

Article

Present status and economic benefit of integrated fish farming system in Noakhali region, Bangladesh

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Abstract: The present study investigated to know the current status and assessment of the economic benefit of twenty-five integrated fish farms in Noakhali region of Bangladesh. Qualitative and quantitative research data were collected between November 2018 to July 2019 through farm visit, focus group discussion and questionnaire interview. This total farming system covers a total 111.27 hectares of landmass where 78.51 hectares were used for fish production and 32.76 hectares for other production. Six major categories of integration were found, namely fish-poultry-livestock-horticulture, fish-poultry-horticulture, fish-livestock-horticulture, fish-horticulture, fish-poultry and fish-livestock integration. There are 21 fish species, 4 types of reared poultry and 3 types of reared livestock and a variety of fruits and vegetables were cultivated throughout the year. An increasing trend of integration was found in the study area. Total fish production from those 25 integrated farms was 326.4 tons/year, and the production value was BDT 43.37M approximately. Average production of fish, horticulture and poultry were 4.54, 13.96 and 1201.79 tons/ha/year. Total investment in 25 different integrated fish farms was about BDT 185.63M while total return was about BDT 227.85M. The benefit of an integrated farming system was BDT 0.38 M/ha/year. The wastes from livestock and poultry directly or indirectly used as fertilizer in the pond and horticulture farming system. A few farms convert this bio-waste as electrical energy through biogas plants to meet up farm's electricity demand. With the help of proper guideline, technical and financial support the production of these integration systems could be boosted up. It will play a remarkable positive impact on the total economy of the country.

Keywords: fish farming; integration; cost-benefit analysis; livestock

1. Introduction

Agriculture in Bangladesh comprises vegetation, farm animals, and fisheries. It presents food, feed, fiber, and gasoline to its citizens and animals, and plays a crucial position in the financial development of Bangladesh. Almost 60% of farmers own not more than 0.8 ha farm that is not enough space for the diversification of farming activities in Bangladesh (FAO, 2019). However, integrated fish farming approach with limited available space have the potential to diversified farming activities. Consequently, farmers can have more food production, nutrition and better household income with possible land utilization (Alam *et al.*, 2009). People in Bangladesh have approximately 47–48 million animals, including cattle, buffaloes, sheep, and goat. Besides, chickens and ducks have been taken together 90 million (FAO, 2019). Those animals appear to produce a significant amount of excreta. These excreta have often been considered as waste products that can cause environmental pollution. In order to reduce such pollution, animals' excreta can be utilized as fertilizer instead of other fertilizers or artificial feed through the integrated fish farming system in a pond (Bekibele *et al.*, 2007). This way, fish production has been increased up to 4-5 t/ha/year (FAO, 2019). In integrated fish farming, fish production is considered to be the main source of profit. Besides, crops, poultry, vegetables, livestock are the additional

source of income (Nishan et al., 2015). As a whole, integrated farming system includes enhancing production by integration of all components in a farm without external inputs. For example, crop may serve as feed for livestock (duck or poultry), manure of a livestock may serve as manure for the crop. Some livestock such as ducks appear to be helpful for controlling weeds by eating them. Thus, the integrated farming system is a kind of recycling process in which resources are well-utilized without being wasted (Bekibele *et al.*, 2007). However, most farmers in Bangladesh are subsistence farmer. They tend to get cashback from the farm investment. While single crop culture entrepreneurs are at risk and facing uncertainty due to inconsistent income and career opportunity to farmers, it is necessary to introduce a favourable integrated fish farming system for obtaining economic benefits and sustainable food production (Al Mamun and Debi, 2012). Therefore, our study attempted to gain information regarding the present status and financial benefit of integrated fish farming system in Noakhali, Bangladesh.

2. Materials and Methods

We collected both qualitative and quantitative data from the farm survey in Noakhali (Figure 1). For collecting data, we followed a focus group discussion and questionnaire interview for about eight months (November 2018 to July 2019). After data collection, data were organized and analyzed by MS Excel. Finally, we produced a graph for a clear understanding of the cost-benefit of integrated fish farms.

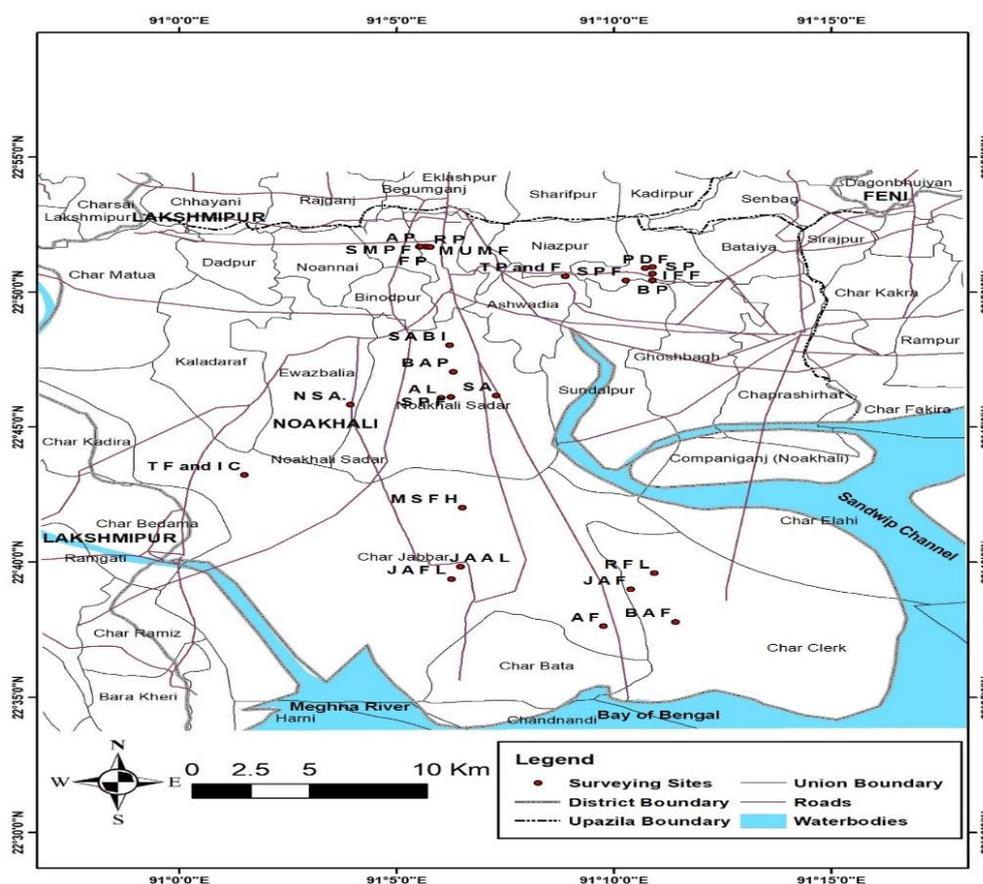


Figure 1. Site of the studied integrated fish farms.

3. Results

3.1. Status of integration system

There are six major categories of integration practiced in the study areas namely Fish-poultry- livestock-horticulture (F-P-L-H), Fish-poultry-horticulture (F-P-H), Fish-livestock-horticulture (F-L-H), Fish-horticulture (F-H), Fish-poultry (F-P) and Fish-livestock (F-L). We found that Fish-poultry farming integration practice was highest (36%) and Fish-horticulture farming integration occupied the lowest (only 4%). Out of the surveyed 25 farms, 19 farms were single ownership, and the remaining 6 farms were multiple ownership (Table 1). The total farms' size was 111.27 hectares, where the fish farming area was 78.51 hectares including 210 grow-out ponds and 71 nursery ponds.

Table 1. Scenario of the studied integrated fish farms.

Farm Code	Ownership	Integration	Farm area (ha)	Pond area (ha)
I-F1	Single	F-L-H	16.19	7.69
I-F2	Single	F-P-L-H	4.05	2.83
I-F3	Single	F-L	3.24	2.43
I-F4	Single	F-L-H	4.05	3.04
I-F5	Single	F-P-L-H	12.15	8.10
I-F6	Single	F-P-H	1.21	1.01
I-F7	Single	F-L-H	2.63	1.42
I-F8	Single	F-P-H	1.94	0.49
I-F9	Multiple	F-P	2.02	1.62
I-F10	Single	F-P	0.32	0.32
I-F11	Single	F-P-H	0.97	0.97
I-F12	Single	F-P-H	2.43	1.94
I-F13	Single	F-P	2.83	2.02
I-F14	Multiple	F-P	6.88	0.81
I-F15	Single	F-P-L-H	3.64	2.15
I-F16	Single	F-P-L-H	4.45	3.97
I-F17	Single	F-L	0.81	0.81
I-F18	Multiple	F-P	0.81	0.81
I-F19	Single	F-H	9.72	9.72
I-F20	Single	F-P	0.65	0.65
I-F21	Single	F-P	4.05	3.85
I-F22	Multiple	F-P	2.02	2.02
I-F23	Multiple	F-L-H	5.99	5.67
I-F24	Single	F-L	6.07	4.05
I-F25	Multiple	F-P	12.15	10.12

I-F1=Babul Agro Farm I-F2=Jabed Agro Farm I-F3=Alauddin farm I-F4=Subarna Agro-Based Initiative I-F5=Bismillah Agro Production I-F6=Safi Poultry Farm I-F7=Shanti Agro I-F8=Shahajan Miya Poultry Farm I-F9=Alauddin poultry I-F10=Faria Poultry I-F11=Ripon Poultry I-F12=Moinul Ulum Madrasa Farm I-F13=Ma Scientific Fisheries Hatchery I-F14=N. S. Agro I-F15=Jahanara Azad Agro Limited I-F16=Jamshed Agro Farm Limited I-F17=Prova Dairy Farm I-F18=Sabuj Poultry I-F19=Ismail Fish Farm I-F20=Bhowmik Poultry I-F21=Tahera Poultry and Fisheries I-F22=Shamola Poultry Farm I-F23=Amble Limited I-F24= Raifa Fisheries Limited I-F25= Tanisha Fisheries and Integrated Complex

Source: Survey 2018-2019 (F-Fish, H-Horticulture, P-Poultry, L-Livestock).

3.2. Available fish species cultured in the integrated studied farms

During the survey, 21 species were found cultured in studied farms pond. These species are *Oreochromis mossambicus*, *Labeo rohita*, *Gibelion catla*, *Pangasius pangasius*, *Cirrhinus cirrhosus*, *Barbonymus gonionotus*, *Labeo calbasu*, *Labeo gonius*, *Hypophthalmichthys molitrix*, *Aristichthys nobilis*, *Ctenopharyngodon idella*, *Heteropneustes fossilis*, *Clarias batrachus*, *Mystus cavasius*, *Ompok pabda*, *Chitala chitala*, *Macrobrachium rosenbergii*, *Cyprinus carpio*, *Lates calcarifer*, *Anabas testudineus* and *Labeo bata*.

3.3. Trends of integration

According to the current research work, all the integrated farms were established between 2000 to 2017. Each year new farms were involved in the integrated farming business. An Increasing trend of Integrated farming business was observed during the study period (Figure 2).

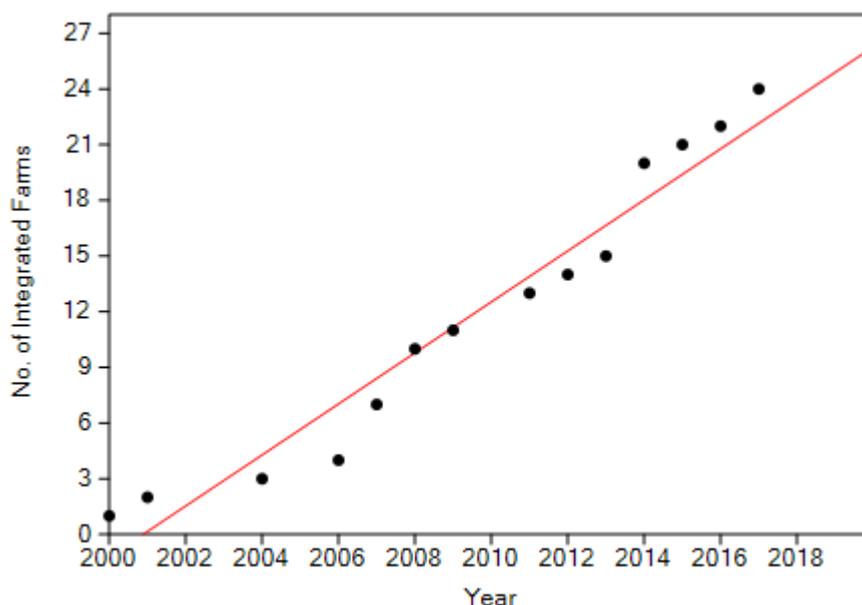


Figure 2. Trends of Integrated farm in the studied area.

3.4. Cost-benefit analysis of integrated fish farming

Our survey showed that the total investment of Fish-Horticulture-Poultry-Livestock, Fish-Horticulture-Poultry, Fish-Horticulture-Livestock, Fish-Horticulture, Fish-Poultry and Fish-Livestock farming system was BDT 81370400.00, 14242500.00, 23303860.00, 740000.00, 54307950.00 and 11664300.00 respectively (Figure 3). The total return of Fish-Horticulture-Poultry-Livestock, Fish-Horticulture-Poultry, Fish-Horticulture-Livestock, Fish-Horticulture, Fish-Poultry and Fish-Livestock farming system was BDT 98540800.00, 19601000.00, 31033900.00, 1265000.00, 62756275.00 and 14654300.00, respectively (Figure 3). The total benefit of Fish-Horticulture-Poultry-Livestock, Fish-Horticulture-Poultry, Fish-Horticulture-Livestock, Fish-Horticulture, Fish-Poultry and Fish-Livestock farming system was BDT 17170400.00, 5358500.00, 7730040.00, 525000.00, 8448325.00 and 2990000.00 respectively.

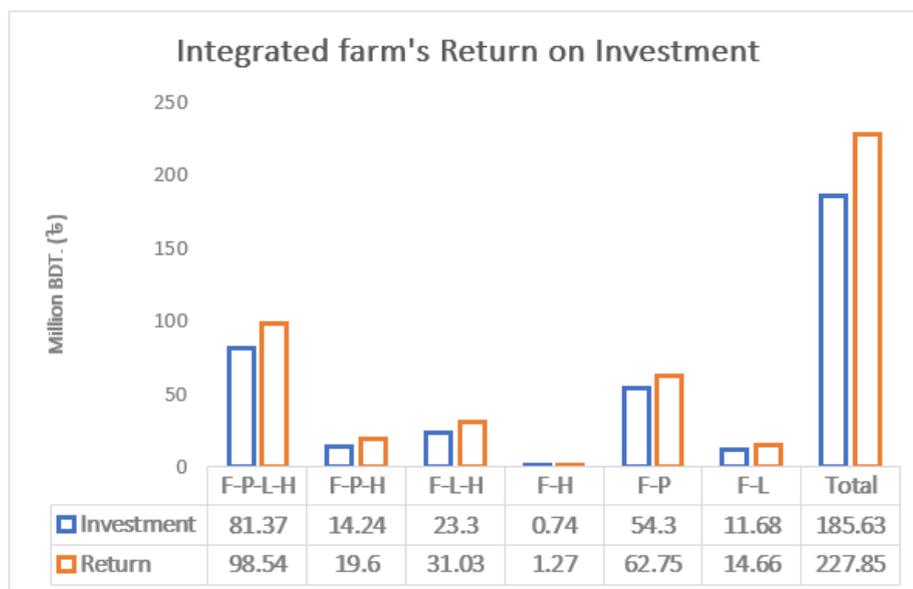


Figure 3. Comparison of cost-benefit analysis in the different farming system.

4. Discussion

Our results show that six major categories of integration available in the current study area, including Fish-poultry-livestock-horticulture, Fish-poultry-horticulture, Fish-livestock-horticulture, Fish-horticulture, Fish-poultry and Fish-livestock. Our study revealed that most of the farms practiced fish-poultry in their farms which is evidenced by other studies conducted in Mymensingh (Uddin *et al.*, 2015). Similarly, fish cum poultry culture

is the most popular in Nigeria, among other integrated fish farming like fish-piggery and fish-rice-vegetable culture (Zira *et al.*, 2015). Besides, we found 21 species that are being cultured in the present study area. These species are *Oreochromis mossambicus*, *Labeo rohita*, *Gibelion catla*, *Pangasius pangasius*, *Cirrhinus cirrhosus*, *Barbonymus gonionotus*, *Labeo calbasu*, *Labeo gonius*, *Hypophthalmichthys molitrix*, *Aristichthys nobilis*, *Ctenopharyngodon idella*, *Heteropneustes fossilis*, *Clarias batrachus*, *Mystus cavasius*, *Ompok pabda*, *Chitala chitala*, *Macrobrachium rosenbergii*, *Cyprinus carpio*, *Lates calcarifer*, *Anabas testudineus* and *Labeo bata*. Among cultured twenty-one species, *O. mossambicus* was the most common as it is a hardy species and resistant to disease, high temperature and salinity. This species can survive at low oxygen and high density. Similar evidence of culturing *O. mossambicus* also found in another study (Nishan *et al.*, 2015).

The total investment of Fish-Poultry farming system was BDT 54.31M, the total return was BDT 62.76M, and the overall benefit was BDT 8.45M in the study area. In contrast, Paisa (2011) conducted that in Mymensingh cost of integrated fish-poultry and mono poultry were BDT 0.33M and BDT 0.28M, respectively. Gross return from integrated fish-poultry and mono poultry was BDT 0.47M and BDT 0.32M. The net returns were found BDT 0.14M and 0.042M, respectively. Moreover, integrated crop cum livestock farming produce crop residues which appear to be used for animal feed, and livestock produce manure that can increase agriculture production. We found that integrated fish farming is income source all the year round for farm owners. Integrated farming was more profitable than other occupation. Our results revealed that out of twenty-five farm owners, sixteen farm owners have different professions. We found that farm owners were self-sufficient by financial income. Integrated farming helps them to achieve experience for practicing integration in future.

5. Conclusions

The typical farming system is one-dimensional, but an integrated farming system is a multi-dimensional system. The integrated farming system is more sustainable and eco-friendlier than other farming systems. The integrated farming system can ensure the proper utilization of wastes and resources e. g. land, water, feed and also minimize the wastes, feed and labour costs. Therefore, utilizing small space, we can produce various products including fish, vegetables, meat, fruits, and other products with low price. However, to increase the production of integrated fish farming in Noakhali need proper management of integrated fish farms. Proper and systematic guideline, technical and financial support will assure the enhancement of production of these integration systems.

Conflict of interest

None to declare.

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