

Original Research Paper

GO-NGO Support in Selected *Char* Areas of Sirajganj District in Bangladesh: Impact on Crop Profitability and Farmers' Income Generation

¹Md. Monirul Islam, ²Arifa Jannat and ¹Aurup Ratan Dhar

¹Department of Agricultural Economics,

²Institute of Agribusiness and Development Studies,
Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Article history

Received: 08-05-2017

Revised: 19-06-2017

Accepted: 23-10-2017

Corresponding Author:

Md. Monirul Islam

Department of Agricultural

Economics, Bangladesh

Agricultural University,

Mymensingh-2202, Bangladesh

E-mail: monir.bau_96@yahoo.com

Abstract: The study was carried out to elucidate the GO-NGO support on farmers' income generation in selected *char* areas of Sirajganj district. Following purposive sampling technique, a total of 60 farmers (30 non-supported and 30 GO-NGO supported) were selected for the study. Descriptive statistics, mathematical and statistical analyses were used to analyze the collected data from field survey method. The average benefit cost ratio (BCR) of crop farming for non-supported farmers was 1.70 and for GO-NGO supported farmers it was 1.80 indicated that crop farming was more profitable under GO-NGO supported farmers. The double difference estimates for total income in the year of 2012 and 2014 was Tk. 14046.8 which was statistically significant. Ravallion test result also picturized that, income was increased by Tk. 10404.0 for the support obtained from the different GOs and NGOs. From logit model it was found that farm size, household size, education level of the household head and farm income had significant influence on adopting GO-NGO supports in farming practices. Farmers expressed their opinion about the lack of transportation facilities, low price of output, etc. as major problems. Transportation and communication facilities should be improved in the study areas, government social safety net programmes should be enhanced to support the farmers in *char* areas and compulsory primary education programme for both male and female should be implemented.

Keywords: GO-NGO Support, *Char*, Profitability, Income Generation

Introduction

Bangladesh is furnished with diverse agricultural seasons, which allows the farmers cultivating two and sometimes more than two crops on the same field. Nearly 5%, as well as about 10 million people of Bangladesh live on the *char* narrowed as 7200 square kilometers (Kelly and Chowdhury, 2002). The economy of the people of river basin areas is highly dependent on agriculture. Majority of the *char* residents are engaged in different farming systems which were also different from the main land. A number of social protection interventions such as, social safety net programmes, various training facilities, awareness campaign, etc. have been providing by the government and non-government organizations (GOs and NGOs) to the poorest households in *char* areas. Different GOs and NGOs have tried to overcome their vulnerable condition

by increasing the productivity of income-generating activities (IGAs) according to their time, interest, geographical area, and needs. It is promising that GOs and NGOs like *Polli Karma Sahayak Foundation* (PKSF), Bangladesh Rural Development Board (BRDB), Grammen Bank (GB), Bangladesh Rural Advancement Committee (BRAC), *Char* Livelihood Programme (CLP), etc. have taken initiatives to make vulnerable situation tolerable.

Government of Bangladesh has strategic plan and program for increasing the agricultural production of *char* people, improvement of their livelihood status and also to mitigate various problems faced by them. The employment opportunities of *char* dwellers are even less diversified than the ones of other rural poor in the district. Different NGOs are working in the *char* areas to provide applied knowledge and links to sources of information, to contribute to the poverty alleviation and community development through various support and

services. Basically, the poor people of the bottom stratum of the society, having no capital and little access to resources are the inhabitants of those *char* areas. Without the intervention of GO-NGOs, the situation would be more problematic and challenging.

The study can be supported by a modest number of literatures which are: Islam *et al.* (2011) discussed socioeconomic analysis of alternative farming systems in improving livelihood security of small farmers in selected areas of Bangladesh and reported that small farmers included more enterprises in farm practices to have better food security, higher income and improving livelihood; Hasan and Sultana (2011) observed that most of the respondents were middle aged, had medium to big families, were mostly illiterate and different types of vegetables were being grown by the respondents including spinach, bitter gourd, cowpea, etc. in the summer season and red amaranth, brinjal, tomato, etc. in the winter season; Uddin (2004) aimed at evaluating the production levels, costs and benefits, profitability in relation to farm size and resource use of various enterprises that comprise integrated farming in Bangladesh and revealed that there was a big gap in profit by farm size among integrated farms with a similar pattern of enterprise composition; Mahamud (2011) examined the livelihood of the people of Boyer *char* in Noakhali district of Bangladesh, under the intervention of *Char* Development and Settlement Project (CDSP) by the government of Bangladesh and aimed to evaluate whether and to what extent the intervention brought a change in the livelihood of the people.

The above review indicates that most of the studies discussed about different farming systems, their respective profitability and farmers' livelihood condition but most of them are not in the *char* areas. To minimize the research gap, the present study will examine the socioeconomic status of *char* farmers, comparative profitability of non-supported and GO-NGO supported farming practices and its impacts on changes in farmers' monetary income.

The specific objectives of the study are:

- To examine the comparative profitability analysis of GO-NGO supported farmers
- To investigate the key determinants of the adoption of different supports and services provided by the GOs and NGOs

Materials and Methods

Study Areas and Sample Size

A total of 60 farmers (30 from non-supported and 30 from GO-NGOs supported both in Belkuchi and Chauhali upazila in Sirajganj district) were selected by following purposive sampling technique for data

collection where different GO-NGOs organizations are working for the improvement of the lot of *char* people. This survey has covered ten numbers of crops along with non-farm activities for one year. The data were collected from the selected farmers through direct interview on recall basis. Moreover, Focus Group Discussions (FGD) and Key Informant Interviews (KII) were conducted. The primary data were collected on ten different competitive crops grown in a calendar year (Karim *et al.*, 2014) namely, Aus, Aman, Till, Boro, Jute, Wheat, Dhoincha, Mustard, Maskalai and Khesarikala. Secondary information sources like different books, handouts, publications, notifications, published and unpublished documents of Government of Bangladesh and its different non-government organizations were also taken into consideration.

Analytical Techniques

The data were analyzed with an amalgam of descriptive statistics (i.e., sum, mean, percentages, etc.), mathematical (profitability analysis) and statistical (difference-in-differences method, Ravallion test and logit model) analyses.

Profitability of Different Crop Farming

Per hectare profitability of crop production, from the view point of individual farmers was measured in terms of gross return, gross margin, net return, benefit cost ratio (undiscounted) and profitability ratio. The formulae needed for the calculation of profitability are discussed below:

Gross Return (GR)

The following equation was used to estimate GR:

$$GR = P \times Q$$

Where:

- GR* = Gross return
- P* = Sale price of the product (Tk.)
- Q* = Yield per hectare (unit)

Gross Margin (GM)

Gross margin was calculated by:

$$GM = GR - TVC$$

Where:

- GM* = Gross margin
- GR* = Gross return
- TVC* = Total Variable Cost

Net Return (NR)

The following algebraic form of net return was used for estimation:

$$NR = GR - (TFC + TVC)$$

Where:

NR = Net return
 GR = Gross return
 TFC = Total fixed cost (Tk.)
 TVC = Total variable cost (Tk.)

Benefit Cost Ratio (BCR)

The formula of calculating BCR (undiscounted) was as follows:

$$BCR = GR \div (TFC + TVC)$$

Where:

BCR = Benefit cost ratio
 TFC = Total fixed cost (Tk.)
 TVC = Total variable cost (Tk.)

Profitability Ratio

The formula used for estimating profitability ratio was as follows:

$$\text{Profitability ratio} = NR_{NS} \div NR_S$$

Where:

NR_{NS} = Net return of non-supported farmers; and
 NR_S = Net return of GO-NGO supported farmers

Impact of GO-NGO Support on Farmers' Income Generation

Ravallion Test

The impacts of GO-NGO support on crop farming were measured by using comparison of the non-supported and GO-NGO supported farmers' income generation with the help of Ravallion test. The formula used for estimation defined by Ravallion (2008) was as follows:

$$I = \frac{1}{n} \sum_{i=1}^n (O_i^T - O_i^C)$$

Where:

I = Average impact
 N = Sample size
 I = Sample units
 O = Value of the interpretable impact indicator
 T = Treatment group
 C = Control group

The paired sample t test was applied to test the significance of relevant parameters.

Difference-In-Differences (DID) Method

DID was constructed to measure what would have happened if the GO-NGO support had not been available, and to find the difference between the previous

and present situation after the support provided. The following formula was used for estimation:

$$DID = (S_1 - N_1) - (S_0 - N_0)$$

Where:

S_0 = 'Before' situation of GO-NGO supported farmers
 S_1 = 'After' situation of GO-NGO supported farmers
 N_0 = 'Before' situation of non-supported farmers
 N_1 = 'After' situation of non-supported farmers

Determinants of Adopting GO-NGO Support in Different Farming Operations

To determine the factors that have significant influence on the adoption of GO-NGO support in the study areas, logit regression model of the following form was used:

$$Y = \ln\left(\frac{P_i}{1 + P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon_i$$

where, P_i is the probability of adoption and non-adoption of GO-NGO support; and $P_i = 0$ indicates non-adoption and $P_i = 1$ indicates adoption. Dependent variable (i.e., binary variable): Y = Probability of adoption of GO-NGO support. Independent variables: X_1 = Farm size (ha); X_2 = Age of household head (years); X_3 = Household size (number); X_4 = Educational level of household head (years of schooling); X_5 = Farm income (Tk.); X_6 = Non-farm income (Tk.); β_0 = Intercept; β_1 to β_6 = Regression coefficients of the dependent variables and ε = Disturbance term.

According to Gujarati (1995), the marginal probabilities of the key determinants of adopting GO-NGO support were estimated based on expressions derived from the marginal effect of the logit model which was estimated as:

$$dY / dX = \beta_i \{P(1 - P_i)\}$$

where, β_i = Estimated logit regression coefficient with respect to the i^{th} factor; and P_i = Estimated probability of a farm household adoption status.

Results and Discussion

Socioeconomic Status of the Char Farmers

Socioeconomic status of the farmers in *char* areas is represented in Table 1. Average crop area was 0.21 ha for non-supported and for GO-NGO supported farmers it was 0.25 ha. Average numbers of livestock and poultry birds were 3.83, 4.27 and 5.35, 7.65 for non-supported and GO-NGO supported farmers, respectively.

Table 1. Socioeconomic status of the *char* farmers

Particulars	Non-supported farmers	GO-NGO supported farmers
Crop area (ha)	0.21	0.25
Livestock (no.)	3.83	4.27
Poultry (no.)	5.35	7.65
Agroforestry (no.)	5.15	5.48
Family size (no.)	5.20	6.30
Age (16-55 years) (%)	51.60	61.90
Average literacy rate (%)	53.30	64.30
Occupational status		
Farming (%)	23.30	30.00
Farming + handloom (%)	40.00	20.00
Rented/mortgaged/leased-in land (%)	55.20	60.50
Dependency ratio (no.)	2.25	2.52

Source: Field survey, 2015

Average number of agroforestry was 5.15 and 5.48 for non-supported and GO-NGO supported farmers, respectively. Most of the farmers fell within the working age group of 16 to 55 years and it was 51.6 and 61.9%, respectively for non-supported and GO-NGO supported farmers in *char* areas. Average family size of non-supported and GO-NGO supported farmers was 5.2 and 6.3 which was higher than the national average of 4.53 (HIES, 2010). Average literacy rate of GO-NGO supported farmers (64.3%) was higher than the non-supported (53.3%) farmers and it also exceeded the national average literacy rate (57.9%) (BER, 2013). On an average, 23.3% farmers were engaged in crop farming in case of non-supported whereas, which was 30.0% for GO-NGO supported farmers. Rented/mortgaged/leased-in land contained the maximum portion of the total farm size, and it was 55.23 and 60.50% for non-supported and GO-NGO supported farmers, respectively. In the study areas, economically working and earning persons were 2.25 and 2.52 for non-supported and GO-NGO supported farmers, respectively.

Credit and Training Utilization Pattern

The GO-NGO supported farmers have spent the loan they took mainly for the farming and non-farming activities. From Table 2 it is apparent that 44.5 and 55.5% loaned money were utilized for agricultural and non- agricultural purposes. Being poor, they used their credit in some non-agricultural purposes such as small business, daughter marriage, food consumption (during flood period), etc. There are different GO-NGO organizations working in *char* areas that provide loans and training to the farmers for various purposes. Farmers of *char* areas generally borrowed money from BRDB under the project of 'one house one farm', ASA, MMS, GKS, CLP, CARITAS, NDP, BRAC, CARE, Bangladesh, etc. They also provide the farmers facilities with safe drinking water, sanitation and hygiene, and involvement with various income generating activities.

They also provide various training and technical assistance in agricultural activities such as, rice plantation, vegetable cultivation, cattle and goat rearing, poultry production, etc. for both men and women in the study areas. Sometimes different expert teams also visited the *char* areas and gave some valuable advice to cope with the natural calamities.

Profitability of Different Crop Farming

Variable Cost

Average cost of human labor was estimated at Tk. 14525 and Tk. 16334 per hectare for non-supported and GO-NGO supported farmers, respectively in *char* areas. Farmers usually used power tiller on the basis of rent. Average power tiller cost was estimated at Tk. 6424 and Tk. 6299 per hectare for non-supported and GO-NGO supported farmers, respectively. Most of the farmers used purchased seeds for different crop production from the local market. Costs of different seed per hectare was at Tk. 2139 for non-supported and Tk. 2397 was estimated in case of GO-NGO supported farmers in the study areas. Farmers applied following kinds of fertilizers such as, urea, TSP, MoP, DAP and others, the cost of which were Tk. 3035, 1570, 462, 310 and 402 for non-supported farmers and for GO-NGO supported farmers it were Tk. 3145, 1670, 555, 245 and 345 per hectare, respectively. It is seen that cost of fertilizers for crop farming were estimated at Tk. 5779 and Tk. 5730 per hectare for non-supported and GO-NGO supported farmers, respectively. In the study areas, all farmers were dependent on deep tubewell and shallow tubewell for irrigation. Average irrigation costs were Tk. 4560 and Tk. 4698 per hectare for non-supported and GO-NGO supported farmers, respectively. Costs of insecticides were found to be Tk. 206 and Tk. 148 in case of non-supported and GO-NGO supported farmers, respectively. It is observed that total variable cost varied from year to year. It was Tk. 33635 for non-supported farmers and on the other hand, it was estimated at Tk. 35609 for GO-NGO supported farmers (Tables 3 and 4).

Table 2. Uses of credit by the GO-NGO supported farmers

Purposes	Amount (Tk.)	Percentage of credit used (%)
Agricultural activities	8835.0	44.5
Non-agricultural activities	11065.0	55.5
Total	20000.0	100.0

Source: Field survey, 2015

Table 3. Cost of production per hectare for non-supported farmers

Cost items	Aus	Aman	Till	Boro	Jute	Wheat	Dhoincha	Mustard	Maskalai	Khesari kalai	Average
Variable cost											
Human labor	29572	20461	9818	19702	9615	8113	10382	11352	12074	14167	14526
Power tiller	4749	12152	2072	9585	4315	7211	4464	14034	1661	4002	6425
Seed/seedlings	4631	2664	309	2950	1226	3691	748	390	3019	1770	2140
Fertilizer cost											
Urea	5552	1430	788	5980	2750	3290	2345	7865	1190	1765	3035
TSP	2876	463	100	2985	670	1865	200	2455	-	345	1570
MoP	1476	-	-	1198	-	1142	-	1598	-	-	462
DAP	670	-	-	780	-	456	-	1186	-	-	310
Others	450	20	-	111	157	1097	362	1866	89	218	402
Total fertilizer cost	11024	1913	888	11054	3577	7850	2907	14970	1279	2328	5779
Irrigation	45602	-	-	-	-	-	-	-	-	-	4560
Insecticides	1907	-	-	-	-	159	-	-	-	-	207
A. Total variable cost	97484	37190	13087	43291	18733	27024	18501	40747	18033	22266	33636
Fixed cost											
Lease value	8732	4366	4366	8732	8732	8732	4366	4366	4366	4366	6113
Interest on operating cost	4549	1736	611	2020	874	1261	863	1902	842	1039	1570
B. Total fixed cost	13282	6102	4977	10753	9607	9993	5230	6268	5208	5405	7682
C. Total cost (A +B)	110766	43292	18064	54043	28340	37018	23730	47014	23240	27672	41318

Source: Authors' estimation, 2015

Table 4. Cost of production per hectare for GO-NGO supported farmers

Cost items	Aus	Aman	Till	Boro	Jute	Wheat	Dhoincha	Mustard	Maskalai	Khesari kalai	Average
Variable cost											
Human labor	30562	18793	10603	29192	21374	11412	11222	9238	10501	10449	16335
Power tiller	4375	13315	4374	11228	4966	9942	4476	6928	925	2463	6299
Seeds/seedlings	4077	3243	324	3368	1525	5328	771	411	3367	1563	2398
Fertilizer cost											
Urea	4567	1458	1456	4678	2890	4789	2347	7345	865	1386	3145
TSP	2765	455	356	2564	876	2979	200	2765	-	472	1670
MoP	1655	-	234	1198	230	1465	-	765	-	-	555
DAP	670	-	-	795	-	357	-	634	-	-	245
Others	499	20	218	121	229	793	362	1655	108	83	345
Total fertilizer cost	10156	1933	2264	9356	4225	10383	2909	13164	973	1941	5730
Irrigation	46985	-	-	-	-	-	-	-	-	-	4698
Insecticides	1488	-	-	-	-	-	-	-	-	-	149
A. Total variable cost	97643	37283	17566	53144	32090	37065	19378	29741	15766	16416	35609
Fixed cost											
Lease value	8732	4366	4366	8732	8732	8732	4366	4366	4366	4366	6113
Interest on operating cost	4557	1740	820	2480	1498	1730	904	1388	736	766	1662
B. Total fixed cost	13289	6106	5186	11212	10230	10462	5270	5754	5102	5132	7774
C. Total cost (A +B)	110932	43389	22752	64356	42320	47527	24649	35495	20868	21548	43384

Source: Authors' estimation, 2015

Fixed Cost

The value of owned land was calculated as 'opportunity cost' principle. Per hectare lease value was estimated at Tk. 6112 in crop farming both for non-supported and GO-NGO supported farmers. Lease value was estimated for one year period of time based on

prevailing rate. Interest on operating cost was charged for a period of four months at the rate of Tk. 14.0% per annum. Interest on operating cost incurred Tk. 1569 and Tk. 1661 per hectare for non-supported and GO-NGO supported farmers, respectively. Total fixed cost for non-supported was estimated at Tk. 7682 and Tk. 7774 for GO-NGO supported farmers per hectare (Tables 3 and 4).

Total Cost

Total cost was calculated by summing up total variable cost and total fixed cost. Average total cost was Tk. 41318 and Tk. 43384 for non-supported and GO-NGO supported farmers per hectare, respectively (Tables 3 and 4).

Gross Return (GR)

Average gross return was Tk. 65635 and Tk. 76870 per hectare for non-supported and GO-NGO supported farmers, respectively (Tables 5 and 6).

Gross Margin (GM)

Gross margin of crop farming were estimated at Tk. 32000 and Tk. 41261 for non-supported and GO-NGO supported farmers per hectare, respectively in the study areas (Tables 5 and 6).

Net Return (NR)

Tables 5 and 6 exhibit that net return of crop farming were Tk. 24317 and Tk. 33486 for non-supported and GO-NGO supported farmers per hectare, respectively (Tables 5 and 6).

Benefit Cost Ratio (BCR)

Average benefit cost ratio (BCR) of crop farming for non-supported farmers was 1.7 indicating that crop

farming is profitable. On the other hand, the BCR was 1.8 for GO-NGO supported farmers which indicate that, the crop farming is more profitable than the non-supported one (Tables 5 and 6).

Profitability Ratio

Table 7 represents that the profitability ratio of non-supported farmers and GO-NGO supported farmers was 0.73; which implies that non-supported farmers earned Tk. 73 from crop farming while GO-NGO supported farmers earned Tk. 100. The result was significant at 5% level.

Impact on GO-NGO Support on Farmers' Income Generation

An analysis of income sources adds further insight into the income generation process. There were two sources of income for both non-supported and GO-NGO supported farmers. These sources were farm and non-farm income. After the intervention, the income of the GO-NGO supported farmers was increased because of credit facilities, extension services, supervision and monitoring of the field worker. Table 8 depicts that average annual income of non-supported and GO-NGO supported farmers in 2014 were Tk. 102672.1 and Tk. 128076.1, respectively. Table 8 also illustrates that average yearly income of non-supported and GO-NGO supported farmers in 2012 were Tk. 89200.0 and Tk. 103700.0, respectively.

Table 5. Profitability of different crops for non-supported farmers

Crops	Aus	Aman	Till	Boro	Jute	Wheat	Dhoincha	Mustard	Maskalai	Khesari kalai	Average
Output	156	50	20	102	32	94	4236	90	31	32	484
Price	728	808	1459	887	1750	837	7	925	1708	1178	1029
Return	116001	39618	29080	90671	56665	78419	28405	83065	52904	38392	61322
By-product	3612	12806	-	16571	10148	-	-	-	-	-	4314
Gross Return (GR)	119613	52424	29080	107242	66813	78419	28405	83065	52904	38392	65636
Gross margin (GM = GR-TVC)	22129	15234	15993	63951	48079	51395	9904	42318	34872	16126	32000
Net Return (GR-TC)	8847	9132	11016	53198	38473	41401	4675	36051	29664	10721	24318
Benefit-Cost Ratio (BCR = GR/TC)	1.08	1.21	1.61	1.98	2.36	2.12	1.20	1.77	2.28	1.39	1.70

Source: Authors' estimation, 2015

Table 6. Profitability of different crops for GO-NGO supported farmers

Crops	Aus	Aman	Till	Boro	Jute	Wheat	Dhoincha	Mustard	Maskalai	Khesari Kalai	Average
Output	157	53	30	112	57	104	4188	95	36	27	486
Price	838	772	1568	850	1760	864	6	920	1541	1171	1029
Return	131446	41621	47248	95434	99490	87281	25428	87547	56037	31572	70310
By-product	5374	13759	-	33683	12783	-	-	-	-	-	6560
Gross Return (GR)	136820	55380	47248	12911	112273	87281	25428	87547	56037	31572	76870
Gross margin (GM = GR-TVC)	39177	18097	29682	75973	80183	50216	6050	57806	40271	15156	41261
Net return (GR - TC)	25888	11991	24496	64761	69954	39754	779	52052	35169	10024	33487
BCR (BCR = GR/TC)	1.23	1.28	2.08	2.01	2.65	1.84	1.03	1.68	2.69	1.47	1.80

Source: Authors' estimation, 2015

Table 7. Profitability ratio

Farmers' categories	Net return	Profitability ratio	p-value	t-value
Non-supported farmers	24318	0.73**	0.026	2.262
GO-NGO supported farmers	33487			

Source: Authors' estimation, 2015; Note: ** Significant at 5 percent level

Table 8. Average annual income of the farmers

Sources of income	Non-supported farmers		GO-NGO supported farmers	
	Amount (Tk.)	Percentage (%)	Amount (Tk.)	Percentage (%)
In 2014				
A. Total farm income	71605.4	69.74	89326.1	69.74
B. Total non-farm income	31066.7	30.26	38750.0	30.26
C. Total income (A+B)	102672.1	100.00	128076.1	100.00
In 2012				
A. Total farm income	60800.0	68.16	68100.0	65.67
B. Total non-farm income	28400.0	31.84	35600.0	34.33
C. Total income (A+B)	89200.0	100.00	103700.0	100.00

Source: Field survey, 2015

In addition to assessing the impact of GO-NGO support and services on income generation in the study areas, the authors' also estimated the change in total farm income, total non-farm income as well as total income behavior of the GO-NGO supported and non-supported farmers over 2012 to 2014 periods. DID estimates showed that for non-supported farmers, total income difference was Tk. 13472.1 and for GO-NGO supported farmers, it was Tk. 24376.1. The estimated result of Double-Difference (DID) method was Tk. 10904 in the year 2012 and 2014 which is statistically significant (Table 9).

The result of Ravallion test shows that the annual average income per farm was increased from Tk. 117672.1 to Tk. 128076.1 because of the GO-NGO support. The income was increased by the amount of Tk. 10404.0 due to the support obtained from the different GO and NGO organizations working in the study areas. The finding was significant at 10% probability level and verified by the value of t-statistic (Table 10).

Determinants of Adopting GO-NGO Support by the Farmers

The result of logit regression model showed that four out of six variables included in the model were significant in explaining the variation of adopting GO-NGO support in farming practices. The significant variables were: farm size, household size, education level of the household head and farm income of the sample farm households in *char* areas (Table 11). The estimated equation was as follows:

$$Y_i = -2.542 - 3.164X_1 + 0.0056X_2 + 0.327X_3 + 1.196X_4 + 1.141X_5 + 0.046X_6$$

Farm Size

The farm size of the farmers has negative coefficient and it was 3.164, which was significant at 10% level. One unit increase in the farm size will decrease the probability of adopting GO-NGO support in farming practices by 3.16 unit, keeping other factors constant (Table 11).

Household Size

Household size has also positive coefficient and it was 0.327, which was also statistically significant at 10% level. One unit increase in the household size will increase the probability of adopting GO-NGO support in farming practices by 0.33 unit, keeping other factors constant (Table 11).

Education Level of Household Head

The parameter estimates of education level carry a positive result which is 1.196 and is statistically significant at 5% level. One unit increase in the education level of the household head will increase the probability of adopting GO-NGO support in farming practices by 1.196 unit, keeping other factors constant (Table 11).

Farm Income

This result implies that households' annual average farm income was positive which was 1.141 and significant at 10% level. If other things remain constant, one unit increase in the level of farm income will increase the probability of household to be adopted GO-NGO support in farming systems by 1.14 unit (Table 11).

Marginal Effects Subsequent to Logit Model

The results of marginal effects subsequent to logit model are shown below:

$$Y = Pr(\text{type of farmers}) (\text{predict}) = 0.492$$

Table 9. Double difference estimates for income generation

Outcome variables	Non-supported farmers	GO-NGO supported farmers	Difference	t- statistic	p-value
Total farm income in 2012	60800.0	68100.0	7300.0	15.12	0.0000
Total farm income in 2014	71605.4	89326.1	17720.7	11.93	0.0532
Difference in total farm income (2014-2012)	10805.4	21226.1	10420.7	11.30	0.1945
Total non-farm income in 2012	28400.0	35600.0	7200.0	11.50	0.1341
Total non-farm income in 2014	31066.7	38750.0	7683.3	16.36	0.0000
Difference in total non-farm income (2014-2012)	2666.7	3150.0	483.3	14.78	0.0000
Total income in 2012	89200.0	103700.0	14500.0	17.93	0.0000
Total income in 2014	102672.1	128076.1	25404.0	53.22	0.0000
Difference in total income (2014-2012)	13472.1	24376.1	10904.0	58.94	0.0000

Source: Authors' estimation, 2015; Note: Total farm incomes in 2012 and in 2014 are considered as before-after situation

Table 10. Ravallion test result (in Tk./farm)

Sources of income	Non-supported farmers (Tk.)	GO-NGO supported farmers (Tk.)
Total farm income	81605.4	89326.1
Total non-farm income	36066.7	34750.0
Total income	117672.1	128076.1
Change in total income	10404.0 (2.02*)	

Source: Authors' estimation, 2015; Note: *Significant at 10% level

Table 11. Estimates of the logit regression model

Variables	Coefficient (Y)	Std. Err.	z	P>z	95% Confidence Interval
Constant	-2.542	1.981	-2.12	0.051	-6.931
Farm size (X ₁)	-3.164*	1.551	-1.77	0.072	- 6.521
Age of household head (X ₂)	0.056	0.051	1.21	0.276	- 0.045
Household size (X ₃)	0.327*	0.169	1.79	0.097	- 0.077
Education level of household head (X ₄)	1.196**	0.631	1.92	0.059	- 0.043
Farm income (X ₅)	1.141*	0.746	1.53	0.101	- 0.321
Non-farm income (X ₆)	0.046	0.490	0.10	0.926	- 0.915

Source: Authors' estimation, 2015; Note: **Significant at 5 percent level and *significant at 10 percent level

Table 12. Estimates of the marginal effect

Variables	dy/dx	Std. Err.	z	P>z	95% Confidence Interval	X
Farm size (X ₁)	-0.771*	0.412	-1.87	0.061	-1.579	0.037
Age of household head (X ₂)	0.012	0.010	1.11	0.265	-0.009	0.032
Household size (X ₃)	0.078*	0.047	1.67	0.095	-0.014	0.170
Education level of household head (X ₄)	0.285**	0.141	2.02	0.044	0.008	0.562
Farm income (X ₅)	0.285*	0.186	1.53	0.101	-0.080	0.650
Non-farm income (X ₆)	0.012	0.123	0.09	0.925	-0.023	0.252

Source: Authors' estimation, 2015; Note: **Significant at 5% level and *significant at 10% level

The result of marginal effect shows that the farm size of the farmers has a negative value of dY/dX and it was 0.771 unit, which was significant at 10% level. It indicated that the predicted probability of adoption was 0.771 unit lower for the individual in higher farm size than for one who was smaller one, remaining all other factors the same. The marginal effect on the probability of adopting GO-NGO support in different farming practices was 0.078 unit greater

for large household size than the smaller one, keeping all other factors constant. The predicted probability of adoption was 0.285 unit higher for the individual in better education level than for one who was less educated, holding all other factors equal. The predicted probability of adoption was 0.285 unit higher for the individual in higher farm income than for one who was smaller farm income earner, assuming other things unchanged (Table 12).

Constraints of Farming Systems in Char Areas

Majority of the farmers pointed out that lack of transportation problem was the main problem in the study areas. A number of the farmers said that, low price of output was an important problem in the study areas. Basically, the reason behind this was the lack of transportation facilities. High prices of different inputs were also one of the most important problems which was stated by both non-supported and GO-NGO supported farmers the study areas. Lack of education and training facilities were also identified as foremost difficulties for GO-NGO supported farmers compared to the non-supported farmers.

Conclusion

For increasing farm productivity and income, credit can play a very important role. The GO-NGO supported farmers have used their credit loan especially for the purpose of agricultural and non-agricultural activities. Major amount of loaned money the utilized for agricultural purposes included purchasing of agricultural inputs and maintenance. Different crop farming was much more profitable for GO-NGO supported farmers than the non-supported farmers. Income generation was increased due to the intervention of different support agencies for GO-NGO supported farmers compared to the non-supported farmers.

Policy Implications

Increase in farm size, household size, level of education and farm income enable farmers to renovate their production system through GO-NGO supports would be more helpful to increase the production level of *char* farmers. To overcome these stated constraints, GOs and NGOs should take initiatives to carry out the suggestions given by the local farmers to achieve self-sufficiency in production of food as well as in consumption.

Acknowledgement

The authors are thankful to Ministry of Science and Technology (MoST), Government of the People's Republic of Bangladesh to grant National Science and Technology Fellowship, 2014-15 for funding partly to conduct this study. The authors also express their earnest gratitude to the respondents and stakeholders of the study areas for their alliance and assistance in conducting surveys and collecting the data and information.

Author's Contributions

Md. Monirul Islam: Designed, collected and checked the analyzed data; prepared the draft manuscript and approved the final manuscript.

Arifa Jannat: Coordinated the study, analyzed the data and supervised the draft manuscript.

Aurup Ratan Dhar: Reviewed the draft manuscript, prepared the draft manuscript and contributed in data interpretation.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

References

- BER, 2013. Ministry of Finance, Government of the Peoples' Republic of Bangladesh.
- Hasan, S.S. and S. Sultana, 2011. Food and economic security through homestead vegetable production by women in flood affected *char* land. The agriculturists. *Sci. J. Krishi Found.*, 9: 44-53. DOI: 10.3329/agric.v9i1-2.9478
- HIES, 2010. Preliminary report on household income and expenditure survey, Bureau of Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.
- Islam, S., M.T. Uddin, M. Akteruzzaman, M. Rahman and M.A. Haque, 2011. Profitability of alternate farming systems in Dighapota *haor* area of Netrokona district. *Progress. Agric.*, 22: 223-239.
- Karim, M.M., M.S.U. Bhuiya and S.M.A. Hossain, 2014. Crop diversification and intensification through community vegetable production trial in a village of Dingaputa *haor*. *J. Environ. Sci. Natural Res.*, 7: 59-61.
- Kelly, C. and M.H.K. Chowdhury, 2002. Poverty, disasters and the environment in Bangladesh: A quantitative and qualitative assessment of causal linkages.
- Mahamud, M.S., 2011. Intervention of *char* development and settlement project: does it make a difference in people's livelihood at Boyer *char* in Bangladesh. Department of General and Continuing Education, North South University, Bangladesh.
- Ravallion, M., 2008. Evaluating Anti-Poverty Programs. In: *Handbook of Development Economics*, Paul Schultz, T. and J.A. Struass, (Eds.), Elsevier, pp: 3787-3846.
- Uddin, M.T., 2004. Economic analysis of integrated farming by agricultural enterprise in Mymensingh district of Bangladesh. *J. Rural Development*, 16: 40-49.