, the duck cum fish integrated farming system might have been more efficient in case of polyculture system for optimum utilization of primary resources like feed & fertilizers, labours, water & land. Therefore, the study was planned to determine the function of duck excreta in recycling the nutrients & their effect on fish production as well as to develop an appropriate polyculture technique in integrated duck cum fish farming system suitable for the local ecological condition and to the prevailing of socio-economic status of Bangladesh.

Materials and Methods

Study area and shape of ponds

The study area was at Gaffer Goan Upazilla in Mymensingh district. The average bottom area of the pond was 515m^2 and surface area of 66.67m x 12m (0.08 hactare). All the ponds were rectangular in shape and well exposed to sunlight.

Preparation of ponds

One month prior to stock, the ponds were completely dried out by dewatering. The ponds were then kept exposed to sunlight for one month. In the interior time, the bottom was cleaned off of all unwanted weeds from the inner side of the pond embankments were also cleaned. Then the ponds were treated with lime (CaO) at the rate of 250 kg per hactare and then were sun dried for 7 days. After filling up the ponds with water from the deep tube well, urea & TSP was supplied initially at the rate of 40 and 60 kg per hectare, respectively.

Selection of fish species

The following fast growing and widely cultivated carps were selected for stocking under polyculture system, such as Silver carp (*Hypophthalmichthyn molitrix*), Grass carp (*Ctenopharyngodon idella val.*), Mrigal (*Cirrhinus mrigala Ham.*) and Rajpunti (*Puntius gonionotus*).

Stocking rate of fish

The table 1 showed the stocking rate of fish in the ponds. The ponds were stocked with the fish species to utilize the optimum available food materials.

Table 1. Stocking rate of fish

Ponds	Area of the pond (acre)	Name of the fishes	No. of fishes/acre	Total no. of fishes/acre
Pond 1	0.8	Silver carp Grass carp Rajpunti	1500 1500 1500	4500
Pond 2	1	Silver carp Grass carp Mrigal	1500 1500 4500	7500
Pond 3	1.2	Silver carp Grass carp Rajpunti	1750 750 2000	4500

Feed and fertilizer supplied to the fish

No extra feed and fertilizer was supplied to the fishes except the duck excreta & waste feed that fall directly into the pond. Soft green grass was supplied to the grass carps twice daily at the rate of 10-20% of their body weight.

Construction of duck- shed

Six duck-sheds were constructed over six ponds with locally available materials. Split bamboos were used to make the floor and wall. Top most centrally joined that were used to construct the roof. Larger size whole-bamboos were used to support the sheds over ponds. The sheds constructed for the first and second year. The floor area of duck-shed was about 13.5m^2 (4.5m x 3.0m). The height of the shed was 2.8m. The pond bottom to floor height was 1.8m and from water level to floor was l.0 m. The floor of the shed was made of bamboo splits with a gap of about 1 cm between the two to allow the duck droppings and waste feed falling directly into the pond. The shed was constructed at the middle of the pond but to the one of the embankments. Ventilation facilities were developed by cutting the wall and the cutting space was covered with net. The shed was provided with a bamboo slate made of single shutter to close the single main door near the embankment. Bamboo made ladder was used to go into the shed from the embankment. Another smaller door was provided just opposite to the main door from where another smaller slopping ladder of bamboo slate was installed for movement of the ducks from the pond into the shed and vice-versa.

Stocking rate of duckling

The table 2 showed the stocking rate of duck in the ponds. Ducklings of Khaki Campbell breed were procured from the Central Duck Breeding Farm, Narayangonj. The number of ducks was raised in the fish pond depending on the quality of excreta which again was determined by the ducks species quality and quantity of feed given as well as the method of raising of ducks. The stocking rate of ducks was also depended on the climatic conditions and the stocking ratio and density of the various fish species polycultured in the pond.

Table 2. Stocking rate of ducks

Pond No.	Area of ponds (acre)	No. of ducks/pond	No. of ducks/acre
1	0.8	75	94
2	1	100	100
3	1.2	150	150

Feed preparation and feeding of ducks

The composition of duck feed was showed in Table 3. Duck feed was prepared with locally available agricultural products and by-products such as broken wheat, broken maize, rice polish, till oil cake, fish meal, oyester shell powder, common salt and vitamin-mineral pre-mix and chopped green soft grass was mixed with the feed at the rate of 2.5% of the total feed.

Table 3. Composition of duck feeds

Ingredients	1st year Amount (%)	2nd year Amount (%)
Broken wheat	51.4	44
Til Oil Cake	8.0	12
Rice polish	23	30
Fish meal	17	10
Oyester shell powder	-	3.5
Common salt	0.3	0.5
Vitamin-mineral pre-mix	0.3	-
Total	100	100

The ducklings were feed at the rate of 25g/duck/day. The ration was increased at the rate of 5g at every succeeding week and at

the age of 165 days they were feed at the rate of 125g/duck/day. This rate of ration was continued up to the culling of the ducks. The ducks were feed twice a day i.e. in the morning (between 07:00-10:00 am) and in the evening (between 4:00-6:00 pm). Depending on the time of dawn and dusk, the feeding time was adjusted. Two wooden feeders (45cm x 18cm x 12cm) were set at two sides in the floor of the shed. Feed was supplied into the feeder. Tin made two waterers (40cm x 15cm x 10cm) were also set for arranging of supply of drinking water for the ducks.

Others management activities

The feeder and waterer were cleaned daily. Fresh pond water was supplied twice daily in consistence with the feed supplying time. The sticky deposition formed by the dried mixture of pasty duck excreta and waste feed on bamboo splits of the floor was washed out into the ponds from time to time. Ducks were vaccinated with Duck cholera and Duck Plague. Antihelminthes were also used for controlling of Endo-parasites of the ducks.

Data analysis

All collecting data was tabulated, processed and recorded in computer Microsoft Excel sheet and finally it was analyzed by using Statistical Program for Social Science (SPSS, Version 22.0) computer program.

Result and Discussion

Integrated farming system such as duck cum fish farming system based on the relationship between ducks and fish, organisms at different levels of the food chain and the environment. This concept might extend an integrated farming system as a whole with poultry and fish cultured together to optimize the output and nutrient utilization.

Water quality

Each pond was stocked with four species of fishes (silver carp, grass carp, mrigal, rajpunti) and Khaki Campbell ducks for integrated duck cum fish culture. Duck dropping spread over the entire pond by wave movement and duck itself. The water body was served for fish production and water surface made duck raising possible. Water in integrated ponds was richer in natural productivity of Phytoplankton and Zooplankton of either in species or density compared with nonintegrated ponds. Fish species reared in integrated ponds exhibited better body weight, food conversion ratio and thus, fish yield in the integrated ponds were much better as well.

Growth and production performance of duck

Table 4. The average age at first laying, mature weight, egg production performance and season of peak production

Ponds	No. of duck	Age at first laying (days)	Egg production /year/female	Matured body weight (g)	Season of peak production
Ponds 1	75	180^{a}±8.52	180^{c}±10.50	1850^{c}±87.44	Winter
Ponds 2	100	150^{c}±7.41	210^{b}±09.42	1975^{b}±78.25	Winter
Ponds 3	150	160^{b}±6.23	245^{a}±14.21	2234^{a}±85.47	Winter
Level of significance	-	*	*	*	-

Means with different superscripts in the same column differed significantly (, p<0.05).*

The average age at first laying, mature weight, egg production performance and season of peak production was shown in Table 4. The egg production/year/female observed 245±14.21 was significantly ($p<0.05$) higher in Pond 3 than those produced 210±09.42 and 180±10.50 eggs/year/female in Pond 2 and Pond 1, respectively (Table 4). Similarly, mature body weight of duck obtained 2234±85.47g in Pond 3 was also heavier ($p<0.05$) than the duck in Pond 2 and Pond 1 had the matured weight of 1975±78.25 and 1850±87.44g, respectively (Table 4). The results of the present study were parallel to the results obtained by Ali *et al.* (1994), All *et al.* (1995), and Ali and Islam (1995) found that egg production of duck and weight attainment of spent duck, excreta and fish production were correlated.

Higher egg production performance and heavier matured weight of the ducks in Pond 3 might be due to taking of extra feed and grazing, chasing and dabbing freely over the Pond 3 than other Ponds. Age at first laying (days) of the duck in Pond 1 was significantly ($p<0.05$) higher than the duck in Pond 3 and then Pond 2 (Table 4), i.e. the age at first laying (days) of the ducks observed shorter in Pond 2 than in Pond 3 and then Pond 1 might be due to environmental status and its associates in the pond.

Relationship between duck excreta and fish

Duck dropping contains 81% water, 0.91% nitrogen and 0.38% phosphorous. Ducks were allowed to free range in the pond from 9 a.m. to 5 p.m. and the excreta released during this period were easily mixed with pond water and fertilized it. Moreover duck droppings voided during night at the duck house were collected and applied to the fish pond in the morning to fertilize the pond water. Duck dropping acted as a good fertilizer which helped in producing fish feed like Phytoplankton & Zooplankton in fish pond. Therefore, application of extra feed or fertilizer to fish pond for raising fish was not needed. This reduced the production cost of fish by 60%. One duck voided about 125-150 g excreta in a day. These excreta was served as direct fish food and also acted as source of nutrients for the growth different fish food organisms. Thus, the duck excreta and net fish production were found to be maintained more or less a positively correlation. The observation agreed with the finding of Schroeder (1978), and Burns and Stickney (1980) who found that fish productions were directly correlated with manure input.

Growth performance of fish

The growth performance of silver carp, grass carp, mrigal and rajpunti are shown in Table 5. Growth responses of fish in different pond in integrated farming system were found and these results of growth rate of fish clearly indicated that silver carp in each pond showed highest growth amongst to all other species of fish.

Table 5. Fish growth at 5 month periods of Silver Carp, Grass Carp, Mrigal and Rajpunti

Sl. No.	Fishes	Growth (g)	
		Pond-1	Pond-2
1	Silver carp	500	500
2	Grass carp	200	150
3	Mrigal	100	80
4	Rajpunti	-	80

Relatively best growth performance of silver carp was found in all the stocking combinations and the superiority of silver carp observed over other species was supported by the study result

of Sukumaran *et* al., 1969. This might be due to the effect of the duck droppings produced sufficient food in the pond water for all of the species in their feeding level where there was no inter-specific food competition among them.

***Economical aspect of integrated duck cum fish* farming**

The summary of cost-benefit analysis of integrated farming system of duck cum fish culture is presented on the Table 6. The net profit obtained 346200 Tk. (Table 6) in integrated farming system of duck cum fish culture. The highest profit observed 135700 Tk. in Pond 3 and then 108500 and 102000 Tk. in Pond 2 and Pond 1, respectively (Table 6). Profit came from sale of spent ducks, eggs and fishes. The egg production was desirable of the ducks in all the ponds although ducks in Pond 3 produced highest number of eggs than Pond 2 and Pond 1. This satisfactory production of eggs was probably due to ducks taken excess feed (Phytoplankton and Zooplankton) from the ponds with supplementary feed

Table 6. The summary of cost-benefit (Tk.) analysis of integrated farming system of duck cum fish culture

Items	Pond -1			Pond -2			Pond -3			Total	Total	Net
	nvestmen	Return	Profit	nvestmen	Return	Profit	nvestmen	Return	Profit	nvestmen	return	profit
Duck	32500	48500	16000	37000	63000	26000	43700	75000	31300			
Egg	-	65000	65000	-	64000	64000	-	77400	77400			
Fish	53000	74000	21000	45000	63500	18500	55000	82000	27000	266200	612400	346200
Total	85500	187500	102000	82000	190500	108500	98700	234400	135700			

and the ducks allowed to perform good exercise freely in the pond. Moreover, ducks get 50-75% of their total feed requirement from the ponds itself in the form of aquatic weeds, insects, mollusks, etc and thus, they gained themselves a good matured body weight (Table 4). There were no supplementary feeds supplied to the ponds for fishes except chopped grass for grass carp, but the fish production was profitable might be due to their higher growth rate by taking the duck droppings and felled down waste feed of ducks in the fish ponds. Therefore, the net profit became desirable and very profitable in present experiment of duck cum fish farming.

Conclusion

The present study was conducted to duck cum fish integrated farming to find out the performance of ducks and fishes. Three selected ponds were stocked with four species of fishes like Silver Carp, Grass Carp, Mrigal and Rajpunti. The 75, 100, 150 heads of Khaki Campbell breed were integrated with fishes for recycling the wastes of different selected ponds. The results revealed that duck excreta was good source of nutrients that was readily soluble in pond water and became available for growing of fish feeds as Phytoplankton and Zooplankton. Moreover, the duck excreta improved the nutrient level in the fish pond ecosystem at productive range. Duck also showed better growth rate and attained a reasonable matured body weight with a good egg production performance. The average number of yearly egg production per female observed 245±14.21 was significantly ($p<0.05$) higher in Pond 3 and then 210±09.42 and 180±10.50 in Pond 2 and Pond 1, respectively. The matured body weight of duck obtained 2234±85.47g was also significantly ($p<0.05$) higher in Pond 3 and then 1975±78.25 and 1850±87.44g in Pond 2 and Pond 1, respectively. The fish growth was highly satisfactory with duck droppings and waste feed of ducks received by the fishes in different ponds. The highest matured body weight and egg production performance of ducks in Pond 3 was probably due to have the nutrient availability and suitable environment per duck in Pond 3 than had other ponds. The net profit observed 253800 Tk. in the integrated system of duck cum fish farming was desirable. Thus, it was concluded that an integrated duck cum fish farming system was more desirable and profitable than the duck or fish farming alone.

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