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POVERTY ALLEVIATION OF FARMING COMMUNITY IN *HAOR* AREA THROUGH FARMING SYSTEMS

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ABSTRACT

The project entitled "Livelihood Improvement of Farming Community in Haor Area through System Approach (LIFCHASA)" of the Department of Agronomy, Bangladesh Agricultural University; Mymensingh worked in Purbo Tethulia village of Mohanganj Upazila under Netrakona district from April 2010 to June 2013 with the financial assistance from The Bangladesh Agricultural Research Council. Different research activities were done as per plan for different five components. The Crop and Agroforestry Component conducted experiments both in the homestead land and crop land. Under Livestock Component, experiments were conducted on rearing of egg producing hen, duck, fattening of animals, artificial insemination and continuous vaccination programme. In the Fisheries Component, experiments on cage culture in open water emerged as a promising technology. From the result of the soil sample analysis of the research site under Rural Hydrology and Mechanization Component, it was found that additional application of sulphur and zinc fertilizers were unnecessary. From the study under Socioeconomic Component, it was distinctly clear that the efficiency of marginal and small farms was improved in agro economic productivity with the increase of number of farming enterprises intervened irrespective of farm sizes. The marginal and small farmers appeared to be the most efficient performers in the integration and arrangement of farming enterprises. This was followed by landless and medium farms. The gross margin for marginal and small, landless and medium increased by 84%, 89% and 50 %, respectively involving the enterprises like crop and agroforestry, livestock and fisheries. The findings of 25 physical models on integrated farming systems revealed that the agro-economic/bio-economic productivity of all those models increased tremendously in terms of total production, biodiversity, human resource enlightened with knowledge, skill and motivational spirit in modern techniques and technologies.

Keywords: *haor, poverty alleviation, farming systems, livelihood, integrated farming model, intervention.*

INTRODUCTION

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-mechanization of tillage 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. In spite of the progress made above, a large part of the Bangladesh population still does not consume sufficient food or survive on a diet lacking in micronutrient and food insecurity problems are massive in the country (Gill *et al.*, 2003). Poverty is the main obstacle in achieving food security but factors such as natural disaster, high incidence of disease, poor hygiene and caring practices and limited nutritional awareness also contribute to food insecurity. Bangladesh claims to be self-sufficient in rice production. But other foods are deficit to a large extent. Even the rice food security is not achieved at the household level in many poor and extreme poor families in urban and rural areas including those of the highly food insecured areas of Bangladesh of which the flood prone areas of the Sylhet *haor* basin can be mentioned although the *haor* is a surplus area of rice and fish (Hossain, 2008).

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, Moulvibazar and part of Sylhet and

Brahmanbaria (*Haor* Task Force Report, 1985).The *haor* area extends as many as 43 upazilas of the aforesaid districts. The area of the *haor* is about 932793 hectares. The *haors* go under flooding (5-10 m) from late May to October while it looks like a sea. There is only one cropping season in *haor* i.e. the rabi, when *boro* rice, potato, groundnut, sweet potato, mustard, pulses etc. are grown. Sometimes in some years the crops of the *haor* areas are affected by natural calamities like flash flood, hailstorm and insect pests. The *haor* is a vital supplier of inland fresh water fisheries with a fishing area of 114793 hectares (Hossain *et al*,. 1987). The main communication to the *haor* is by boat with or without engine.

During monsoon, a *haor* looks like a vast stretch of turbulent water. The *haor* basin constitutes about 47 major *haors* and some 6300 *beels* of which 3500 are permanent and 2800 are seasonal. Swamp forest is dominated by hijal (*Barringtonia acutangula*), koroch (*Pongamia pinnata*) and other flood tolerant tree species are also visible in the *haor*.

People have been living here for generations, building their houses on large earthen mounds that remain above flood water level. The poor and the extreme poor households constitute 35% and 40%, respectively of the total population. Access to land and fishing ground is very limited. Mainly one crop i.e. *boro* rice is grown. Homestead erosion, siltation and flash floods frequently occur and severely limit yields or even destroy most of the crops. The area is highly food insecure for the poor and extreme poor people. The medium and resource rich farmers produce surplus rice. There are absentee landlord in the area. The poor and the extreme poor face the issue of land ownership, housing, soil quality, water use, subsidies, inputs, credit, market stability, insurance and often crop loss by disasters, employment, etc. They have a very little production assets and have no year round working opportunities to earn money for purchasing food and other daily necessities of life. As a result, they face hunger during lean period of work. They are mostly agricultural labourers, who suffer from food insecurity and high micro-nutrient deficiencies which results in consistently reduced productivity, loss of working days and various illnesses. The project was implemented with the following objectives:

a. Increase productivity of field crops, vegetables, livestock and fishes in a household through the use of appropriate technologies and techniques devised / developed/ designed/refined by the farmers for ensuring household food security and nutritional upliftment and raising income;
b. Diversify enterprise, mobilize resources and intensify farming and non-farming activities for *in situ* employment generation;
c. Conserve farm environment through efficient mobilization and management of natural resources for sustainable production system;
d. Develop human resources for capacity building of the participants and improve their livelihood through system approach.

RESEARCH METHOD

The research site geographically is located at 28°57' N latitude and 90°50' E longitude. The site belongs to the Non-calcareous Dark Gray Flood Plain soil under the Sylhet Basin of AEZ 21 (UNDP and FAO, 1988).In Purbo Tethulia, about 70% of the area is medium low land and the remaining 30% is low land. The land with medium low topography remains water logged for 5-6 months (May to October) during monsoon season is flooded with maximum of 90-180 cm water. On the other hand, land with low topography remains water logged for 6-7 months (May to November) during monsoon season and is flooded with water height of 180 to 275 cm. The soil in Purbo Tethulia is clayey in texture with dark grey colour (LIFCHASA, 2010). The soil in the area is mostly acidic in nature (pH 6.5) with high organic matter content (4.05%). Status of P, CEC was medium and K status was low.

A team of 13 members of five disciplines with interdisciplinary in setting and action responsible for planning and implementing the activities of the integrated farming through participatory approach. For implementing the LIFCHASA project, the general methodology of the Farming Systems and Environmental Studies (FSES) was followed. The methodology was developed based upon the warming experiences over 1 -5 years on cropping systems and farming systems research under the leadership of the Bangladesh Agricultural Research Council (BARC). The FSR Methodology Guide line of BARC was also consulted. The schematic presentation of general implementation methodology can be seen in Figure 1.

Planning was initiated at the site level by the Site Working Group as mentioned above and reviewed

the progress from time to time. The Site Coordinator acted as the Convener of the site level Working Group.The proposed plan was discussed, refined and finalized at the Programme Development Workshop attending researchers from BAU, NARS institutes and GO and NGO representatives at BAU once in a year and reviewed the progress of LIFCHASA.

Farmer selection for the integrated farming model development was done through identification of

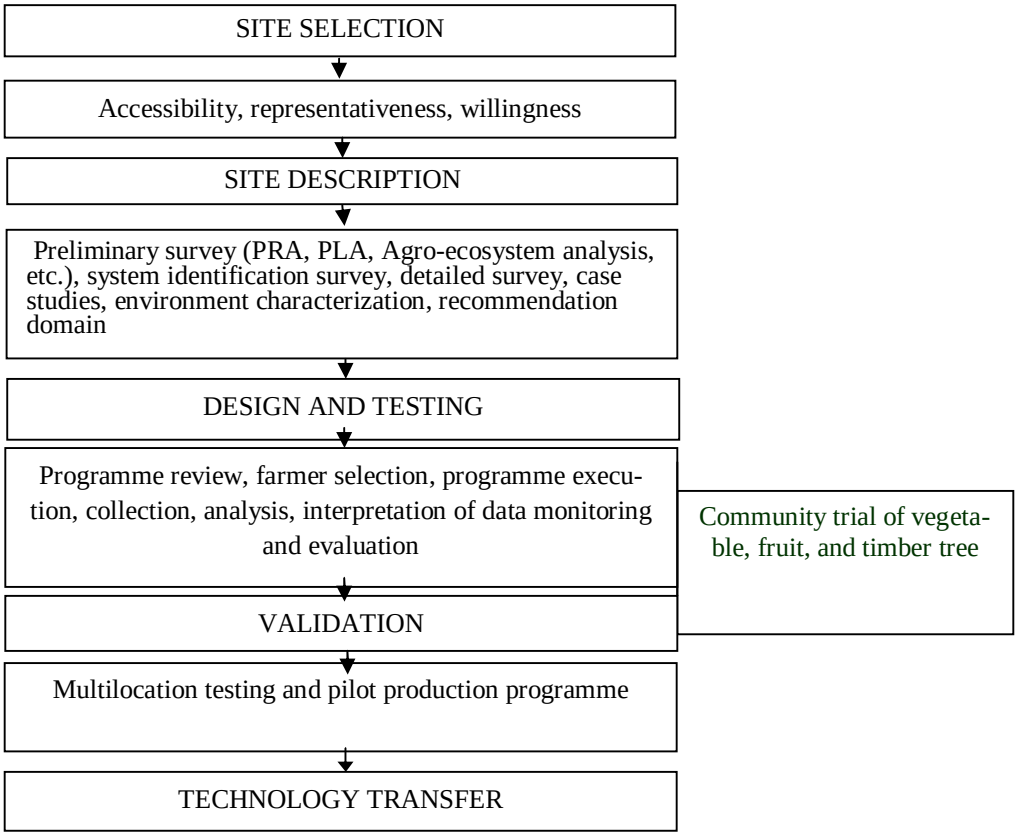

Fig. 1. Schematic representation of general implementation methodology developed by FSES (2002)

farmers, their farm sizes and farming systems. Out of 462, 232 farming households were found having stable and sustainable farming systems, the rest of households (230) appeared to have most volatile farming enterprises and the system may not continue for long time. On system basis classification in each system the number of farmers was less than 10 and they were dropped from the study. Thus 25 farmers were selected based on farmer category and farming systems for intervention of integrated farming development in addressing livelihood improvement.

The technologies of the LIFCHASA were disseminated through participating farmers, non-participating farmers and government extension departments. The LIFCHASA received feed back from technology users for further refinement them more adaptively.

The 'physical' or 'Iconic' model is also called descriptive model. These types of models are needed for guiding extrapolation to similar environment. These models can be continuously refined depending upon the physical, biological, socio-economic, political and other factors and also the resource-base of the farmers (Hossain *et al*,. 1993*)*. Since principle of integration is adopted, these models are cost-effective and risk-aversive.

Intervention provided by LIFCHASA included Crop and Agroforestry Component, Livestock Component, and Fisheries Component. The Crop and Agroforestry Component covered homestead area and field area. The homestead area was addressed for raising Bottle gourd (cv. BARI lau-1), country bean (cv. BARI sheem-2), lady's finger (cv. Hi-soft), Indian spinach (cv. Puishak Shabuj), snake gourd (cv. Kobra), sweet gourd (cv. Shotabdi), ash gourd (cv. Super Star), yard long bean (cv. Kegornatoki),

bottle gourd (cv. Martina), country bean (cv. Knoldog), lady's finger (cv. Arka Anamika), Indian spinach (cv. Boropata), snake gourd (cv. Jhumlong), mango (Amropaly), guava (cv. Madhury), lemon (cv. Baromashi), jujube (cv. BAU Kul/ Apple Kul), papaya (cv. Kashimpuri, Red Lady), drum stick (cv. Baromashi), mahogani, lambu, African *dhaincha*. The field area, on the other hand, was addressed for Potato-*Boro* rice-*Dhaincha*, Mustard-*Boro* rice- *Dhaincha*, Radish-*Boro* rice-Fallow, Cabbage-Lady's finger- Fallow, Cauliflower-Indian spinach – Fallow, Tomato-Stem amaranth-Fallow. The Livestock Component was addressed for hen (Br. Sonali, Hilly), duck (Br. Khaki Campbell, Jinding and Deshi), beef fattening, vaccination programme and artificial insemination. Similarly, Fisheries Component comprised of cage culture and mixed pond culture.

The impact of LIFCHASA interventions was evaluated on the basis of bio-economic performance and improvement of social status.The biological performance was measured in terms of productivity of crop, livestock, fishes and biomass fuel including timber. The crop data were collected through seasonal (four period) monitoring while those of livestock, fisheries and agroforestry were collected through six period monitoring. The homestead production data were collected through yearly monitoring. The collected data were analyzed on yearly basis and the average of all years' data was presented in the respective models component wise.

Economic performance was measured with respect to land holding, labour utilization, gender participation, labour potentiality, labour productivity and energy status. The potential labour farm^{-1} was calculated as 22.5 days male^{-1} adult multiplied by total family members. In calculating the potential female and child labour the following conversion rate was followed.1 adult male = 1.5 adult female = 2 children (12-18 years). In calculating the labour productivity of a model the following formula was used.

$$\text{Labour productivity} = \frac{\text{Gross return year}^{-1}}{\text{Total labour days utilized year}^{-1}}$$

The economic analysis of various components of the model was done on the basis of local market price of inputs and products. The gross margin was calculated by deducting total variable cost from gross return. The cost-benefit ratio was calculated on the basis of total annual gross return divided by total annual cost of the farmer.

The contribution (Tk.) of each component was calculated as percentage of total Tk. of a farm (model) year^{-1}. The capita^{-1} labour productivity was calculated as per value of total production divided by total family members of age 12 and above. The contribution in resource was calculated as per money value of inputs and cash investment total. Social change was evaluated on the basis of improvement in nutrition, housing, clothing, medicine, education, communication, leadership and saving.

RESULTS AND DISCUSSION

The activities of integrated farming started with 25 farms in Purbo Tethulia of which eight landless, nine marginal and small and seven medium under five components. All the households (462) of Purbo Tethulia were also intervened from the project. The interventions were either by improved/high yielding breed/variety/species of crop, vegetables, livestock, poultry and fish farming. It was observed that as the number of enterprises increased in the farming system, the income also increased. The evidence also showed that the training of the beneficiaries increased their knowledge and skill.

Almost 100% households were practicing year round vegetable production. Vegetables were available throughout the year for consumption of the villagers and for sale for additional. Diversification and intensification of crops in homestead and crop land were closely visible. After intervention, local breed of hen, duck increased due to proper maintenance and introduced improved poultry breed of duck and hen. Cattle breed was under improvement through artificial insemination. Cage culture in open water accepted as a promising technology.

To develop human resources for capacity building of the participants and improve their livelihood through system approach about three hundred farmers were trained on integrated farming systems. One person was trained on artificial insemination. Effective linkages developed between project beneficiaries and the concerned service providers.

The research site was mainly rice based. Due to project activities cropping pattern intensified,

cultivation of diversified crops increased, men and women even school going boys and girls were involved in homestead production systems. About 85% of the fallow lands are now under utilization through installation of a Shallow Tube Well. To conserve farm environment through efficient mobilization and management of natural resources for sustainable production systems the LIFCHASA project initiated to adapt the farmers compost preparation by using homestead waste through polythene pit method. African *dhaincha* was used as green manure and protection of homestead erosion from wave. On the other hand, recommended doses of fertilizer and pesticide were being practiced.

Performance of integrated farming under landless, marginal and small and medium farm categories have been summarized in Table 1- 3. The average farm size of landless, marginal and small and medium was 0.10, 0.77 and 2.11 ha, respectively. Findings indicated that after three years of intervention, the annual income increased in each category of farm. Average gross margin farm^{-1} year^{-1} of landless, marginal and small and medium farms was increased 89%, 84% and 50%, respectively, over the inception. As a result, livelihood improvement of the participatory farmers increased. It was evident that a treasure of excellent knowledge, skill and innovativeness hidden in the man and woman of the farming community irrespective of farming household.

CONCLUSION

Table 1. The performance of integrated farming on landless farm in Purbo Tethulia after three years of intervention

Farm	Period	Farm size (decimal)	Total cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)	Socio-economic impact
1	A	47	32040	86726	54686	Set up a sanitary latrine and raised homestead plinth.
	B	47	11500	45901	34401	
2	A	55	87070	164565	77495	Raised homestead plinth, invested on fishing net purchased on share basis
	B	45	35620	78570	42950	
3	A	73	59145	136385	77240	Rented in 20 decimals of crop land, invested on fishing net purchased on share basis and purchased a cow.
	B	53	23570	60210	36640	
4	A	14	15235	45601	30366	Housing pattern changed, loan repaid Tk. 5000, rented in 10 decimals of crop land and food security improved.
	B	4	7200	23346	16146	
5	A	5	9880	33801	23921	Raised homestead plinth, loan repaid Tk. 5000, invested on fishing net purchased on share basis and food security improved.
	B	5	5400	20565	15165	
6	A	5	26575	79511	52936	Loan repaid Tk. 10000, made profit about Tk. 15000 by egg selling, brought a rickshaw, earned money was used on children's education purpose and food habit changed
	B	5	14000	34968	20968	
7	A	55	19629	62034	42405	Started new poultry - fish selling business as retailer, built a new tin roofed - bamboo fenced house and food security improved.
	B	45	11585	37046	25461	
8	A	42	16998	50411	33413	Loan repaid Tk. 20000, recovered rented out 35 decimals of crop land and food security improved.
	B	42	5550	24520	18970	
9	A	146	38233	88197	49964	Housing pattern changed, bought a motorcycle, and raised homestead plinth and food security improved.
	B	46	4397	27655	23258	
Average	A	49	33867	83026	49158	Gross margin increased by 89%
	B	32	13202	39198	25995	

Table 2. The performance of integrated farming on marginal and small farms in Purbo Tethulia after three years of intervention

Farm	Period	Farm size (decimal)	Total cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)	Socio-economic impact
1	A	230	134102	226154	92052	Money earned was invested in a grocery shop and rented in 30 decimals of crop land.
	B	200	77861	125597	47736	
2	A	254	197088	368993	171905	Purchased a milching cow and installed a tubewell for drinking water.
	B	204	80581	215673	135092	
3	A	310	213174	517266	304092	Rented in 100 decimals of crop land, Housing pattern was changed and repaid loan amount of Tk. 47000 to ASA
	B	210	74645	194039	119394	
4	A	335	129861	220724	90863	Loan repaid Tk. 9000, rented in 110 decimals of crop land and food security improved.
	B	225	73490	118945	45455	
5	A	203	92442	180303	87861	Housing pattern changed, rented in 65 decimals of crop landand food security improved.
	B	138	34030	64380	30350	
6	A	145	76048	146477	70429	Raised homestead plinth, loan repaid Tk. 10000 and food security improved.
	B	145	37820	84450	46630	
7	A	92	34390	86835	52445	Loan repaid Tk. 10000, rented in 10 decimals of crop land and food security improved.
	B	82	7550	26890	19340	
8	A	525	132625	342515	209890	Housing pattern has changed, invested on fishing net purchasing by share and food security improved.
	B	405	126338	283831	157493	
9	A	115	27773	124786	97013	Housing pattern changed, raised homestead plinth, loan repaid Tk10000 and food security improved.
	B	95	16120	52535	36415	
Aver-age	A	245.44	115278	246006	130728	Gross margin increased by 84 %
	B	189.33	58715	129593	70878	

Table 3. The performance of integrated farming on integrated medium farm in Purbo Tethulia after three years of intervention

Farm	Period	Farm size (decimal)	Total cost (Tk.)	Gross return (Tk.)	Gross margin (Tk.)	Socio-economic impact
1	A	745	262121	395436	133315	Loan repaid of Tk. 15000, which received from BRAC and purchased a milching cow with Tk. 22000.
	B	745	196240	270421	74181	
2	A	690	310801	535048	224247	Set up a sanitary latrine as Tk. 9000 and repaired house.
	B	690	210280	377258	166978	
3	A	332.5	196220	293326	97106	Improved Housing pattern and money earned was utilized in educational purpose for the children.
	B	332.5	143715	228013	84298	
4	A	613	138794	226242	87448	Housing pattern changed, invested on fishing net purchased on share basis and food security improved.
	B	613	107950	155412	47462	
5	A	300	79068	197405	118337	Raised homestead plinth, invested on fishing net purchased on share basis, money earned was utilized in the marriage ceremony of younger sister and food security improved.
	B	300	46650	120160	73510	

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6	A	460	167262	260113	92851	Rented in 50 decimals of crop land, repaid loan Tk 20000, Housing pattern was changed and food security improved.
	B	410	75196	107179	31983	
7	A	570	106051	272282	166231	Raised homestead plinth, money earned was utilized in the marriage ceremony of younger daughter and food security improved.
	B	570	90910	224912	134002	
Aver-age	A	530.07	180045	311407	131362	Gross margin increased by 50%
	B	522.93	124420	211908	87488	

A = After intervention, B = Before intervention

From the study it was distinctly clear that the efficiency of marginal and small farms was improved in agro economic productivity with the increase of number of farming enterprises intervened in respective of farm sizes. The marginal and small farmers appeared to be the most efficient performers in the integration and arrangement of farming enterprises. This was followed by landless and medium farms. The gross margin for marginal and small, landless and medium increased by 84%, 89% and 50%, respectively involving the enterprises like crop and agroforestry, livestock and fisheries. The integrated farming also generated more employment irrespective of male and female labour. Food security was improved due to integration of farming enterprises. Integrated farming also improved farm environment by application of compost through its production and preservation of kitchen waste by polythene pit method. Based upon research findings, the following conclusions can be drawn:

1. Crop technologies refined / developed in the homestead and in the crop field needs further upscaling.
2. The findings of livestock viz., cross bred and hybrid hen and duck were very promising for dissemination in the *haor* area
3. Beef fattening was very successful in the Research Site and need further upscaling in the *haor* area.
4. Performance of case culture of tilapia was excellent. This technology needs to dissemination in the *haor*.
5. Pond culture of fishes performed well and this technology needs extension.
6. The technology generated on irrigation can successfully be extended in the *haor* area.

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