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PROFITABILITY OF ALTERNATE FARMING SYSTEMS IN DINGAPOTA *HAOR* AREA OF NETROKONA DISTRICT*

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ABSTRACT

The study was conducted at Dingapota *Haor* under Mohongonj Upazila in Netrakona District during April 2011 to March 2012 to examine the profitability of individual farming systems namely crop-livestock-poultry–fishcatching (C-L-P-FC), crop-livestock-fish catching-labour selling (C-L-FC-LS), fish catching–labour selling (FC-LS), crop-livestock (C-L), crop-livestock-fish catching (C-L-FC) and crop-livestock-poultry (C-L-P). A total of 60 farm households under six farming systems were selected that analyzed the level of input used in different enterprises. The results showed that the highest net return of C-L-FC farming system was Tk. 119214 and lowest for C-L-P farming system which was Tk. 25131.The estimated total costs of C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 287959**,** 304430, 62316, 255624, 322654 and Tk. 241354 respectively. Again for C-L-P-FC, C-L-FC-LS, FC-LS and C-L farming systems, the net returns were Tk. 66238, 107578, 74673 and 42967 respectively. Among the farming systems, C-L-FC produced the highest gross margin of Tk. 424859 and C-L-P produced the lowest which was Tk. 266486. The benefit cost ratio of all the farming systems was more than 1 which indicates that all of these were profitable. The gross margin, net return and BCR for C-L-FC farming system was reasonably high and the system earned positive management income indicating that the farming systems were economically viable even under all possible full cost assumptions.

Key Words: Farming systems, Family income, Production

INTRODUCTION

The economy of Bangladesh depends on agriculture which is the principal occupation of the rural people. The Government has identified agriculture and rural development as the topmost priority section for rapid poverty reduction, with about 19.95 percent of GDP contributed by agriculture (crops and vegetables 11.24 percent, livestock and poultry 2.57 percent, fisheries 4.43 percent and forestry 1.71 percent) and another 36 percent by the

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rural non-farm sector. The rural economy as a whole contributes more than 56 percent of total GDP. Agriculture generates 48.4 percent of total employment (BER, 2011), contributes a quarter of total export earnings and provides food security to the increasing population. Bangladesh has made commendable progress in reducing extreme poverty and food insecurity through productivity increase in agriculture and has become self-sufficient in rice through intensification of crop culture with the use of seed-fertilizer-water-pesticide-

*This study is conducted through grants from SPGR, NATP Phase I, Bangladesh Agricultural Research Council, Farmgate, Dhaka and implemented by Bangladesh Agricultural University, Mymensingh. Mechanization of technology at the cost of degradation of soil, depletion of surface and underground water, pollution of farm and non-farm environment, nutrient mining, arsenic and other heavy metal pollution.

However, *haor* is a bowl-shaped depression of typical low land area within the estuarine flood plain of the Surma, Kushiyara, Meghna, Dhenu and Ghorautre rivers. The *haor* of Bangladesh covers the districts of Kishoreganj (eastern part), Netrakona, Sunamganj, Habiganj, Moulabibazar and part of Sylhet and Brahmanbaria (Haor Task Force Report, 2005). The *haor* area is a great natural diversity of Bangladesh and it can play a great role on economic, social and commercial aspects. Farmers of those areas practice different farming systems like crop-cattle-goat-poultry-fish, crop-cattle-buffalo-poultry, cattle-goat-poultry, crop-fish for their livelihood for generating income and ensuring food security of their households. Uddin (2004) reported that integrated farming was recommended to farmers by the Bangladesh government for the purpose of increasing their income, and most of the farmers implemented multiple enterprise management. He also showed that there was a big gap in profit by farm size among integrated farms with a similar pattern of enterprise composition. Farmers were able to provide better observation, proper input of chemicals and manure, and were more closely involved with farming activities in comparison with the large farmers who were dependent on their employees. It had been felt that there is a necessity of studying the profitability of different farming systems of *haor* population of Bangladesh. Therefore, the present study has been undertaken to examine the profitability of alternative farming systems in Dingapota haor of Netrakona district.

MATERIALS AND METHODS

The locations for the present study were selected purposively in Dingapota Haor at Mohangonj Upazila under district of Netrakona where multiple crops, livestock, poultry and fish catching of the different farming systems were practiced. A two stage random sampling procedure was followed in this study. In the first stage, the Upazila namely Mohangonj under Netrakona district was selected purposively for the convenience of the study. Secondly, in the study areas, six dominant farming systems were observed. These were: crop-livestock-poultry-fish catching (C-L-P-FC), crop-livestock-fish catching-labour selling (C-L-FC-LS), fish catching–labour selling (FC-LS), crop-livestock (C-L), crop-livestock-fish catching (C-L-FC) and crop-livestock-poultry (C-L-P). The sample design is shown in Table 1. In order to fulfill the objectives of the study, an interview schedule was carefully prepared to collect necessary information. The period covered in this study was the crops in production period of different farming system. The data related to cost and

return of different farms was collected during January to March 2012 for analysis. After collection of data, each interview schedule was verified for the sake of consistency and completeness. Editing and coding were done before putting the data in the excel programme of computer. The tabular analysis was used mainly based on ratio, averages, percentages, etc. Necessary graphs have also been presented.

Table 1. Study design and distribution of sample farmers

Farming systems (FS)	Sample farm households (%)
Crop-livestock-poultry-fish catching (C-L-P-FC)	14 (23.00)
Crop-livestock-fish catching-labour selling (C-L-FC-LS)	12 (20.00)
Fish catching–labour selling (FC-LS)	11 (18.00)
Crop-livestock (C-L)	10 (17.00)
Crop-livestock-fish catching (C-L-FC)	7 (12.00)
Crop-livestock-poultry (C-L-P)	6 (10.00)
Total farm households	60 (100.00)

Note: Figures within the parentheses indicate percentage of total number of farm households
Source: Field survey, 2012

RESULTS AND DISCUSSION

Costs and returns of rice production under the selected farming systems

The production costs refer to the total amount of funds used in production. In the present study, the total costs per farm per hectare and per farm were worked out. Hence variable and fixed costs were calculated separately. Summation of all the individual costs represents per hectare total costs for production of rice, livestock, poultry, fish catching and labour selling**.**

The variable costs are the costs of using the variable inputs. These costs vary with the level of production produced. Higher the production more will be the variable costs; lower the production, lower will be the variable costs. In the production process various input costs like seed cost, hired human labour cost, cost of fertilizer and manure, irrigation cost, costs of insecticide and pesticide etc. are considered as variable costs.

Cost of fertilizers and manures

For rice production farmers used the following types of fertilizer such as Urea, DAP, MP, Gypsum and Zinc sulphate. It can be seen from Table 2 that the farmers used 440 kg of fertilizers and 2100 kg of cowdung under C-L-P-FC farming system. The highest amount was used by C-L-FC farmers amounted 500kg and 4200 kg, respectively of fertilizers and manures. The estimated costs of fertilizers for rice production were Tk.11000, 11375, 12000, 12500, 11500 under C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively and their corresponding values for manure were Tk. 1050, 1200, 2000, 2100 and 1600 respectively.

Table 2. Per hectare costs and returns of rice production under the selected farming

system

	Farming systems				
	C-L-P-FC	C-L-FC-LS	C-L	C-L-FC	C-L-P
Labour cost					
Family labour	19000	20000	18000	21000	19000
Hired labour	20000	23000	24000	20000	18000
Material cost					
Power tiller	4500	4700	4600	5000	4600
Seedlings	8400	8310	8600	8810	8850
Fertilizer	11000	11375	12000	12500	11500
Manure	1050	1200	2000	2100	1600
Insecticide	2200	2500	2650	2800	3000
Irrigation	10627	10868	10553	10929	11294
Interest on operating cost	2373	2532	2547	2571	2406
A. Total variable cost	79150	84485	84950	85710	80250
Fixed cost					
Land use cost	29300	29300	29300	29300	29300
Depreciation cost	2220	3050	3110	3311	3164
B. Total Fixed Cost	31520	32350	32410	32611	32464
C. Total Cost	110670	116835	117360	118321	112714
Gross return					
Main product	117000	122400	129600	135000	111600
By product (straw and husk)	7100	7500	7200	7600	7400
D. Gross return	124100	129900	136800	142600	119000
E. Gross Margin(D-A)	44950	45415	51850	85710	38750
F. Net Return (D-C)	13429	13064	19439	24278	6285
G. BCR(Undiscounted)	1.12	1.11	1.17	1.20	1.06

Source: Field survey, 2012

Cost of insecticides

Most of the farmers used insecticides because they want to protect their rice from insect and disease attack. They used insecticides like Furadon, Dimecron, Bashudin etc. In the study areas, per hectare insecticides costs were Tk. 2200, 2500, 2650, 2800 and 3000, respectively C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems.

Cost of irrigation

Irrigation water was also another important input for production of rice. In the study areas farmers used irrigation water only for the production of paddy and sometimes for

the pond fish. Per hectare irrigation cost for C-L-P-FC farming system for producing rice was Tk. 10627. However farmers under C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems had to pay Tk. 10868, 10553, 10929 and 11294 respectively for irrigation water for per hectare of rice production in the study areas (Table 2).

Interest on operating cost

Interest on operating cost was estimated on total cost incurred for rice production. An average interest on operating cost were estimated at Tk. 2373, 2532, 2547, 2571 and 2406 per hectare for rice production under C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively.

Depreciation cost

Depreciation cost was estimated on total cost incurred for rice production. An average depreciation cost were estimated at Tk. 2220, 3050, 3110, 3311 and 3164 per hectare for rice production under C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively.

Land use cost

In the study areas, most of the farmers had own land for producing the rice. The seasonal rental cost of land was treated as land use cost for the farmers. Land use cost as a fixed cost for the producers. Table 2 shows that per hectare land use cost amounted to Tk. 29300 for each farming system.

Total cost

In order to estimate the average total cost per hectare, all the resources used in rice production as mentioned earlier have been recaptured together. This analysis revealed that per hectare total cost of production of rice under C-L-FC farming system was the highest and it was Tk. 118321. The C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farmers spent Tk. 110670, 116835, 117360 and 112714 for rice production respectively.

Gross return

Per hectare gross returns were calculated by multiplying the total amount of product with their respective market prices. The Gross return also included the byproduct income also. The gross return per hectare of rice production under the C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 124100, 129900, 136800, 142600 and Tk. 119000 respectively (Table 2).

Gross margin

It is known that gross margin is the differences between total variable cost and gross return. Gross margin per hectare for all the farming systems (C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P) were Tk. 44950, 45415, 51850, 85710 and 38750 respectively.

Net return

Net return is a useful tool to evaluate the business profitability or performance/financial solvency of any kind of agribusiness. It was estimated by deducting total cost from total return. Per hectare net return for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 13429, 13064, 19439, 24278 and 6285 respectively. Net return of rice production under C-L-FC farming system was the highest because small farmers are more efficient.

Benefit cost ratio

Table 2 reveals that benefit cost ratio (undiscounted) of rice production was emerged as 1.12, 1.11, 1.17, 1.20 and 1.06 under C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively implying that Tk. 1.12, 1.11, 1.17, 1.20 and 1.06 would be earned by spending every Tk. 1.00 investing in rice production.

Costs and returns of livestock production under the selected farming systems

In this study cost items like labour cost, feed cost, veterinary cost and artificial insemination cost were included in the study. The farmers under the five(C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P) farming systems had 3 cattle head on an average and their costs and returns are discussed below.

Human labour cost

For the livestock farm (Table 3) the family labour costs were Tk.36090, 31842, 31752, 31752 and Tk.32236 for the C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems, respectively whereas the hired labour costs for these farming systems were Tk. 11600, 12400, 12800, 13400 and Tk. 12200, respectively. Family labour costs were calculated on the basis of opportunity cost as man-days engaged for the livestock enterprise and valued at market labour price.

Feed cost

Feed cost was one of the major cost items for livestock production and rearing. An attempt was made to estimate feed cost for the cows in the research areas during the study period. Cost of feed included expenses on paddy straw, green grass, oil cake, bran molasses and salt. The purchased feed was valued according to the average prices actually paid by the livestock owners. Home supplied or own feeds were also charged according to the average prices prevailing in the market. Feed cost shared a large portion of the total cost for livestock rearing. Most of the cows are cross breed in the study areas mainly. The main cost occurred among the feed was for the wheat and rice bran. The costs of bran for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 21615, 25625, 27616, 33415 and Tk. 23254, respectively. Another important feed was the oil cake. The C-L-P-FC, C-L-FC-LS, C-L and C-L-P farmers paid Tk. 9100, 109395, 10513 and Tk. 9630, respectively for oil cake whereas the C-L-FC farmers paid Tk. 12210 for feed which was the highest compared to other systems.

Table 3. Profitability of livestock production under the selected farming systems

	Farming systems				
	C-L-P-FC	C-L-FC-LS	C-L	C-L-FC	C-L-P
Labour cost					
Family Labour	36090	31842	31752	31752	32236
Hired labour	11600	12400	12800	13400	12200
Feed cost					
Paddy straw	2000	8000	15000	16000	12000
Green grass	5200	7315	7812	7900	6400
Oil cake	9100	10215	10513	12210	9630
Bran	21315	25325	27316	33115	22954
Molasses	6240	6420	7025	7118	6110
Salt	540	620	702	764	604
Artificial insemination cost	300	300	300	300	300
Veterinary cost	300	400	400	400	500
Interest on operating cost	5910	6558	7248	7848	6564
A. Total variable cost	98595	109395	120868	130807	109498
Fixed cost					
Housing cost	3500	3620	3680	5000	3540
Land use cost	7400	7400	7400	7400	7400
Depreciation cost	5518	5820	6316	6216	5513
B. Total Fixed Cost	16418	16840	17396	18616	16453
C. Total cost (A+B)	115013	126235	138264	149423	125951
Gross return					
Cow sold	42000	56000	61600	70000	50400
Calf Sold	30800	30800	30800	30800	30800
Milk	56000	65500	67312	85211	59315
Cowdung	1900	2000	2080	2900	2600
D. Gross return	130700	154300	161792	188911	143115
E. Gross margin (D-A)	34105	44905	40924	58104	33617
F. Net return (D-C)	17686	28064	23528	39488	17163
G.BCR (Undiscounted)	1.14	1.22	1.16	1.26	1.13

Source: Field survey, 2012

Veterinary cost

Veterinary cost was calculated by taking into account the actual cost incurred by the farmers. Doctor's fee and medicine were two major components of the total veterinary

cost. Table 3 shows that the veterinary costs of C-L-FC-LS, C-L and C-L-FC farming systems was same as Tk. 400 over the year and Tk. 300 and Tk. 500 for the C-L-P-FC and C-L-P farming systems respectively.

Artificial insemination cost

The farmers in the study areas used to inseminate their cows at the Upazila artificial insemination center, sub-center and also calling field assistants to the house with extra charge. Thus the artificial insemination cost was varied. On an average the artificial insemination cost for them was same as Tk. 300 (C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P) farming systems.

Interest on operating cost

As mentioned earlier, the interest on operating cost was calculated by using the total variable cost with 12% interest per annum. The interests on operating cost were Tk. 5910, 6558, 7248, 7848 and Tk. 6564 for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming system respectively.

Depreciation cost

As mentioned earlier, the depreciation cost was calculated by using the total cost. The depreciation cost were Tk. 5518, 5820, 6316, 6216 and Tk. 5513 for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming system respectively.

Housing cost

Most of the houses for cows in the study areas were straw made and tin sheds. The cost of housing was calculated by taking into account of average value of animal shed. The housing costs for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 3500, 3620, 3680, 5000 and Tk. 3540 respectively.

Land use cost

The land for the shed was not much more and situated just beside the farmer's house. The land use cost thus included as fixed cost. The land use costs for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively were Tk. 7400 on an average.

Total cost

The total cost is the summation of all kind of variable and fixed costs. Hence the estimated total costs were Tk. 115013, 126235, 138264, 149423 1and Tk. 125951 under C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively.

Gross return

The return from livestock consisted of value of milk, value of cowdung, return from cow and calf sold. The return from milk was calculated on the basis of the average quantities of milk yield and average price received per litre of milk. Returns from cowdung were found out by taking average price at which cowdung was sold in the study areas. From the Table

3, it is presented that the annual return from cow and calf sold were Tk. 42000 and Tk. 30800 for C-L-P-FC farming system Tk. 56000 and Tk. 30800 for C-L-FC-LS farming system, Tk. 61600 and Tk. 30800 for C-L farming system, Tk. 70000 and Tk. 30800 for C-L-FC farming system and Tk. 50400 and Tk. 30800 for C-L-P farming system respectively. The annual milk were Tk. 56000, 65500, 67312.75, 75211.8 and Tk. 59315.2, from C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively and the values of the return from selling cowdung at the market prevailed price were Tk. 1900, 2000, 2080, 2900 and Tk. 2600. The gross returns thus estimated by adding all the values of the, consisted items and the total were Tk. 130700, 154300, 161792, 188911 and Tk. 143115 for the C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively.

Gross margin

The gross margin was estimated at Tk. 34105, 44905, 40924, 58104 and Tk. 33617 for the C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively. The gross margin for C-L-FC farming system was higher than the other farming systems because the farmers of C-L-FC farming system were more careful to the livestock enterprise.

Net return

Net return was determined by deducting gross cost from gross returns. Table 3 indicates that net returns for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems were Tk. 17686, 28064, 23528, 39488 and Tk. 17163, respectively. In case of livestock production, the C-L-FC farming system was more profitable than other farming systems.

Benefit cost ratio

The undiscounted BCR is obtained when the total benefit stream is divided by the total cost. The BCR of the five farming systems were 1.14, 1.22, 1.16, 1.26 and 1.13 which indicated that the investment gave per taka return of Tk. 1.14, 1.22, 1.16, 1.26 and 1.13 for C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P farming systems respectively.

Costs and returns of pond fish production under the selected farming systems

Profit of pond fish production under different farming systems has been estimated on the basis of full cost. Economic returns of fish production under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems, respectively have been measured in terms of net return and undiscounted benefit cost ratio.

Labour use cost

For C-L-P-FC farming system farmers used 70 and 95 man-days from family and hired labour respectively whereas the fish farmers under C-L-FC-LS, FC-LS and C-L-FC farming systems used 75, 75, 70 man-days, for family and 90, 92, 97 man-days, respectively for hired labour. The family labour cost around the year for fish production was Tk. 14000 both for C-L-P-FC and C-L-FC farming systems and Tk. 15000 both for C-L-FC-LS and FC-LS farming systems, respectively. The hired labour cost for fish farmers under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming system was Tk. 17716, 16806, `7266 and Tk. 18380, respectively.

Feed cost

Cost of feed items of producing pond fish is major one. The feed plays a vital role in the fish growth in the pond. In the study areas, the farmers used rice bran, oil cake and different kinds of readymade feed for pond fish production. Table 4 shows that per hectare feed cost of pond fish production were Tk. 8520, 7915, 7800 and Tk. 7500 under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems respectively.

Table 4. Per hectare costs and returns of pond fish production under the selected farming systems

	Farming systems			
	C-L-P-FC	C-L-FC-LS	FC-LS	C-L-FC
Labour cost				
Family labour	14000	15000	15000	14000
Hired labour	17716	16806	17266	18380
Feed	8520	7915	7800	7500
Fertilizer	1830	1759	1680	1550
Lime	810	920	960	1000
Cowdung	1000	960	920	800
Medicine	150	180	185	200
Water supply	1000	800	600	500
Fingerlings	7500	6810	6215	5020
Interest on operating cost	1284	1194	1134	1020
Miscellaneous	620	590	560	440
A. Total variable cost	21430	19934	18920	17010
Fixed Cost				
Land use cost	33300	33300	33300	33300
Depreciation cost	5315	5125	5096	4600
B. Total fixed cost	38615	38425	38396	37900
C. Total cost (A+B)	60045	58359	57316	54910
D. Gross return	72054	93375	103170	93347
E. Gross margin (D-A)	50624	73441	84250	76337
F. Net return (D-C)	33439	54949	64773	55447
G. BCR (Undiscounted)	1.2	1.6	1.8	1.7

Source: Field survey, 2012

Costs of fertilizers, lime and cowdung

In the study areas, farmers used Urea, T.S.P, MP as well as lime and cowdung for the pond preparation and for producing the green plankton as a natural feed for the pond

fishes. The cost of fertilizers, lime and cowdung were computed at the rate of existed market price. The costs of fertilizers for pond fish production under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems were Tk. 1830, 1759, 1680 and Tk. 1550, respectively. Following that order of farming systems, the costs of lime were Tk. 810, 920, 960 and Tk. 1000 respectively. However Tk. 1000, 960, 920 and TK. 800 respectively were spent for cowdung for per hectare of pond fish production.

Cost of water supply

Water supply is very essential for fish production in the dry season. Farmers in the study areas used shallow tube-well for supplying water into their ponds. So water supply cost depends on the size of pond and level of water. Per hectare water supply costs were Tk. 1000, 800, 600 and Tk. 500 under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems respectively.

Fingerling cost

Fingerling cost is important for pond fish production. Cost of fingerlings depends on the price of fingerlings and number of stocking stocked by the fish farmers. Table 4 shows that the costs of fingerlings per were Tk. 7500, 6810, 6215 and Tk. 5020 under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems, respectively of the house with extra charge. Thus the artificial insemination cost was varied. On an average the artificial insemination cost for them (C-L-P-FC, C-L-FC-LS, C-L, C-L-FC and C-L-P) farming systems was same as Tk. 300.

Interest on operating cost

As mentioned earlier, the interest on operating cost was calculated by using the total variable cost with 12% interest per annum. The interests on operating cost were Tk. 1284, 1194, 1134 and Tk. 1020 for C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming system respectively.

Land use cost

Lease value of land (pond) was considered as land use cost. The land use cost was estimated Tk. 33300 for per hectare for C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems respectively.

Total cost

The total costs per hectare of fish production for the farmers of C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems were Tk. 60045, 58359, 57316 and Tk. 54910 respectively.

Gross return

Per hectare gross return was calculated by multiplying the total amount of production by their respective price. The value of fishes was determined by the market price. Per hectare returns were estimated at Tk. 72054, 93375, 103170 and Tk. 93347 under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems respectively.

Gross margin

The gross margin is the value of gross return with deduction from its total variable cost. The gross margin of pond fish production for C-L-P-FC farming system was Tk. 50624.24. On the other hand, the gross margin of C-L-FC-LS, FC-LS and C-L-FC farming system were Tk. 73441, 84250 and Tk. 76337 respectively.

Net return

The net return is the difference between the gross return and the total cost. The net return per hectare of fish production under C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems were Tk. 33439, 54949, 64773 and Tk. 55447 respectively.

Benefit cost ratio

Undiscounted BCR for C-L-P-FC, C-L-FC-LS, FC-LS and C-L-FC farming systems were 1.12, 1.6, 1.8 and 1.7 respectively.

Costs and returns of poultry production under the selected farming systems

The costs and returns were estimated for eight poultry birds in different farming systems and discussed below.

Labour cost

Labour cost was an important cost item for poultry production. Labour was used mainly for feeding, medical care, purchasing and selling etc. in the study areas. As earlier mentioned about the scavenging condition, the family labour was used for the rearing of poultry production. The labour cost thus for farmers under C-L-P-FC and C-L-P farming systems were Tk. 1486 and Tk. 1922 respectively all round the year on an average.

Cost of feed

The cost of feed mainly included the rice bran, broken rice and sometimes the marketed feed. The feed costs were Tk. 300 and 320, respectively under C-L-P-FC and C-L-P farming systems.

Medication cost

Vaccine, medicine and doctor's fees were included in the medication cost. The costs incurred for poultry birds under C-L-P-FC farming system were Tk. 41 whereas, the C-L-P farmers' poultry birds medication cost was Tk. 37 for CLP farming systems.

Interest on operating cost

The interests on operating cost were (as derived from the variable cost and 12% per annum interest rate) Tk. 114 and 78 for C-L-P-FC and C-L-P farming systems respectively.

Depreciation cost

The Depreciation cost was Tk. 169 and 197 for C-L-P-FC and C-L-P farming systems respectively.

Table 5. Profitability of poultry production under the selected farming systems

	Quantity			Price per unit (Tk.)	Total value (Tk.)	
	Unit	C-L-P-FC	C-L-P		C-L-P-FC	C-L-P
Cost items						
Labour cost						
Family labour	Man-days	8	10	200	1486	1922
Hired labour	Man-days	-	-	-	-	-
Feed					300	320
Interest on operating cost					114	78
Rice/rice bran broken	Kg	30	32	10	300	320
Medication	Tk.	-	-	-	41	37
A. Total variable cost		-	-	-	1941	2357
Fixed cost		-	-	-		
Housing cost		-	-	-	120	135
Depreciation cost		-	-	-	169	197
B. Total fixed cost		-	-	-	289	332
C. Total cost (A+B)		-	-	-	2230	2689
Return items						
Meat sold	Kg	2	3	250	500	750
Egg sold	Kg	350	372	9	3150	3348
Inventory change		-	-	-	264	276
D. Total gross return		-	-	-	3914	4371
E. Gross margin (D-A)	Tk.	-	-	-	1973	2014
F. Net return (D-C)	Tk.	-	-	-	1683	1682
G. BCR (Undiscounted)					1.75	1.63

Source: Field survey, 2012

Housing cost

The housing cost in scavenging condition of poultry birds calculated. The housing cost was the highest (Tk. 135) for C-L-P farming system whereas it was lowest (Tk. 120) for the C-L-P-FC farming system.

Total cost

The total costs for the different farming systems are shown in Table 5. The total cost of poultry rearing was Tk. 2230 for C-L-P-FC farming system and that of TK. 2689 for C-L-P farming system.

Gross return

To estimate the gross return from the poultry birds, the selling egg and meat and inventory change were taken into account. The return from the meat sold of poultry birds were Tk. 750 (highest) for C-L-P and Tk. 500 (lowest) for C-L-P-FC farming system. The egg sold returns were estimated as Tk. 3150 and 3348 under C-L-P-FC and C-L-P farming systems respectively. The inventory change is shown in the Table 5. The inventory changes estimated as Tk. 264 for C-L-P-FC farming system whereas the other farming system's returns were about Tk. 276. The gross returns (Table 5) were Tk. 3914 and Tk. 4371 under C-L-P-FC and C-L-P farming systems, respectively.

Net return

The net returns for each farming system are shown in the Table 5. Under the C-L-P-FC and C-L-P farming systems the net returns were Tk. 1683 and 1682 respectively.

Benefit cost ratio

The BCR of the each system shows 1.75 and 1.63, respectively for C-L-P-FC and C-L-P farming systems (Table 5). This farm enterprise was profitable for each farming system.

Table 6. Costs and returns of labour selling under the selected farming systems

	Farming systems	
	C-L-FC-LS	FC-LS
Medicine	1060	2015
Cigarette	500	600
Transportation	850	1535
Miscellaneous	590	850
A. Total cost	3000	5000
B. Gross return	15000	14000
C. Gross margin	12000	12500
D. Net return	11500	9000
E. BCR (Undiscounted)	5.00	2.80

Source: Field survey, 2012

Costs and returns of labour selling under the selected farming system

For every production process cost plays a vital role for making decision of the farmers. The main theme of this section is to calculate costs, returns and profitability of labour selling within poor people of the *haor* areas. Profit of labour selling under different farming systems has been estimated on the basis of full cost. Economic returns of labour selling under C-L-FC-LS and FC-LS farming systems respectively have been measured in terms of net return and undiscounted benefit cost ratio. They costs on medicine, cigarette, transportation etc. of C-L-FC-LS and FC-LS farming systems.

Table 7. Average annual costs and returns of alternate farming systems

Particulars	Total cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)	Net return (Tk.)
C-L-P-FC				
Rice	110670	124100	44950	13429
Livestock	115013	130700	34105	17686
Poultry	2230	3914	1973	1683
Fish catching	60045	72054	50624	33439
Total	287959	330768	131652	66238
C-L-FC-LS				
Rice	116835	129900	45415	13064
Livestock	126235	154300	44905	28064
Fish catching	58359	93375	73441	54949
Labor Selling	3000	15000	12000	11500
Total	304430	392575	175761	107578
FC-LS				
Fish catching	57316	103170	84250	64773
Labor Selling	5000	14000	12500	9000
Total	62316	117170	96750	74673
C-L				
Rice	117360	136800	51850	19439
Livestock	138264	161792	40924	23528
Total	255624	298592	92774	42967
C-L-FC				
Rice	118321	142600	85710	24278
Livestock	149423	188911	58104	39488
Fish catching	54910	93347	76337	55447
Total	322654	424859	220152	119214
C-L-P				
Rice	112714	119000	38750	6285
Livestock	125951	143115	33617	17163
Poultry	2689	4371	2014	1682
Total	241354	266486	74381	25131

Source: Field survey, 2012

Total cost

The total costs of per labour selling for the labour of C-L-FC-LS and FC-LS farming systems were Tk. 3000 and Tk. 5000 respectively.

Gross return

Per labour gross return was calculated by the total amount of labour selling. The value of labour selling was determined by the bargaining. Per labour returns were estimated at Tk. 15000 and Tk. 140000 under C-L-FC-LS and FC-LS farming systems, respectively.

Gross margin

The gross margin is the value of gross return with labour selling. The gross margin of labour selling for C-L-FC-LS farming system was Tk. 12000. On the other hand, the gross margin of FC-LS farming system were Tk. 12500.

Net return and Benefit cost ratio

The net return is the difference between the gross return and the total cost. The net return per labour selling under C-L-FC-LS and FC-LS farming systems were Tk. 11500 and Tk. 9000 respectively. Undiscounted BCR for C-L-FC-LS and FC- farming systems were 5.00 and 2.80 respectively.

Comparative economic return of selected individual farming systems

The preceding analysis showed that there were differences in various cost items and returns among the farming systems under each enterprise. Considering all the farming systems selected, total costs, gross returns, gross margins and net returns are presented here to make comparative study.

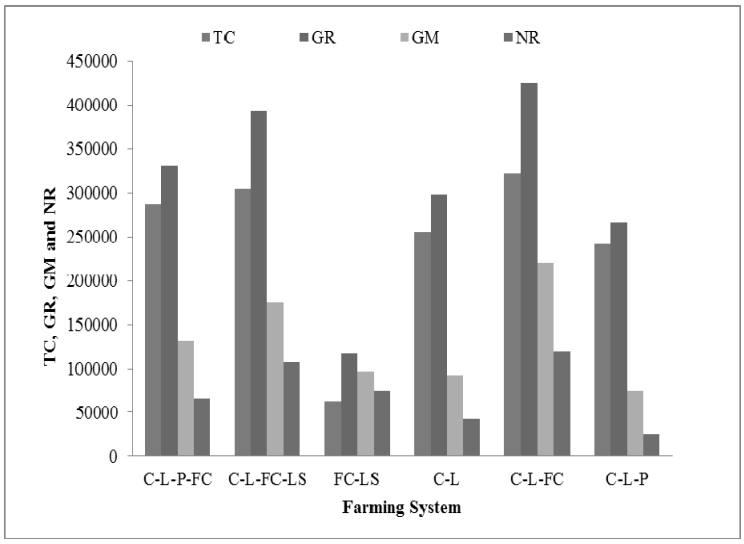

Fig. 1. TC, GR, GM and NR of different farming systems

Table 8 showed that the higher number of enterprises in a farming system had the higher total cost, gross return, gross margin and net return. The numbers of enterprises under C-L-P-FC and C-L-FC-LS farming system was the highest and thus the total cost, gross

return, gross margin and net return were Tk. 287959, 330768, 330768, 66238 and Tk. 304430, 392575, 175761, 107578, respectively. Under C-L-P and C-L-FC farming systems, the number of enterprises were three. However, the difference was that the livestock enterprise included in C-L-P farming system and the fish catching included in C-L-FC farming system. But the total costs, gross return and net returns were not varied much. The lowest number of enterprises was under C-L farming system and the total cost, gross return, gross margin and net return were Tk. 255624, 298592, 92774 and 42967 respectively. The graph 1 shows that the farming systems are profitable.

Table 8. Average total annual costs and returns of individual farming systems

Particulars	Total cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)	Net return (Tk.)
C-L-P-FC	287959	330768	330768	66238
C-L-FC-LS	304430	392575	175761	107578
FC-LS	62316	117170	96750	74673
C-L	255624	298592	92774	42967
C-L-FC	322654	424859	220152	119214
C-L-P	241354	266486	74381	25131

Source: Field survey, 2012

CONCLUSION

It can be concluded from the study that the alternate farming is profitable. Almost all the small farmers in Bangladesh usually practice individual farming including different types of enterprises. Above all, rice is the only crop which is produced by all farmers and occupies about 70 percent of total cropped area in Bangladesh. Other enterprises included in different farming are livestock and poultry rearing and pond fish production. Results of the study showed that enterprises included in alternate farming incurred higher cost and that provided higher return as well as net return per unit of land.

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