Base line survey for farmer livelihood improvement at farming system research and development, Lahirirhat, Rangpur

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ABSTRACT

A base line survey was undertaken to know the existing farming practices of the farmers of Lahirirhat area of Rangpur. Survey covered crop, livestock, fish, homestead, agro forestry systems with data pertaining to 50 farmers from two villages of Chandonpat union. Data refer to the input output details and other socio-economic characteristics of farm households in the crop year 2011-2012. Random sampling technique has been used for collecting data. The result of the baseline survey showed that out of 50 sample farmers; landless (less than 0.02 ha), marginal (0.021–0.2 ha), small (0.21–1 ha), medium (1–3 ha) and large (>3 ha) farmer numbers were 4, 9, 28, 8 and 1, respectively. Four types of major farming systems exist in the Farming System Research and Development (FSRD) site of BARI. Among the four farming systems, the highest number of farmer were under Crop+Livestock+Poultry system followed by Crop+Livestock+Poultry+Fisheries, Crop+Poultry and Crop+Livestock+ Poultry+Agroforestry. Average farm size was the highest under Crop+Livestock+Poultry+Fisheries+Agroforestry system and lowest under Crop+Poultry farming systems. About 87 percent of lands were used under high yielding variety crop whereas only 13 percent land use under local variety. There were 7 major cropping patterns are observed in the site. The main cropping pattern was Boro–Fallow–T. Aman rice followed by Potato–Maize–T. Aman, Potato–Jute–T. Aman, year round vegetable, Potato–Boro rice–T. Aman, Banana and sugarcane. Out of seven cropping patterns, net returns was the highest in banana cultivation (Tk. 159,767 ha^{-1}) followed by Vegetables–Vegetables–Vegetables (Tk. 117,996 ha^{-1}), Potato–Jute–T. Aman (Tk.115,590 ha^{-1}), Potato–Maize–T. Aman (Tk. 10,610 ha^{-1}), Potato–Boro–T. Aman (102,898 ha^{-1}), Sugarcane (Tk 59,036 ha^{-1}) and Boro-Fallow-T. Aman rice (Tk. 31,352 ha^{-1}). Average per farm total net return were from livestock Tk.12,132 and from poultry Tk. 392 for the year 2011–2012. Out of 50 sample farmers, 10 farmers culture fishes in the Farming System Research and Development site. On an average, per farm total gross margin was Tk. 2680 containing telapia Tk. 620, carps Tk.600 and other fish Tk.1460. Income was categorized by crop, livestock, fisheries, poultry, homestead, agro forestry, off farm and non-farm system. In case of landless and marginal farm, non-farm income was higher compared to farm income. Contrary, in case of small, medium and large farm, farm income was higher compared to non-farm income. Farming constraints that were identified include lack of knowledge about new crop variety and technology was the main problems of the farmer followed by high price of inputs, lack of knowledge about fish feed and pond management, lack of quality seeds/fingerlings/duck links, lack of credit facility, lack of knowledge about homestead vegetables production, lack of knowledge about vaccination, deworming, feed of livestock and poultry, insect/pests/weeds and lack of money for buying inputs.

I. Introduction

Bangladesh is one of the most densely populated countries in the world and as a result, per capita arable land is very low. Of the 17 million households in Bangladesh, about 80% are small farmers and some of these farmers are landless (BBS, 2009). Due to its subsistence nature, agriculture in Bangladesh is characterized by diversified farming to meet the household requirements and to minimize the risk and uncertainty. Small farmers try to develop as many enterprises as their farming systems (FS) allow within the present socioeconomic and agro-climatic condition, and in accordance with household goals, preference and resources. In this regard, land topography, soil composition, and availability of different inputs along with the environmental factors which influence the farmers in choosing different enterprises in their farming are considered. Accordingly, the interdependence of resources is usually higher in small farming compared to conventional farming and it also enhances sustainable agriculture which in turn leads to total production and household income (Taj Uddin & Takeya, 2007)

In most developing countries (including Bangladesh), agriculture is the leading source of employment, income, food and nutrition security. Hence, sustainable increase in food production broadly to achieve food self-sufficiency and improve well-being (i.e. reduce poverty) of small scale farmers under continuing rise in population, economic growth, changing food habit, rapid urbanization and severe climate change situation is crucial to economic growth and development. This increase in food production will have to be achieved by using less land, with less water, labor and chemicals (Doss, 2006; IRRI, 1998; Khush, 2001). Dey et al. (2005) mentioned that the technologies have been widely adopted by the neighboring communities in the farming system research sites. Mamun et al. (2011) explored the linkages of components in the farming system to enhance the farm productivity, reduce the environmental degradation, improve the quality of life for poor farmers and to maintain sustainability. In Farming System Research and Development site, the farmers by participating in the research process help in the identification of the research problems as well as take part in testing the possible solution.

Before starting the Farming system research activities, a base line survey was carried out in the year 2011-12 to understand existing crop, variety, cropping pattern, input use, cost of production, socio-economic and agro-climatic situation, problems and potentials affecting the present farming systems. The results of base line survey help to develop appropriate research program for increasing farm productivity and reduce the degradation of environment quality or to develop sustainable land use, which will optimize farm resource, minimum degradation with consideration to regenerative capacity, increase income and employment for farm families and promote quality of life.

II. Materials and Methods

Study area: Selection of the study area is an important step and largely depends upon objectives or purpose of the study. According to Yang (1962) the area in which a farm survey is to be made depends on the particular purpose of the survey and the possible cooperation of the farmers. Two villages under Chandonpat Union were selected from 'Sadar Thana' of Rangpur district near the FSRD of Lahirirat, Rangpur.

Data: The study accounting data of 50 farms were collected from two villages of Chandonpat Union under 'Sadar Thana' of Rangpur for base line survey of farming systems research development project by using Random Sampling Technique method.

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Sample Size: The study accounting data of 50 farms were collected from two villages of Chandonpat Union under 'Sadar Thana' of Rangpur for base line survey of farming systems research development project. At first, a list of all farms from the two represented villages was prepared and then 50 farms of the villages were selected using random sampling technique.

Processing, Analysis and Presentation of Data: After collection of data, each interview schedule was verified for the sake of consistency and completeness. Editing was done before putting the data in the computer. Summarization, careful scrutiny and necessary summary tables have been made from the data. Tabular techniques have been used for analysis, interpretation and presentation of data to fulfill the objectives of the base line survey.

III. Results and Discussion

Age distribution, literacy level and farm category of selected farmers: There is little variation in the age of households of the five categories (Land less, marginal, small, medium and large) of the farmer. In case of farming, age, literacy and farm size have important impact on decision making processes. The younger farmers have more technically efficiency than the older farmers and a younger farmer can easily adopt new technology and thereby increase his efficiency (Battese & Coelli, 1995). The average age of farm marginal (38 years) was the lowest than all other farmers (landless, small, medium and large).

Level of education of the sample farmers have been divided into five groups, illiterate, PSC (Primary school certificate), JSC (junior school certificate), SSC (secondary school certificate), HSC (higher secondary school certificate and above). Among the five levels, highest percentage of the farmers was in PSC level whereas lowest in HSC and Above H.S.C level (Table 01).

Table 01. Average age and educational level of different categories of farmers of Farming System Research and Development site (FSRD)

Farmer category	Age (year)	Educational level (%)				
		Illiterate	PSC	J.S.C	S.S.C	HSC & Above H.S.C
Landless (0.02 ha)	41	25	50	25		-
Marginal (0.021–0.2 ha)	38	11	67	-	22	-
Small (0.21–1 ha)	44	29	32	18	11	11
Medium (1–3 ha)	48	-	12	-	38	50
Large (above 3 ha)	48	-	-	100	-	-

Farm size of the selected farmers: Based on farmer category, sample farmers were in five categories: landless, marginal, small, medium and large. According to extension manual, less than 0.02 hectare of cultivated lands are landless, 0.021 –0.2 ha of cultivated lands are marginal, 0.21–1 ha of cultivated lands are small, 1–3 ha of cultivated lands are medium and above 3 ha of cultivated lands are large farmer. Out of 50 sample farmers, the highest numbers of sample farmer were in small farm category followed by marginal, medium, landless and large. Average farm size for landless, marginal, small, medium and large were 0.02 ha, 0.14 ha, 0.57 ha, 1.37 ha and 3.44 ha, respectively. Again, average family size for landless, marginal, small, medium and large were 4, 4.7, 5.8, 7.3, and 4 numbers, respectively.

Table 02. Average family size and farm size of the sample farmers

Farm Categories	Family size (no.)	Farm size (ha)	Number of sample farmers
Landless (0.02 ha)	4	0.02	4
Marginal (0.021–0.2 ha)	4.7	0.14	9
Small (0.21–1 ha)	5.8	0.57	28
Medium (1–3 ha)	7.3	1.37	8
Large (above 3 ha)	4	3.44	1

Land ownership pattern of different farm categories: At the FSRD site Lahirirhat, Rangpur, three types of land holding systems were observed. These were (i) Rented in and rented out land holding system (ii) leased in and leased out land holding system (iii) mortgage in and mortgage out land holding system. In the 1st system, land holder provide one third of their produces to the owner of the land. In the 2nd system, land holder cultivates a land providing a certain amount of money (non-returnable) to the owner of the land. In the 3rd system, land holder cultivates a land providing a certain amount of money (returnable) to the owner of the land. The formula for computing total cultivated land is own cultivated land +rented in land–rented out land+leased in land–leased out land+mortgage in land–mortgage in land+homestead land. Own cultivated land for marginal, small, medium and large were 0.02 ha, 0.46 ha, 1.46 ha and 3.81 ha, respectively whereas total cultivated land for marginal, small, medium and large were 0.14 ha, 0.57 ha, 1.37 ha and 3.44 ha respectively (Table 03).

Table 03. Land ownership pattern of different farm categories, FSRD site, Lahirirhat, Rangpur, 2012

Farm category	Own cultivated land (ha)	Shared out land (ha)	Shared in land (ha)	Leased out land (ha)	Leased in land (ha)	Mortgage out land (ha)	Mortgage in land (ha)	Homestead area (ha)	Fallow land (ha)	Total cultivated land (ha)
Landless	-	-	-	-	-	-	-	0.02	-	0.02
Marginal	0.09	0	0.01	0.03	0.03	0.02	0.04	0.02	-	0.14
Small	0.46	0.05	0.03	0.02	0.05	0.03	0.1	0.03	.01	0.57
Medium	1.46	0.06	0.01	0.02	0.02	0.1	0.02	0.04	.03	1.37
Large	3.81	0.12		0.05		0.3		0.1		3.44

Total Cultivated land = Own cultivated land+ all in land–all out land

Land and soil type of the sample farmers: There are four land and soil types are found in the study area. High land: This land is high and also cannot hold water during monsoon. Medium high land: This land is relatively lower high than high land and comparatively more fertile than high land. Medium land: The medium land is uniformly flat faced, water holding capacity is higher than high land and medium high land, In the monsoon, normally no water are retains in the land but water can be easily retained by raising "bandh" around the field. Medium low land: This land also uniformly flat faced and water movement can easily be controlled by "bandh". The main characteristic of this land is it stays under 1 or 2 feet water for 2-3 months. Sometimes in rainy season water level of this land can be raised. The highest amounts of land exist under medium high land and sandy loamy soil type (Table 04).

Table 04. Land and soil type of the sample farmers

Land Type	Area (ha)		Soil Type	Area (ha) (irrigated+ non –irrigated)
	Irrigated	Non-irrigated		
High land	7.24	-	Loamy soil	7.59
Medium high land	16.38	-	Sandy soil	3.46
Medium land	6.08	-	Sandy loamy	18.45
Medium low land	1.88	-	Clay loamy	2.08
Lowland	-	-		
Total	31.58		Total	31.58

Major farming systems followed by the sample farmers: Four types of major farming systems exist in the FSRD site. Among the four farming systems, the highest number of farmer were under Crop+Livestock+Poultry system followed by Crop+Livestock+Poultry+Fisheries, Crop+Poultry and Crop+Livestock+Poultry+Agro forestry. On the other hand, average farm size was the highest under Crop+Livestock+Poultry+Fisheries+Agro forestry system and lowest under Crop+Poultry systems (Table 05).

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Table 05. Major farming systems of the sample farmers

Major Farming Systems	Number of households	Average farm size (hectare)
Crop+Livestock+Poultry	28	15.30
Crop+Livestock+Poultry +Fisheries	4	0.96
Crop+Poultry	14	10.43
Crop+Livestock +Poultry+Agro forestry	4	4.39
Total	50	31.58

Major growing crops in the study area: About 87 percent of lands were used under HYV crop variety whereas only 13 land use under local variety. Both HYV and local varieties of crop were used in cause T. aman rice, mustard, potato and vegetables. Out of 59.92 hectare of land under HYV crops area, the highest amount of area under boro rice followed by T. aman rice, potato, maize, sugarcane, banana, jute, wheat, vegetables, pulses and mustard. Per hectare yield of rice of HYV were greater than that of local varieties in all cropping seasons. Average yield of the crops were lower compared to their potential yield due to crop variety and management practices (Table 06).

Table 06. Major crops grown by sample farmers in 2012

Crops		HYV		LOCAL	
		Area (ha)	Yield (t ha^{-1})	Area (ha)	Yield (kg ha^{-1})
Rice	DSR (Aus)	-	-		
	T. Aus	-	-		
	T. Aman	15.66	4.1	4.76	3.43
	Boro	16.31	5.56		
Banana		2.73			
Wheat		2.10	2.91		
Maize		5.13	5.34		
Mustard		0.23	0.96	1.36	0.55
Pulses		0.75	0.65	-	
Potato		9.58	17.29	2.40	11.48
Jute		2.33	1.93		
Sugarcane		2.98			
Vegetables		1.85	8.56	0.54	6.34
Others		0.30	-	0.21	-
Total		59.92		9.27	

Table 07. Sowing and harvesting time of major crops at farming system research and development site, lahirirhat, Rangpur

Crops		Sowing/Planting time Range	Harvesting time Range
Rice	DSR (Aus)	-	
	T. Aus	-	
	T. Aman	July to August	October to November
	Boro	February to March	May to June
Wheat		November to December	April
Maize (Summer)		February to March	May to June
Mustard		November	January to February
Pulses		March	May
Potato		November to December	January to February
Jute		April	July
Sugarcane		November to December	October to November
Vegetables		Rabi, Kharif	Rabi, Kharif
Banana			

Time of sowing and harvesting the major crops: Sowing/Planting time and harvesting time differs in different agrological zones. At FSRD site, Lahirirhat, Rangpur sowing/planting time and harvesting time are shown in the Table (07). In the site, Boro rice transplant February to March due to land types and cropping patterns (Boro Rice– Fallow–T. Aman rice and Boro Rice–Potato–T. Aman rice). Most of the farmer's sown maize after potato harvest (Table 07).

Cropping patterns practiced by the sample farmers: Cropping patterns differs on lands (types of land), farms (marginal, small, medium and large) and AEZ due to climate, soil and farmers attention of crop production. There were 7 major cropping patterns are observed in the site. The main cropping pattern in the site was Boro rice–Fallow–T. Aman rice followed by Potato–Maize–T. Aman, Potato–Jute–T. Aman, Veg–Veg–Veg, Potato–Boro. Rice–T. Aman, Banana and sugarcane. The varieties of the different crops in the site are shown in the Table 08.

Table 08. Major cropping patterns practiced by the farmers

| Acreage (ha) | Cropping patterns and variety in different seasons | | | | | |
| | Kharif-1 | | Kharif-2 | | Robi | |
	Crop	Variety	Crop	Variety	Crop	Variety
Boro Rice- F- T. Aman	-	-	T Aman	BRRIdhan 11, 33, BINA 7, Sarna	Boro. Rice	BRRIdhan 28
Potato–Maize–T. Aman	Maize	NK40	T Aman	BRRIdhan 11, 33	Potato	Cardinal, Granola, local
Potato–Jute–T. Aman	Jute	Local	T. Aman	BRRI dhan 11, Sarna	Potato	Cardinal, Granola, local
Veg–Veg-Veg	Pui, Brinjal	Local	Bitter gourd	local	Bottle gourd, Bean, Cauliflower, Cabbage	Imported
Potato–Boro Rice–T. Aman	Boro Rice	BRRIdhan28	T Aman	BRRIdhan 11, Sarna	Potato	Cardinal, Granola, local
Banana	Banana		Banana		Banana	
Sugar cane	Banana Sugar cane		Sugar cane		Sugar cane	

Per farm input used by the sample farmers: Labour, Seed, Urea, TSP, MP, Zn, Gypsum, Cowdung, Pesticide, Irrigation are the main inputs for crop production. At the FSRD site, T. Aman rice, Boro rice, wheat, maize, mustard, pulses, potato, jute, sugarcane, vegetables and banana are the main cultivated crops. Among the crops, the highest input cost was in the potato followed by banana, sugarcane, boro rice, maize, jute, wheat, pulse and oilseed (Table 09).

Table 09. Average per farm input use for crop production of the sample farmers

| Name of crops | Input use (no. or kg ha⁻¹) | | | | | | | | | | Total input cost (Tk ha⁻¹) | Tillage cost (Tk ha⁻¹) |
	Labor (Male+ Female)	Seed (kg)	Urea (Kg)	TSP (Kg)	MP (Kg)	ZnSO₄ (Kg)	Gyps um (Kg)	Cow dung (Kg)	Pesticide (taka)	Irrigation (Tk.)		
T. Aman	120	35	150	35	35	-	35	-	2000	-	35845	4500
Boro.rice	140	30	200	100	80	3	60	400	5000	9000	59655	4500
Wheat	95	130	180	120	100	-	100	500	-	2800	45100	4000
Maize	110	10	400	-	100	-	-	500	2000	9000	50485	5625
Mustard	60	8	180	120	150	10	75	600	4000	1400	42730	5000
Pulses	90	35	60	120	100	6	60	500	4000	1400	45230	5000
Potato	210	2000	300	220	260	18	90	800	9000	4600	124560	6000
Jute	140	6	100	120	100	10	60	500	-	-	46500	4500
Sugarcane	250	1560	160	150	120	12	70	10000	4800	5500	71700	5000
Vegetables	210	-	180	160	130	10	120	10000	6000	5400	65000	5210
Banana	260	-	280	230	210	12	160	10000	5400	4800	86000	5600

Per farm homestead vegetable production and disposal: Homestead vegetables production increases of consumption of vegetables per person per family. There are six to ten production units (Open sunny places, roofs, trellis, fences, marshy areas, slightly marshy areas, back yard, etc.) in the

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homestead area. Among the sample farmers, average per farm vegetables production was 9 kilogram in summer season whereas it was 21 kilogram in winter season. The sample farmers consumed most of the vegetables.

Table 10. Average per farm homestead vegetables production and disposal pattern

Crop season	Vegetables produced (kg)	Vegetables consumed (kg)	Vegetables distributed to others (kg)	Vegetables sold (kg)	Market price at harvest (Tk.kg-1)
Summer vegetables					
Puisak	5	4	1	-	10
Lalsak	4	4	-	-	10
Total	9	9	1		
Winter vegetables					
Napasak	6	5			10
Lausak	4	3	1		10
Radish	4	4	1		10
Bean	3	3			10
Bottle gourd	4	4			10
Total	21	21			

Per farm fruit production and disposal: On an average, there are two or three fruit trees exist in the most of the homestead area of the FSRD site. These are mango, jackfruit, banana, papaya, litchi, and guava. Average per farm mango, jackfruit, banana, papaya, litchi, and guava were 6 kg, 50 kg, 20 kg, 3 kg, 1 kg and 5 kg, respectively. The farmers consumed most their produces (Table 11) and distributed a smaller amount.

Table 11. Average per farm homestead fruit production and disposal pattern

Name of fruits	Total fruits produced (no./kg)	Fruits consumed (no./kg)	Fruits distributed to others (no./ kg)	Market price of fruit at harvest (Tk.piece-1 kg-1)	Total value of fruits (Tk.)
Mango	6	5	1	40	240
Jackfruit	50	40	10	30	1500
Banana	20	18	2	20	400
Papaya	3	3	-	15	45
Litchi	1	1	-	80	80
Guava	5	4	1	20	100

Management practices of field crops by the sample farmers: The agronomic management include variety selection, seed rate, seeding date, transplanting date application of fertilizer, organic matter, weed control, water management, application of pesticide and time of harvesting. Cultivated crops at the FSRD site were Taman rice, boro rice, wheat, maize, jute, sugarcane, potato, mustard, banana, mungbean and vegetables. Agronomic managements of the cultivated crops have been described in the Table 12.

Sources of inputs used by sample farmers
Sources of inputs used by sample farmers described in the Table 13. On an average, 26 percent farmers used their own seed, 47 percent farmer from market, 5 percent farmer from BADC, 5 percent farmer from NGO and 17 percent farmer from other farmer. All fertilizer and pesticide source were in the market. . On an average, 64 percent farmers used own organic fertilizer and 36 percent farmer from other. Similar sources were found in cause of mechanical power and labour.

Table 13. Sources of inputs used by sample farmers

Inputs	% input used from				
	Own	Market (with brand name if there is)	BADC	Other	NGO
Seeds/ Seedlings	26	47	5	17	5
Fertilizers		100			
Pesticides		100			
Organic fertilizers /Farm Yard Manure	64			36	
Mechanical power	5			95	
Labour	44			56	

Per farm cost and return of livestock and poultry: Average per farm cost and return of livestock and poultry enterprise of the sample farmers have been described in the Table 14. In cause of livestock, on an average per farm bullock, calf, cow and goat were 0.74, 0.94, 1.20 and 1.09 numbers, respectively. Again, net return of the bullock, calf, cow and goat were Tk. 3724, Tk. 4475, Tk. 3861 and Tk. 773, respectively. Similarly, on an average, per farm net return for chicken, duck, hen and pigeon were Tk.152, Tk.40, Tk.130 and Tk.70, respectively. On an average per farm total net return were from livestock Tk.12132 and from poultry Tk. 392 for the year 2011 - 2012.

Table 14. Average per farm cost and return of livestock and poultry enterprise of the sample farmers for the year 2011 – 2012

	Average Number (present)	Original value (Tk.) 1	Feed & medicine Cost (Tk.) 2	Present value (Tk.) 3	Total cost (Tk.) 1+2=4	Net Return (Tk.) 4-3
Livestock						
Bullock	0.74	8043	2889	14656	10932	3724
Calf	0.94	1495	1561	7531	3056	4475
Cow	1.20	15200	3723	22784	18923	3861
Goat	1.09	1226	209	2208	1435	773
Total		25964	8382	47179	34346	12833
Poultry						
Chicken	4.52	152		740	152	152
Duck	0.3	40		80	40	40
Hen	1.2	130		250	130	130
Pigeon	0.45	70		100	70	70
Total		392		1170	392	392

Per farm cost and return of fish culture: Per farm cost and return of fish culture of the sample farmers for the year 2011–2012 have been described in the Table 15. Out of 50 sample farmers, 10 farmers culture fishes in the FSRD site. On an average, per farm total gross margin was Tk. 2680 containing telapia Tk. 620, carps Tk. 600 and other fish Tk. 1460.

Table 15. Per farm cost and return of fish culture of the sample farmers for the year 2011- 2012

Name of fish	Number of fishes	Area (decimal)	Production (kg)	Production cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)
Tilapia	20	2	15	880	1500	620
Carps	10	4	8	200	800	600
Other	25	5	20	540	2000	1460
Total	55	11	43	1620	4300	2680

Farm gate price of fish 100 (Tk. kg^{-1})

Per farm credit received and purpose of credit: The farmers of Bangladesh have not always solvency to purchase the inputs for crop cultivation. So, sometimes they receive credit from local

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somity, NGO (Asha, BRAC etc), bank (Krishi Bank, Gramen Bank, etc), money lenders and others (relatives, friends, etc) for household service and crop cultivation. Average per farm credit received and purpose of their credit have been presented in the Table 16.

Table 16. Average per farm credit received and purpose of their credit

Name of Organizations	Amount of Credit (Tk.)	Purpose of Credit
Local Somity	500	Household service
NGO (Asha, BRAC)	1040	Crop Cultivation
Bank (Krishi Bank, Gramen Bank)	2155	Crop Cultivation
Money lenders	1030	Household service
Others	560	Household service
Total	5285	

Cost and return of major cropping patterns: Seven existing cropping patterns were observed in the FSRD site lahirirhat, Rangpur. Total cost, gross return, net return and BCR have been shown in the Table 17. Out of seven cropping patterns, net returns was the highest in banana cultivation (Tk.159767 ha^{-1}) followed by Vegetables–Vegetables–Vegetables (Tk.117996 ha^{-1}), Potato–Jute–T.aman (Tk.115590 ha^{-1}), Potato–Maize–T. Aman (Tk.106610 ha^{-1}), Potato–Boro rice–T.aman (Tk.102898 ha^{-1}), Sugarcane (Tk.59036 ha^{-1}) and Boro Rice-Fallow-T. Aman (Tk. 31352 ha^{-1}).

Table 17. Cost and return of major existing cropping patterns at FSRD site, Lahirirhat, Rangpur 2012

Cropping Patterns	Total cost (Tk. ha^{-1})	Gross Return (Tk. ha^{-1})	Net Return (Tk. ha^{-1})	BCR
Boro Rice-Fallow- T. Aman	110508	141860	31352	1.28
Potato –Maize – T. Aman	240270	346880	106610	1.44
Potato – Jute –T.Aman	227249	342839	115590	1.51
Vegetables –Vegetables – Vegetables	210513	328509	117996	1.56
Potato –Boro Rice –T. Aman	257145	360043	102898	1..40
Banana	124814	284581	159767	2.28
Sugarcane	113325	172361	59036	1.52

Per household livestock and poultry assets: Livestock is generally classified by countries by genera, sub-divided in a few cases by species. Generally, Cattle, buffaloes, camels, sheep, goats are the livestock species. More frequently, individuals of various genera or families are being aggregated into a single group, e.g., the term "poultry" covers domestic fowls, guinea fowl, ducks, geese and turkeys. Average per household livestock and poultry assets (no.) under different categories of farm of sample farmers have been shown in the Table 18.

Table 18. Average per household livestock and poultry assets (no.) of sample farmers

Assets	Landless	Marginal	Small	Medium	Large	Average
Bullock	0.25	0.89	1.06	1.15	0.80	0.74
Cow	0.25	0.78	1.32	1.75	1.00	1.20
Calf	1.00	0.75	0.93	1.00	1.00	0.94
Goat	2.00	1.11	1.25	1.63	0.00	1.09
Chicken	2.25	6.22	5.42	3.25	3.00	4.52
Duck	0.75	0.12	0.15	0.63	0.00	0.3
Hen	3.75	0.33	2.29	0.05	0.06	1.2
Pigeon	0.00	2.33	0.00	0.63	0.00	0.45

Per farm income of the sample farmers: The amount of money or its equivalent received during a period of time in exchange for labor or services, from the sale of goods or property, or as profit from financial investments. Average per farm income (Tk.) of the sample farmers in the year 2011–2012 have been shown in the Table 19. The items of income were categorized by crop, livestock, fisheries,

poultry, homestead, agro forestry, off farm and nonfarm. In cause of landless and marginal farm, non-farm income was higher compared to farm income. Contrary, in cause of small, medium and large farm, farm income was higher compared to non-farm income.

Table 19. Average per farm income (Tk.) of the sample farmers in the year 2011 - 2012

Item	Landless	Marginal	Small	Medium	Large
Crop	560	5125	20340	27340	84098
Livestock	3452	6436	7563	6576	8674
Fisheries	0	540	2460	4420	8659
Poultry	180	210	430	830	562
Homestead	109	210	340	510	320
Agro-Foresty	0	0	320	540	2105
Total Farm	4301	12521	31453	40216	104418
Off-farm	30273	28628	0	0	0
Non-farm	11600	12727	23696	20479	3707
Total	46174	53876	55149	61564	108125

Per farm expenditure of the sample farmers: Payment of cash for goods or services against available funds in settlement of an obligation as evidenced by receipt, voucher or other such document is called expenditure. Mainly food, cloth, shelter, education, medicine, etc are the expenditure of farm household. Average per farm expenditure (Tk.) of the sample farmers have been shown in the Table 20. All the items of expenditure were the highest in the large farmer followed by medium, small, marginal and landless.

Table 20. Average per farm expenditure (Tk.) of the sample farmers

Item	Landless	Marginal	Small	Medium	Large
Food	35100	35895	35279	56055	62235
Cloth	1800	3430	3119	1665	4388
Shelter	780	1183	1376	1110	1890
Education	0	4250	5018	3996	3375
Medicine	1500	2537	1494	1858	2700
Others	5460	4951	8281	333	7391
Total	44640	52246	54567	65017	81979

Services from different organizations: There were four types of services observed in the FSRD site, viz, suggestions about crop production, pest, diseases, etc, suggestions about New Technology, credit for crop production, credit for crop production and credit for crop production & suggestions (Table 21). These services were provided by Department of Agricultural Extension, Research Institutes (NARS), Bangladesh Krishi Bank and other Bank and Non-Government Organizations (NGO), respectively. In the FSRD site, highest service was provided by Department of Agricultural Extension and the lowest service was by Non-Government Organizations.

Table 21. Services provided by different organizations

Name of services	Service provider (name)	Farmers
Suggestions about crop production, input, pest, diseases, etc	Department of Agricultural Extension	20
Suggestions about New Technology	Research Institute (NARS)	22
Credit for crop production	Bangladesh Krishi Bank and other Bank	10
Credit for crop production & suggestions	Non-Government Organizations (NGO's)	4

Problem faced by the farmers: There are many problems for crop production in the study area. Out of the problems, 9 problems have been described in the Tables 22. Farmers were asked about the problems and they answered more than 5 problems. These problems summarized and showed in the

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Table 22. They showed Lack of knowledge about new crop variety/technology was the main problems of the farmer followed by high price of inputs, lack of knowledge about fish feed and pond management, lack of quality seeds/fingerlings/duck links, lack of credit facility, lack of knowledge about homestead vegetables production, lack of knowledge about vaccination, de worming, feed of livestock and poultry, Infestation of insect/pests/weeds and lack of cash money for buying inputs.

Table 22. Problems faced by the farmers in the study areas

Problems	% farmers	Solution(s)
Lack of knowledge about new crop variety/technology	85	Demonstration, Training, Field day
Lack of quality seeds / fingerlings / duck links	75	Education, Information/ Training
Lack of cash money for buying inputs	62	Easy credit system
Lack of knowledge about fish feed and pond management	82	Demonstration, Training, Field day
Lack of knowledge about vaccination, de worming, feed of livestock and poultry	65	Demonstration, Training
Lack of credit facility	75	Easy credit system
Lack of knowledge about homestead vegetables production	70	Demonstration, Training, Field day
High price of inputs	80	Increase subsidy in agricultural inputs
Infestation of insect/pests/weeds	65	Increase knowledge by training

IV. Conclusion

In a country like Bangladesh where land is scarce, effort should be taken to increase production through integration of various production subsystems in agriculture for efficient utilization of resources. It would maximize production of diversified products from a minimum area which will increase the income of the farmers and would enhance food production. In the conclusion it can be said that the integrated farming system is not only technically feasible but also economically viable in Bangladesh. Extensive efforts should be made to transfer this technology among the farmers.

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Chicago/Turabian

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Table 12. Agronomic management practices of different field crops of the sample farmers

Factors	T. Aman Local	T. Aman HYV	Boro HYV	Wheat	Maize (Summer)	Jute	Sugarcane	Potato	Mustard	Banana	Pulses (mung)	Vegetables (Summer)	Vegetables (winter)
Variety	BR 11 Sarna	BRRIdhan 28, Hybrid	BARI Gom-24	Hybrid	Indian /tosa	Isd 16, Isd 18	Cardinal, diamant, Granola, Silbilati	Tori- 7	Sagor	Bari mung	HYV, local	HYV, Hybrid
Seed rate(kg ha^{-1})	25 30 Kg/ha	25 30 Kg/ha	40 -50	20	6-8		1.5 -2	8-9	5000-5500	Feb-Mar	-	-
Seeding date Transplanting date	June July	Dec-Jan Feb-Mar	Nov -Dec -	Feb- Mar -	April -	Feb -Mar -	Nov -Dec -	Nov -	Sep -Oct -	25-30 -	Fe-Ma May-Apr	Oct -Nov -
Urea (kg ha^{-1})	200	200-250	200-250	300	40-50		300-350	100-150	400-500	70-80		
TSP (kg ha^{-1})	40	40-50	30-40	60 -70	-		200-250	30-40	100-150	-		
MP (kg ha^{-1})	-	40-50	20-40	40-50	-		250-300	30-40	100-150	-		
Cow dung (kg ha^{-1})	-	-	4 -6	4-6	-		5-8	4-6	6-8			
Weeding (no.)	2	3	1	2-3	2-3		1	1-2	2-3	1-2		
Irrigation (no.)	-	12-15	2-3	5-6	-		3-4	1-2	4-5	1		
Insecticide application (no.)	1/2	2	-	-	-		6-8	1-2	4-5	1		
Harvesting date	Nov-Dec	May-June	April	May- June	June-July		Feb- Mar	Jan	Jul -Aug	May		Nov-May

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