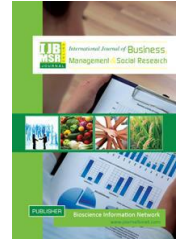


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Baseline survey for farm productivity improvement through agricultural technologies in Charland of Mymensingh

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ABSTRACT

The base line survey was conducted at Sadar upazila of Mymensingh district, to know the existing farming system of the farmers during the crop year 2017-18. The survey was conducted to documented information regarding farmers homestead, crop, traditional agriculture technologies, socioeconomic, livelihood information, problems and potentials affecting the present farming systems with data pertaining to 60 farmers from two villages of Char Sirta union. Random sampling technique administrated by the researchers for collecting information from the selected farm households with the help of a predesigned questionnaire. After collection of data, each interview scheduler was verified for the sake of consistency and completeness. Summarization, careful scrutiny and necessary summery 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. The result of the baseline survey showed that out of 60 sample farmer's landless (less than 0.02ha), marginal (0.021-0.2ha), small (0.21-1 ha), medium(1-3ha) and large (>3ha) farmer numbers were 5, 14, 27, 11 and 3, respectively. Five types of major farming systems exist in the Farming System Research and Development (FSRD) site of BARI. Among the five farming systems, the highest number of farmers practiced Crop +livestock +poultry + agro forestry + homestead production system followed by Crop + Livestock+ poultry + homestead system. About 91% of lands were used under HYV crop variety whereas only 9% land use under local variety. In the site, only HYV rice varieties were used during Boro season whereas in T.aman season both HYV and local varieties were used. There were four major cropping patterns in the study area. The main cropping pattern was Fallow- Boro-T. aman rice followed by Potato-Boro-T.aman and year round vegetable. Out of 60 sample farmers, 16 farmers followed culture fishes in the FSRD site where on an average, fish production 269.33 kg/farm/year. The farmers of the area follow polyculture for fish production. Main source of income of the farmers of the selected area were from crop, livestock, fisheries and others non-farm activities (business, service rickshaw pulling, van pulling and day labor etc.). In case of landless and marginal farm, non-farm income (others) was higher compared to farm income. Contrary, it was observed that small, medium and large farm income from farm was higher compared to non-farm activities (business & others). 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.

Key Words: *Baseline, sample size, methodology, intervention, homestead and management*

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I. Introduction

Bangladesh is predominantly an agrarian country. Due to its very fertile land and favorable weather, varieties of crop grow abundantly in this country. Agriculture sector contributes about 15 percent to the country's Gross Domestic Product (GDP) and employs around 41 percent of total labour force (BBS, 2017). The agricultural and rural sector in Bangladesh has a particular importance for the sustained food and livelihood security of its large, dense and ever-growing population. The agricultural activities in the country are pursued intensively for the crop as well as allied sectors and in conditions of scarce natural resources. The performance of this sector has a great impact on macro-economic situation like employment generation, poverty alleviation, food security and nutritional attainment etc. Resource-poor farmers comprise the bulk of the farming community in Bangladesh. GDP growth rate of Bangladesh mainly depends on the performance of the agriculture sector. Due to natural calamities like flood cyclone, drought, loss of production in both food and cash crops are almost a regular phenomenon. Yet in recent years, there has been a substantial increase in food grain production. Agricultural holding in Bangladesh is generally small but use of modern machinery and equipment is gradually increasing. Rice, jute, sugarcane, potato, pulses, wheat, tea and tobacco are the principal crops of Bangladesh. Crop diversification programme, credit supply, extension work, research and input distribution policies pursued by the government are yielding positive results. The country is now on the threshold of attaining self-sufficiency in food grain production. About 17 million households in Bangladesh, marginal and small farmers (holding 0.5 to 0.49 and 0.50 to 2.49 acre, respectively) jointly with landless households make up more than 70 % of the farm families (BBS, 2017). With ever-increasing population and disintegration of land, small farmers are becoming marginal. Over the last some decades agricultural research has emphasized the needs of farmers with inadequate resource support. Farming in Bangladesh is primarily of survival level. Farmers produce diversified products to meet their home consumption, necessities and other household needs. Most farms raise field crops, homestead vegetables and trees, livestock, poultry and intermittently fish. Off-farm and non-farm activities are pursued to extra cash requirements. Rigorous use of land and the exchanges of multiple farm components and activities make the farming systems of Bangladesh highly multifarious. 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 and Takeya, 2007)

According to the "National Conservation Strategy Papers" charlands are mostly distributed in 11 districts of Bangladesh covering a land area of about 0.82 million hectares. The modern agricultural technologies are not properly disseminated in the char land due to scattered, isolated and disconnected transport network. A large number of people stay in the chars taking high risk of natural vulnerability. According to the 7th Five Year Plans and SDGs, poverty alleviation, end hunger, achieve food security and improved nutrition and promote sustainable agriculture is the new challenge for researchers, extensionists and farmers. Considering the complex factors the char dwellers often could not choice the best farming practices to be followed in their lands. As a result their income becomes lower. From the activities of some projects and NGOs it is clearly understood that, integrated farming approach is one of the best way for income generation of char dwellers. Hence, sustainable increase in food production broadly to achieve food self-sufficiency and reduce poverty of the farmers in char land

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). 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 and 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 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 know the present status of different farm enterprises, explore the constraints to implement and opportunities for further expansion and 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

Location of the Study area: Mymensingh is one of the districts of Mymensingh division, Bangladesh, Mymensingh town is the district headquarters. Mymensingh Sadar upazila is located at 24.7500°N to 90.4167°E. It has 104567 units of household and its total area is 388.45 km². The River Brahmaputra just crosses the section of Mymensingh. A hundred plus years ago the river was wided 5-10 km and now it is a seasonal flow, not an ever-flowing river. A huge land recovered from this riverbed for a hundred years as named 'CHARS' is a big part of Mymensingh and as it was riverine land regular seasonal flood water namely from the GARO hills of Meghalaya of India flashes up to these CHAR's. Mymensingh Sadar had a population of 775733. Males constituted 50.43% of the population and females 49.57%. Muslims formed 93.83% of the population, Hindus 5.96%, Christians 0.17% and others 0.04%. Mymensingh Sadar had a literacy rate of 51.74% for the population 7 years and above. The temperature ranges from 12 to 33 °C, and the annual rainfall averages 2,174 mm. The soil composition is mainly sandy to clay loam in texture.



Figure 01. Map of Mymensingh district

Selection of the Study Area: The study area selection is a vital footstep which depend on objectives of the survey. According to Yang (1962) the area of a survey depends on the meticulous purpose of the survey and the probable collaboration of the farmers. In FSRD site, Char Kharicha, Mymensingh, two villages were selected under Sirta union from Sadar Upazila of Mymensingh district.

Data: The study accounting data of 60 farms were collected from two villages of Char Sirta Union under Sadar Upazila of Mymensingh for base line survey of farming systems research and development project by using Random Sampling Technique method. The data were collected through farmers' interview by structured questionnaire.

Sample Size: At first, a list of all farms of the villages named Char Kharicha and Char Anandipur were prepared and then four categories 60 farms were selected by using random sampling technique. The study accounting data of 60 farms were collected for baseline survey of farming systems research and development project for farmer's livelihood improvement in char land eco-system.

Processing, Analysis and Presentation of Data: Each interview schedule confirmed its consistency and completeness after collection of data. Editing was done before putting the data in the computer. Necessary summery tables have been made after analysis and summarization of the data. Tabular techniques have been used for analysis, interpretation and presentation of data to fulfill the objectives of the survey.

III. Results and Discussion

Farm size and family size of the selected farmers

Based on farm category, sample farmers were grouped into five categories viz. landless, marginal, small, medium and large. According to agricultural extension manual, the farmer those who have less than 0.02 hectare of cultivable land are belongs to landless, cultivable land is 0.021 to 0.2 hectare grouped as marginal farmer, the farmer who possesses 0.21 to 1.0 hectare of cultivable land are categorized as small farmer, while 1.01 to 3.0 hectare of cultivable lands are medium and those who are cultivating more than 3.0 hectare of land are large farmer. Out of sixty farmer's average farm size ranged from 0.02 to 3.78 hectare. Average farm size for landless, marginal, small, medium and large were 0.02 ha, 0.17 ha, 0.93 ha, 1.85 ha and 3.78 ha, respectively. Again, average family size for landless, marginal, small, medium and large were 4.25, 5.00, 4.75, 7.50 and 6.23 members, respectively (Table 01).

Table 01. Average family and farm size of the sample farmers according to farm categories of Farming Systems Research and Development site (FSRD), Mymensingh during 2017-18

Farm Categories	Farm size (ha)	Family size (no)	Number of sample farmers
Landless (0.02 ha)	0.02	4.25	05
Marginal (0.021-0.2 ha)	0.17	5.00	14
Small (0.21-1 ha)	0.93	4.75	27
Medium (1-3 ha)	1.70	7.5	11
Large (above 3 ha)	3.78	6.23	03

Literacy level of selected farmers

The level of education of the sample farmers have been divided into five groups, illiterate, PECE (Primary Education Completion Examination), JSC (Junior School Certificate), SSC (Secondary School Certificate), HSC (Higher Secondary Certificate and above). On an average 17 % sample farmers were illiterate and rest 83 % was literate which was quite higher than national average. Among the five levels highest percent of the farmers was in PECE level whereas lowest in HSC and Above H.S.C level (Table 02).

Age distribution 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. Most of the respondents (45%) belonged to age group 30-60 years. The average age of the sample farmers was 44 years in all groups (Table 03). However, the aged person (47 Years) belonged to landless category farm size while small and medium farmers are younger in age (41 Years). In case of farming, age, literacy and farm size have might put important impact in decision making. The younger farmers are more technically efficient and can easily adopt new technology and thereby increase his efficiency and income than those of older ones (Battese and Coelli, 1995).

Table 02. Educational level of different categories of farmers of Farming System Research and Development site (FSRD), Mymensingh during 2017-18

Farmer category	Educational level (%)				
	Illiterate	PECE	JSC	SSC	HSC & above HSC
Landless (0.02 ha)	40	35	25	-	-
Marginal (0.021-0.2 ha)	25	50	24	1	-
Small (0.21-1 ha)	20	41	16	13	10
Medium (1-3 ha)	0	10	35	24	31
Large (above 3 ha)	0	12	32	29	27

Table 03. Average age level of different categories of farmers at FSRD site, Mymensingh during 2017-18

Farmer category	Average age (Years)	Age group (Years)			
		Below 30	30-60	Above 60	All farmers
Landless (0.02 ha)	47	3 (60)	1 (20)	1(25)	5 (100)
Marginal (0.021-0.2 ha)	45	6 (43)	5 (36)	3(21)	14 (100)
Small (0.21-1 ha)	40	3 (27)	6 (55)	2(18)	11 (100)
Medium (1-3 ha)	42	10 (37)	13 (48)	4(15)	27 (100)
Large (above 3 ha)	46	1 (33)	2 (67)	-	3(100)
All farmers	44	23 (38)	27 (45)	10 (17)	60 (100)

Figures in the parenthesis indicate percentage (%) of the total

Main occupation of selected farmers

Main occupation of all categories of farmers is agriculture. However, the secondary occupation varied among the farmers. About 75% of the respondents at marginal level had secondary occupation like business (25%) and rickshaw/van puller (50%). On the other hand, 25 % of the respondents of small farmers had secondary occupation like business (Table 04).

Table 04. Occupational status of the sample farmers of different categories farm at FSRD site, Mymensingh

Occupation	Farmers category			All farmers
	Marginal	Small	Medium	
Main occupation				
Agriculture	4 (100)	4 (100)	4 (100)	12 (100)
Day labor	-	-	-	-
Govt. service	-	-	-	-
Secondary occupation				
Private service	-	-	-	-
Teaching	-	-	-	-
Business	1(25)	1(25)	-	2(17)
House keeping	-	-	-	-
Driver	-	-	-	-
Rickshaw/Van puller	2 (50)	-	-	2(17)
All farmers	3 (75)	1(25)	-	4 (34)

Household and Farm Assets information

Farmers of the FSRD site, Mymensingh possesses a very few household and farm assets. Among twelve farm families had more than two electric fan (2.75), table (2.25), khat (2.75) and mobile phone (2.58) while more than four chair (4.75). Sewing machine, radio-television and freeze belonging to farmer are in one. For crop production 2-wheeler tractor and accessories, insecticide/pesticide sprayers are possessed by one farmer whereas water pump and tube well belonging to farmers are more than one (1.33 and 1.0). On an average every farmer had a cattle shed (Table 05).

Land Ownership pattern

At the FSRD site, Mymensingh three types of land holding systems were observed. These were (i) Rented in and rented out (ii) leased in and leased out (iii) mortgage in and mortgage out land holding system. Rented in and rented out system land holder provide one third of their produces to the owner

of the land. Leased in and leased out system land holder cultivates the land providing a certain amount of money (non returnable) to the owner of the land. Mortgage in and mortgage out system, land holder cultivates the 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 + all in land– all out land. Own cultivated land for marginal, small, medium and large farmers were 0.11, 0.78 1.65 and 4.24 ha, respectively whereas total cultivated land for marginal, small, medium and large were 0.17, 0.93, 1.70 and 3.78ha, respectively (Table 06).

Table 05. Household and Farm assets of sample farmers at FSRD site, Mymensingh during 2017-18

Household assets	Number	Farm asset	Number
Sewing machine	0.17	2-wheel Tractor and accessories	0.42
Radio TV	0.33	4-wheel Tractor and accessories	-
Freeze	0.75	Insecticide/pesticide sprayers	0.67
Fan	2.75	Water pump	1.33
Table	2.25	Tube well/Agro well	1.0
Chair	4.75	Poultry shed	0.08
Khat	2.75	Cattle shed	1.0
Phone (mobile or land line)	2.58		
Bicycle	0.33		
Three wheeler/Rickshaw/Van	0.25		

Table 06. Land ownership pattern of different farm categories at FSRD site, Mymensingh during 2017-18

Farm category	Own cultivated land (ha)	Leased out land (ha)	Leased in land (ha)	Mortgage out land (ha)	Mortgage in land (ha)	Rent out land (ha)	Rent in land (ha)	Homestead area (ha)	Total cultivated land (ha)
Landless	-	-	-	-	-	-	-	0.02	0.02
Marginal	0.11	-	-	-	0.02	-	-	0.04	0.17
Small	0.78	-	0.06	0.02	0	0	0.03	0.08	0.93
Medium	1.65	0.02	0.12	-	0.10	0.25	-	0.10	1.70
large	4.24	0.06	-	0.41	-	0.11	-	0.12	3.78

Total cultivated land=Own cultivated land+ all in land-all out land

Land and soil type of the sample farmers

There are five land type and four 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 and low land: This land also uniformly flat faced and water movement can easily be controlled by “bandh”. The main characteristic of these land are 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 loamy to clay soil type (Table 07).

Major farming systems followed by the sample farmers

There are five types of farming systems exist in the farming system research and development site. Among the five farming systems, the highest number of farmers (40%) possessed the crop, livestock, poultry, agro forestry and homestead farming system. On the other hand, 33 % farmers were under in crop, livestock, poultry and homestead farming (Table 08).

Major crops growing in rabi season

In rabi season, about 91% of lands were used under HYV crop variety whereas only 9% land use under local variety. Out of 51.40 hectare of land under HYV crops area, the highest area under boro rice followed by potato, vegetable and chilli. In boro rice only high yielding variety was cultivated by the farmer in the study area. The average yield of boro rice was 6.07 t/ha and coverage was 33.71 hectare of land. In potato and other vegetable both the HYV and local varieties were cultivated by the farmers.

In case of spice crops, farmers were usually practiced local varieties and they have got lower yield compared to their potential yield due to crop variety and management practices (Table 09). These results are in agreement with the findings of Anowar et al. (2015).

Table 07. Land and soil type of the sample farmers at FSRD site, Mymensingh during 2017-18

Land Type	Irrigated		Non irrigated		Total Area (dec)
	Area (ha)	Soil type	Area (ha)	Soil type	
High land	4.58	Sandy to loamy	8.25	Sandy	12.83
Medium high land	10.50	Sandy to loamy	2.08	Sandy	12.58
Medium land	21.25	Loamy to Clay	-	-	21.25
Medium low land	6.47	Loamy to Clay	-	-	6.47
Low land	4.50	Clay	-	-	4.50
Total	47.83	-	10.33	-	57.63

Table 08. Major farming systems of the sample farmers at FSRD site, Mymensingh during 2017-18

Major farming system	Households number	% of total Farmers
Crop	-	-
Crop + Livestock	-	-
Crop + Poultry	-	-
Crop + Livestock + Poultry+Household	20	33
Crop + Livestock + Poultry+ Fisheries +Household	08	13
Crop + Livestock + Fisheries+Agroforestry+Household	04	07
Crop + Livestock + Poultry+Agroforestry+Household	24	40
Crop + Livestock + poultry+Fisheries+Agroforestry+Household	4	7
Total	60	100

Table 09. Area and major crops grown in *rabi* season at FSRD site, Char Kharicha, Mymensingh during 2017-18

Crops	HYV		Local	
	Area (ha)	Yield (t ha ⁻¹)	Area (ha)	Yield (t ha ⁻¹)
Boro rice	33.71	6.07	-	-
Wheat	1.73	2.8	-	-
Potato	10.15	32.1	1.23	9.15
Vegetable	3.12	35.95	1.09	15.62
Chilli	2.34	1.42	0.55	0.8
Zinger	-	-	0.45	32.46
Garlic	-	-	0.62	5.78
Onion	-	-	0.50	14.36
Turmeric	-	-	0.28	2.31
Others	0.35	-	0.24	-
Total	51.40	-	4.96	-

Major crops growing in kharif season

In kharif season, about 87% of lands were used under HYV crop variety whereas only 13% land use under local variety. Out of 50.95 hectare of land under HYV crops area, the highest area under T.aman rice followed by bottle gourd, ash gourd and other vegetable. In T. aman rice both high yielding and local varieties were cultivated by the farmers while in T.aus rice only high yielding variety was cultivated by the farmer in the study area. The average yield of T. aman rice in HYV was 4.74 t ha⁻¹ while by cultivating local varieties farmer can get lower yield 2.97 t ha⁻¹. In case of summer vegetables most of the area covered by HYV varieties for their better yield (Table 10).

Time of sowing and harvesting of major crops

Sowing/planting and harvesting time differs in different agro-ecological zones. It might be due to land type and the cropping pattern followed by the farmer of that respected agro-ecological zone. At FSRD site, Char Kharicha, Sadar, Mymensingh sowing/planting and harvesting time of different crops are

shown in Table 11. Boro rice transplanted during January to February and harvested in April to May whereas T.aman was transplanted on July to August and by mid May T. aus was completed to transplant. The both T.aman and T. aus were harvested accordingly after completing the expected duration. The pattern Fallow- Boro- T.aman rice and Potato- Boro- T.aman rice cropping pattern followed by FSRD site, Mymensingh. Lahirirhat under Rangpur district practiced in transplanted Boro rice during February to March (Anowar *et al.*, 2015). A small extent of wheat were cultivated by the farmer in expected time schedule and harvested as well. Year round vegetables (September to May) and spices (October to March) are grown and harvested by the farmers in their homestead and high land.

Table 10. Yield and area covered by major crops grown in kharif season at FSRD site, Mymensingh during 2017-18

Crops	HYV		Local	
	Area (ha)	Yield (t ha ⁻¹)	Area (ha)	Yield (t ha ⁻¹)
T. aus rice	1.41	4.12	0	0
T. aman rice	28.63	4.74	2.15	2.97
Sweet gourd	1.78	28.71	0.55	17.30
Ash gourd	1.66	25.55	1.30	15.67
Bottle gourd	8.10	32.37	1.58	25.30
Bitter gourd	0.66	24.31	-	-
Snake gourd	0.44	29.77	-	-
Others	1.42	-	1.27	-
Total	44.10	-	6.85	-

Table 11. Time of sowing and harvesting of major crops grown at FSRD site, Mymensingh during 2017-18

Crops	Sowing/planting time range	Harvesting time range
Boro rice	January to February	April to May
T. aus rice	May	August
T. aman rice	July to August	October to 30 November
Zinger	March to April	January to February
Garlic	October to November	March to April
Onion	October to November	February to March
Turmeric	March to April	January to February
Chilli	September to October	January to March
Potato	October to November	December to February
Brinjal	September to October	March to April
Radish	September to October	November to December
Sweet gourd	September to October	January to February
Ash gourd	March to April	May to June
Bottle gourd	January to February	November to December
Bitter gourd	April to May	July to August
Snake gourd	April to May	July to Aug

Major cropping patterns practiced by the sample farmers

Cropping pattern of an area depends on soil type, land type, farms category (marginal, small, medium and large) and AEZ due to climate, soil and farmers interest in crop production. However, six major cropping patterns were followed by the farmers of the study area. The main cropping patterns were Fallow- Boro-T.aman followed by Potato-Boro-T.aman-, Potato-Vegetables-Vegetables-, year round vegetables Vegetables-Vegetables-Onion and year round zinger (Table 12). The crop varieties of different crops are varied depending on crops. Farmers usually practiced HYV and hybrid variety for rice cultivation, whereas local variety "Ausha" is extensively followed for potato production due to early marketing. While some of hybrid and local varieties are used for vegetables production and zinger varieties are preferably local. The varieties of the different crops in the site are shown in Table 12.

Table 12. Major cropping patterns, crops and variety used by the farmers at FSRD site, Mymensingh during 2017-18

Pattern	Cropping patterns and variety of crops in different seasons					
	Kharif-1		Kharif-2		Rabi	
	Crop	Variety	Crop	Variety	Crop	Variety
Fallow- Boro-T.aman	Boro	BRRI dhan28, Hira, Agro-4, Shakti, Super hybrid	T.aman	Dhanigold, Pajam, Shawarna, BRRI dhan11, BRRI dhan49	Potato	Ausha(L)
Potato-Boro-T.aman	Boro	BRRI dhan28, Hira, Agro-4, Shakti, Super hybrid	T.aman	Dhanigold, Shawarna, Pajam, BRRI dhan11, BRRI dhan49	Potato	Ausha(L)
Potato- Veg-Veg	Veg	Hybrid	Veg	Hybrid	Potato	Ausha (L)
Year round veg	Okra	Local	Amaranth	Local	Gourd	Hybrid
Veg-Veg-Onion	Veg	Local	Veg	Local	Onion	Local
Zinger	Zinger	Local	Zinger	Local	Zinger	Local

Per farm input used by the sample farmers: Labour, seed, fertilizers, pesticide, irrigation are the main inputs for crop production. At the FSRD site, Boro, T.aman, vegetables, are the major crops grown. A small scale of wheat is also cultivated by the farmers. Among the crops highest input cost was in potato followed by vegetables, brinjal, bottle gourd and Boro cultivation (Table 13).

Table 13. Average input used for different crop production by the farmers at FSRD site, Mymensingh during 2017-18

Name of crops	Input use (no. or kg/ha)										Total input cost (Tk ha ⁻¹)	Tillage cost (Tk ha ⁻¹)
	Labor (Male + Female)	Seed (kg)	Urea (kg)	TSP (kg)	MP (kg)	ZnSO ₄ (kg)	Gyp (kg)	Cow dung (kg)	Pesticide (Tk)	Irrigation (Tk)		
Boro	140	40	200	116	124	7	84	5000	5000	9000	61680	6750
T.aman	120	35	150	45	80	-	45	-	2000	3000	41548	5625
Wheat	90	130	200	150	100	-	60	-	2000	3000	45520	5250
Potato	200	1600	300	120	240	16	70	900	8000	4500	130650	6250
Brinjal	220	0.30	300	222	206	10	96	5000	9000	6000	65960	5250
Gourd	70	6	160	160	150	10	110	5000	6000	5000	65320	5250
Veg	140	-	230	150	120	10	60	5000	6000	4800	86780	5600

Homestead vegetable production and disposal pattern

Homestead vegetable production increases 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 homestead area. Among the sample farmers, average per farm vegetables production was 116 kg among which 27 kg in Kharif-1 season, 35 kg in Kharif-2 season and 54 kg in rabi season. The sample farmers consumed 55 kg, distributed 19 kg, sold 35 kg and damage 7 kg vegetables (Table 14).

Table 14. Average homestead vegetable production and disposal pattern at FSRD site, Mymensingh during 2017-18

Crop season	Total production (kg)	Consumption (kg)	Distribution (kg)	Sold (kg)	Damage (kg)
Kharif-1	27	15	5	5	2
Kharif-1	35	20	4	10	1
Rabi	54	20	10	20	4
Total	116	55	19	35	7

Homestead fruits production and disposal pattern: There observed six types of fruit trees at FSRD site under Mymensingh during 2017-18. Average production of mango was 43 kg while jackfruit, banana, papaya, olive and coconut were 92, 45, 82, 31 and 21 kg, respectively. The farmers consumed most of their produces and distributed to some extent and some of them are sold (Table 15). A very few were damaged or rotten by hazardous condition.

Table 15. Average fruits production and disposal pattern of sample farmers at FSRD site, Mymensingh during 2017-18

Items	Av. production		Consumption		Sold		Distribution		Damage/rotten	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
	(kg)/no	(Tk)	(kg)/no	(Tk)	(kg)/no	(Tk)	(kg)/no	(Tk)	(kg)/no	(Tk)
Mango	43	708	21	267	13	521	6	100	3	67
Jackfruit	92	3613	33	1167	58	2087	5	187	3	96
Banana	45	450	15	150	53	275	5	50	-	-
Papaya	82	1450	8	179	71	1183	6	75	2	21
Olive	31	308	3	33	25	250	3	25	-	-
Coconut	21	548	4	148	14	333	2	73	-	-

Homestead agro-forestry information

On an average, ten to twelve different agro-forestry trees were found in most of the homestead of the FSRD site. Jackfruit, mango, betel nut, black berry, bel, lemon, mehagani, pummelo, olive, coconut etc were the most common trees in homestead agro-forestry system. Average higher number of trees was betel nut (24), mehagani (12), jackfruit (9) and mango (3), respectively (Table 16).

Table 16. Homestead agro-forestry information of sample farmers at FSRD site, Mymensingh during 2017-18

Sl No.	Name of tree species	Number
1.	Jackfruit	9
2.	Mango	3
3.	Betel nut	24
4.	Black berry	1
5.	Bel	1
6.	Lemon	1
7.	Mehagani	12
8.	Pummelo	2
9.	Olive	2
10.	Coconut	2
11.	others	4

Crop production and disposal pattern

The farmers of the FSRD site under Mymensingh during 2017-18 produced 6241 kg rice and its value was Tk. 123158. Most of the rice were sold (4686 kg) and earned Tk. 91257 from them. They were consumed (1846 kg) and few were distributed to relatives or neighbor (Table 17). Some farmer produced wheat (450 kg) and got Tk 11330 which they consumed only 50 kg and rest were sold by Tk.10800. Some farmers of the study area cultivated turmeric a sum of 309 kg and earned Tk 3835 and those were sold 259 kg or consumed (40 kg) by them.

Table 17. Average crop production and disposal pattern at FSRD site, Char Kharicha, Mymensingh during 2017-18

Types of crops	Total production		Consumption		Sold		Distribution		Damage/rotten	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
	(kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)
Rice	6241	123158	1846	36236	4686	91257	19	376	10	250
Wheat	450	11330	50	1250	400	10800	-	-	-	-
Others (Turmeric)	309	3835	40	500	259	3210	10	125	-	-

Agronomic management practices of field crops by the Sample farmers

The agronomic management practices include variety, seeding date, transplanting date and proper harvesting date (Table 18). Boro rice was cultivated with high yielding variety and proper seeding and harvesting time. Some farmers cultivate T.aman rice with HYV and local variety in respective

transplanting and harvesting time. All types of summer vegetables they usually use HYV with respective seeding and harvesting practices.

Table 18. Agronomic management practices of different field crops of the sample farmers at FSRD site, Mymensingh during 2017-18

Crops	Variety		Seeding date	Transplanting date	Weeding (no)	Harvesting date
	HYV	Local				
Boro	Hira, Agro-4, super/Shakti/ BRRI dhan28	-	5-15 Dec	15- 30 Jan	2	15Apr- 15 May
T.aman	Dhanigold, Shawarna, BRRI dhan11, BRRI dhan49, BRRI dhan52	Pajam/ Aloy	10-25 Jun	15 July -15 Aug	1	05-20 Nov
Wheat	BARI Gom-26	-	15-20 Nov	-	-	10- 20 Mar
Potato	BARI Alu-25	Ausha	10 Oct-20 Nov	-	1	10 Dec -15 Jan
Sweet gourd	Hybrid	-	September	October	2	Feb-Mar
Bitter gourd	Hybrid	-	September	October	2	Jan-Feb
Ash gourd	Hybrid	-	March	April	3	June to July
Snake gourd	Hybrid	-	March	April	2	June to July
Turmeric	-	local	April	-	-	Feb-Mar

Sources of inputs used by Sample farmers

The farmers of the study area were used inputs from different sources for crop production. It was observed that 10% farmers use their own seed, 58% farmers purchase seed from market, 25% from BADC and only 7% collected seed from relatives or other farmers (Table 19). Fertilizers and pesticides were purchased from dealers of local market. Eighty percent farmers managed their irrigation from own ability and rest 20% from relative or other farmers. Most of the farmers (85 %) used their own organic fertilizer and rest 15% collected from relatives or other farmers. On an average, 20% farmer used their own draft power while 80% farmers borrowed or bought it from relatives/other farmers. Forty per cent farmer used their own labor and 60% depended on other source of labor. A different scenario was observed for agricultural tools where 70% farmers used their own agricultural tools and rest 30% depended on other sources.

Livestock inventory

The scenario of livestock per household of different categories at FSRD site under Mymensingh during 2017-18 is presented in Table 20. It was observed that every family of different categories reared local chicken (8.88/family) while no family did not rear exotic chicken. The farmers reared chicken for home consumption and sale. In case of goat the farmer reared it for sale of adult animals and the number of goat per farm family is more than one. The highest number of cattle was found in medium (2.62) followed by small (2.39) and marginal (1.17) farmers. The cattle reared by the farmers might be due to home consumption, sale of milk and sale of adult animals. Marginal farmers did not have any duck but had the highest number of pigeons (1.8). On an average, 0.22 duck and 0.99 pigeon were reared by per farm family for home consumption, sale of egg, young and adult animals.

Livestock production and disposal pattern

Farmers of FSRD site, Mymensingh reared cattle, chicken, duck and pigeon in their family. On an average, every farm family possessed 576 (Litre) milk and from it they got Tk. 32792. They sold (428 Litre) milk; some were consumed and distributed to others (Table 21). Every farm family reared chicken, duck and pigeon and got eggs from it, most of them are sold for earning money a few was consumed and a negligible are distributed to neighbor and relatives.

Sources of inputs used by sample farmers in livestock production

The farmers of the FSRD site took inputs from different sources of provider. It was observed that 50% farmer reared cattle from their own sources while rest 50% purchased it from the market (Table 22). Similarly for duck rearing they are dependent on their own source and market whereas for feed collection 60% farmers collected feed from own, 30% from market and a very few are dependent on

relatives or other farmers. For treatment of livestock 50% took medicine from market while 40% got treatment from department of livestock. On an average 60% farmer gave labor of his own for their livestock rearing, a small number are dependent on relatives or other source of input.

Table 19. Sources of inputs used in crop, vegetables, fruits and timber production by the sample farmers at FSRD site, Mymensingh during 2017-18

Item	% Sources of input used from			
	Own	Market	BADC	Relatives/others
Seeds/Seedlings	10	58	25	7
Fertilizers	-	100	-	-
Pesticides	-	100	-	-
Irrigation	80	-	-	20
Organic fertilizers/FYM	85	-	-	15
Draft power	20	-	-	80
Labor	40	-	-	60
Agricultural tools	70	-	-	30

Table 20. Livestock inventory of sample farmer at FSRD site Mymensingh during 2017-18

Assets	Marginal	Small	Medium	Average
Chicken	8.38	9.85	8.40	8.88
Goat	2.27	0.75	0.62	1.21
Cattle	1.17	2.39	2.62	2.06
Duck	0	0.38	0.42	0.27
Pigeon	1.80	0.87	0.30	0.99

Table 21. Average livestock production and disposal pattern at FSRD site, Mymensingh during 2017-18

Items	Total production		Consumption		Sold		Distribution		Died/stolen	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
	(No./kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)	(kg)	(Tk)
Cattle	576	32792	135	6550	428	25613	13	629	-	-
Chicken	19	4867	4	1067	12	3008	1	96	1	42
Egg	47	472	16	161	29	286	3	25	-	-
Duck	3	600	1	200	2	400	-	-	-	-
Pigeon	4	600	1	150	2	300	-	-	1	150

Livestock health management information

It was observed that 50% farmer collected vaccine from DLS, 30% from village trained people, and rest 20% from medicine seller. Similarly source of vaccination used for goat, chicken and duck. For vaccination of pigeon 100% information took from department of livestock (Table 23).

Table 22. Sources of inputs used in livestock production by sample farmers at FSRD site, Mymensingh during 2017-18

Item	% Sources of input used from				
	Own	Market	DLS	Relatives/other farmers	Others
Cattle	50	50	-	-	-
Chicken	40	30	30	-	-
Ducks	45	55	-	-	-
Feed	60	30	-	10	-
Medicine	10	50	40	-	-
Labour	60	-	-	20	20

Fish production: Generally, rui, katla, mrigel, carpio, sarputi, mirror carp, grass carp and pangus are the most common fishes in the study area. Average pond size at FSRD site was 22.50 decimal. The farmers harvested 269.33 kg fish per farm year. Those fishes were mostly used for home consumption (Table 24).

Sources of inputs used by sample farmers in fish production

The farmers of FSRD site took suggestions from different sources of provider. The farmer or any other of his relatives did not know any information about liming in the pond. At FSRD site, 100% farmers were completely dependent on traders of the market for liming and feed while 100% took information on fingerlings from relatives or others farmers (Table 25). It was observed that 100% farmer supplied water to the pond from his own management. For catching fish, 40% farmers involved their own net while 40% borrowed from relatives or other farmers and rest 30% lend it from traders of market instead of money. Most of the farmer gave their own labor for fish production but few (30%) are engaged other farmer for fish cultivation

Table 23. Sources of vaccination used in livestock health management by the farmers at FSRD site, Mymensingh during 2017-18

Animal type	% Sources of vaccination used from				
	DLS	Village trained people	NGO worker	Self	Medicine seller
Cattle	50	30	-	-	20
Goat	40	30	-	-	30
Chicken	45	35	-	10	10
Ducks	50	10	-	-	40
Pigeon	100	-	-	-	-

Table 24. Status of fish cultivation by the farmers at FSRD site, Mymensingh during 2017-18

Sl. No.	Average pond size (dec)	Name of fish	Average production (kg/farm/yr.)
1.	22.5	Rui	24.53
2.		Katla	14.50
3.		Mrigel	19.25
4.		Carpio	22.25
5.		Mirror carp	11.60
6.		Silver carp	37.15
7.		Telapia	35.40
8.		Pangus	73.50
		Total	269.33

Per farm credit received and purpose of credit

The farmers of FSRD site of Mymensingh sometimes received credit from NGO, Krishi bank or some of their friends or relatives. This might be due to fact that farmers of Bangladesh are not always solvent to purchase the inputs for crop production. Hence, the farmers of the study area took credit (2500 Tk) with the interest of 12% from friends or relatives for crop production (Table 26). Some were received credit from non government organization with high interest (15%). While on an average, farmers received Tk 62916 from Krishi bank for crop and fish production and someone to repay the previous loan with the interest of 10%.

Table 25. Sources of inputs used in fish production by sample farmers at FSRD site, Mymensingh during 2017-18

Item	% sources of input used from					
	Own	Market	DoF	Govt. farm	Relatives/other farmers	Others
Lime	-	100	-	-	-	-
Fingerlings	-	-	-	-	100	-
Feed	10	90	-	-	-	-
Net	40	30	-	-	30	-
Water supply	100	-	-	-	-	-
Labour	70	-	-	-	10	20

Income and livelihood 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 2017-18 have been shown in the Table 27. The items of income were categorized by crop, livestock, fisheries, poultry, homestead, agro forestry, off farm and

nonfarm. 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.

Table 26. Per farm average credit received from different sources and purpose of credit at FSRD site, Mymensingh during 2017-18

Sources of credit	Amount of credit (Tk)	Purpose of credit	Rate of interest (%)
Friends/relatives	2500	Crop production, fish	12
NGO	1250	production, repay	15
Krishi bank	62916	previous loan etc.	10

Table 27. Per farm income and livelihood of different categories of farmers at FSRD site, Mymensingh during 2017-18

Main source of income	Landless	Marginal	Small	Medium	Large
Crops	890	17796	30794	67956	117956
Vegetables	290	1517	12413	18789	28790
Fruits	120	1250	2315	7288	7288
Livestock production	3520	19365	37375	49700	49700
Fish production	0	3000	17630	20635	21635
Agro-Forest product	0	0	2500	3790	4790
Business-shop, trade etc	24590	15000	12380	0	0
Others (auto, van & day labour)	35320	36000		0	0
Total	64730	93,928	115,407	1,68,158	2,30,159

Service provided for crop production from different organization

Eight types of services were provided by different service provider at FSRD site. Highest service for crop production was provided by other farmer or relatives (37.50). On an average, Department of Agricultural Extension (DAE) provided 19.37% service in different cases of service while electric media provided the lowest (100%) information. A few farmers took service from research institute (14.71%) and traders took part of some services (16%) as new variety, seed rate, fertilizer application and pest management (Table 28).

Table 28. Service provided for crop production from different organizations at FSRD site, Mymensingh during 2017-18

Services provided	Service provider (%)					
	Farmers/relatives	Electric media	Demo	Research	DAE	Traders
New variety of seed	30	10	15	15	15	15
Seed rate	30	-	20	10	30	10
Fertilizer application	40	-	10	15	25	10
Pest management	30	5	12	18	20	15
Irrigation	40	10	10	15	25	-
Harvesting time	50	10	15	15	10	-
Processing and storing	40	5	20	15	20	-
Market information	40	20	-	-	10	30
Average	37.50	10	14.57	14.71	19.37	16.00

Service provided for livestock production from different organization

For livestock production seven kinds of services were provided from five types of provider at FSRD site, viz. about new breed of livestock, housing, feed and water management, suggestion about breeding, diseases, vaccination and market information. These services were provided by relatives or other farmers, electric media, research institute, Department of livestock and traders. At FSRD site, farmers took most of their suggestion from relatives or other farmers (37.14%) followed by DLS those who provided (31.42%) service in different types. On the other hand, research institute gave suggestions a service (15%) and electric media provided the lowest service (10%) to the farmer as well (Table 29).

Service provided for fish production from different organization

At FSRD site, farmers took suggestion for fish production from their relatives or other farmers, research institute, Directorate of fisheries, some of from traders and a very small from electric media. The highest suggestions took from other farmers or relatives (36.87%) followed by traders (28.33%) and DoF (21.88%) while electric media provided a small service (8.67%) to the farmers. Traders took part a great service to the farmers by giving suggestion on new breed, feeding management, diseases, harvesting, carrying and information on marketing (Table 30).

Table 29. Service provided for livestock production from different organizations at FSRD site, Mymensingh during 2017-18

Services provided	Service provider (%)				
	Relatives /Farmers	Electric media	Research institute	DLS	Traders
New breed of livestock	50	10	10	10	20
Housing	70	-	-	30	-
Feed and water management	45	5	10	30	10
Breeding	40	10	20	30	-
Diseases	35	-	20	40	5
Vaccination	10	5	20	60	5
Market information	10	20	10	20	40
Average	37.14	10.00	15.00	31.42	16.00

Table 30. Service provided for fish production from different organizations at FSRD site, Mymensingh during 2017-18

Services provided	Service provider (%)				
	Farmers/relatives	Electric media	Research institute	DoF	Traders
New breed of fish	30	2	8	35	25
Pond management	50	-	20	30	-
Feeding management	30	5	10	20	35
Diseases	20	10	30	20	20
Breeding	40	-	20	40	-
Fish harvesting	55	10	10	15	10
Carrying/preservation	40	5	10	10	40
Market information	30	20	5	5	40
Average	36.87	8.67	14.13	21.88	28.33

Problem faced by the farmers

Farmers were asked about the problems of crop, livestock and fisheries and they answered more than 25 problems. These problems summarized and 9 problems have been showed in Table 31. 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 31. Problems faced by the farmers in the study area

Problems	% farmers	Solution(s)
Lack of knowledge about new crop /technology	88	Demonstration, Training, Field day
Lack of quality seeds / fingerlings / duck links	77	Education, Information/ Training
Lack of cash money for buying inputs	69	Easy credit system
Lack of knowledge about fish feed and pond management	85	Demonstration, Training, Field day
Lack of knowledge about vaccination, deworming, feed of livestock and poultry	90	Demonstration, Training
Lack of credit facility	75	Easy credit system
Lack of knowledge about homestead vegetables production	75	Demonstration, Training, Field day
High price of inputs	80	Increase subsidy in agricultural inputs
Infestation of insect/pests/weeds	70	Increase knowledge by training

IV. Conclusion

There is enough scope of improvement by imposing appropriate technologies in the study area for the resource poor farm households. 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. Livestock, fisheries and other off-farm activities should be strengthened for improvement of farmers' livelihood. Measure should be taken for improvement of soil health, quality seed supply for crops and quality feed for livestock and fisheries. Agricultural input should be made available to the farmers to boost up crop production. In the conclusion it can be said that the integrated farming system is technically feasible and economically viable in Bangladesh. Extensive efforts should be made to transfer this technology among the farmers.

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