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Economics of sugarcane cultivation in some selected char lands of Bangladesh

Islam, M. S.[1], Khatun, S.[1], Kamruzzaman, M.[1], Kaysar, M. I.[2] and Islam, S[3].

[1]Agricultural Economics Division, Bangladesh Sugarcrop Research Institute (BSRI), Ishwardi, Pabna
[2]Agricultural Economics Division, Bangladesh Agricultural Research Institute (BARI), Gazipur
[3]Agricultural Economics Division, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh, Bangladesh

ABSTRACT

The study was undertaken to examine the profitability of sugarcane cultivation in char areas of Gaibandha and Kurigram districts of Bangladesh. Main objectives of the study were to explore socio-economic condition, profitability of sugarcane cultivation in char lands, factors affecting sugarcane cultivation and constraints of sugarcane cultivation in char areas. Data were randomly collected from 60 farmers taking 30 farmers from each district. A pre-tested interview schedule was used for collect data. Both descriptive and functional analyses were used in this study. Per hectare cost of sugarcane cultivation in char areas were Tk. 113976.5 which was higher in Gaibandha districts (Tk.121113) followed by Kurigram district (Tk.106840). Average yield of sugarcane in two districts were 62.04 t ha^{-1}. Per hectare net return was Tk. 62252 in the study area. Average BCR over variable cost of two districts was 1.81 which was higher in Gaibandha district 2.06 followed by Kurigram district 1.53. Human labor, Urea, TSP and irrigation were positively significant but organic fertilizer was negatively significant in the study areas. Irrigation problem, lack of clean seed, lack of adequate crusher machine, infestation of disease and pests, low price of sugarcane, lack of transportation facility and lack of money are the major constraints of char sugarcane farmers.

Key Words: *Char lands, Socio-economics, Profitability, Sugarcane and Constraints*

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I. Introduction

Sugarcane is a long duration crop and it is the main source of white sugar and *goor*. According to FAO recommendation for 153.60 million people (BER, 2013) annual requirements of sugar/*goor* is 19.97 lakh metric tons in Bangladesh. Bangladesh is producing 6.8 mMT of sugarcane of which 2.3 mMT are used by sugar mills to produce 0.20 to 0.21 mMT of sugar and 3.10 mMT are used to produce 0.30 mMT of *goor* and remaining 1.40 mMT are used for seed and chewing (Alam & Haque 2005). Shortfall of sugar is met from importation. Shortfall in *goor* cannot be met from importation, because *goor* is not

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available in the international market (KA, 1996). It is essential to increase the sugarcane area and production to meet up our national demand. But sugarcane area is decreasing day by day. During the period of 2009-10, 2010-11 and 2011-12 total sugarcane area were 1.18 lack ha, 1.16 lack ha and 1.08 lack ha respectively (BBS, 2013). 50% of sugarcane area is located in the mill zones, where sugarcane is utilized for sugar production and remaining 50% is situated in the non-mill zone, which is used for *goor* and juice production (Alam et al., 2005). At this moment there is no scope to increase the sugarcane area in plain land. But there is a scope to increase sugarcane cultivation in char lands, saline belt and hilly area. Cultivation of sugarcane on fallow char lands is getting popularity as the farmers are getting financially benefited through its cultivation. But cost of production of sugarcane cultivation is higher than any other crops in Bangladesh. The Shares of cost of major inputs for sugarcane production in the mills zones are seed (11.44%), Fertilizer (12.58%), pesticide (3.40%), irrigation (1.90%) and transportation for cane supply to the mills (8.79%) (Kabir & Alam, 2000). Due to geographical isolation from the mainland, chars are considered most backward areas in Bangladesh. Sugarcane cultivation has been creating employment and self-employment opportunities for the unprivileged people living in hardly reachable and remote reverie char areas round the years to improve their life and livelihood. Sugarcane cultivation is now become one of most profitable crops in char areas of Bangladesh. Hence the study was undertaken to examine the financial condition, factors affecting of sugarcane cultivation in char areas and constraints of sugarcane cultivation in char areas of Gaibandha and Kurigram district.

II. Methodology

Study was conducted in two char surrounded sugarcane growing districts Gaibandha and Kurigram during March-April, 2015. Shaghata and Fulchori Upazila from Gaibandha districts and Sadar Upazila from Kurigram district were selected for the study. A total of 60 farmers taking 30 farmers from each district were selected for the study. Necessary information was collected through survey method with the help of a pre-tested interview schedule. Data were collected on inputs, input costs, output, output price, yield and constraints of sugarcane cultivation. Collected data were summarized, analyzed and tabulated. Functional analysis and descriptive statistics were used to analyse the data. Profitability of sugarcane cultivation in char lands were estimated on the basis of gross return, gross margin and benefit cost analysis. In calculating gross margin, all operating costs were considered as variable cost. Family labour was also included in case of calculating total cost. Constraints were identified based on the questions asked to the respondents and then data were edited and summarized to arrive at problems

Analytical technique

Following profit equation were used to assess the profitability of sugarcane cultivation in char areas.

Gross return (GR) was calculated by multiplying the total volume of sugarcane produced by per unit price of sugarcane plus average amount of seed sell. The following equation was used to estimate GR:

$$GRi = \sum_{i=1}^{n} (QiPi + Si)$$

Where,

GR_i = Gross return from i^{th} product (Tk/ha)
Q_i = Quantity of the i^{th} product (ton)
P_i = per unit price of the i^{th} product (Tk)
S_i = Average amount of seed sell (Tk)
i =1, 2, 3, ……., n

Net return analysis considered fixed cost, cost of land rent, interest on operating capital etc. Net return was calculated by deducting all costs (variable and fixed costs) from gross return. To determine the net return following equation was used in the study:

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$$\pi = PyY - \sum_{i=1}^{n} PxiXi - TFC$$

Where,

π = Net return (Tk/ha)
P_y= per unit price of the product (Tk/ton)
Y = Quantity of the production per hectare (ton)
P_{xi} = Per unit price of i^{th} inputs (Tk)
X_i = Quantity of the i^{th} inputs (unit/ha)
TFC = Total fixed cost (Tk)
i = 1, 2, 3, …… …, n (number of inputs)

In this study, cost and return analysis are done on both variable and total cost basis. The following profit equation was developed to assess the profitability of sugarcane in char areas:

π = Gross return - (Variable cost + Fixed cost)

Here,
π = Profit per hectare
Gross return = Total production × per unit price

The following Cobb-Douglas function was used to estimate the effects of variable of sugarcane cultivation in char lands.

$Y_i = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X5^{b5}X_6^{b6}X_7^{b7}X_8^{b8}X_9^{b9}X_{10}^{b10}X_{11}^{b11}ui$

In the linear form it can be written as follows:

$InY = Ina + b_1 InX_1 + b_2 InX_2 + b_3 InX_3 + b_4 InX_4 + b_5 InX_5 + b_6 InX_6 + b_7 InX_7 + b_8 InX_8 + b_9 InX_9 + b_{10} InX_{10} + b_{11} InX_{11} + U_i$

Where,

Y = Return (Tk./ha)
X_1 = Human labor cost (Tk./ha)
X_2 = Tractor/Animal labor cost (Tk./ha)
X_3 = Seed cost (Tk./ha)
X_4 = Urea cost (Tk./ha)
X_5 = TSP cost (Tk./ha)
X_6 = MOP cost (Tk./ha)
X_7 = Gypsum cost (Tk./ha)
X_8 = $ZnSO_4$ cost (Tk./ha)
X_9 = Organic fertilizer cost (Tk./ha)
X_{10} = Pesticides cost (Tk./ha)
X_{11} = Irrigation cost (Tk./ha)
a = Constant or intercept term
$b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, b_{10}, b_{11}$= production coefficient of the respective inputs variables to be estimated
U_i = Disturbance term.

III. Results and Discussion

Socio-economic profile of sugarcane farmers of char areas

Socio-economic characteristics of farmers are very important to make judgment about present situation and further planning. Behavior and attitude of persons differ in many aspects. Age, education, occupational status, farming experience, family size, farm size etc. reflect the community passion toward agricultural practices. These types of socio-economic characteristics were recorded in the study area.

Age: Age of farmers plays a vital role in the crop production and better management. The age of sugarcane farmers of char areas were examined by classifying the farmers into four groups: 20-35, 36-50, 51-65 and 66-80 years (Table 01). Highest percent (45%) of the farmers were under the age group of 36-50 years and lowest percent (11.7%) of the farmers were under the age group of 66-80 years.

Education: Education is the backbone of the nation. Char sugarcane growers are lag behind from higher study. It hampers sugarcane production as well as many aspects of their life. In the study areas 18.3% of the sugarcane farmers of char were illiterate. 50% percent of the farmers stopped their

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education at primary level. 25% famers reached at secondary level and only 5% farmers were at higher secondary level (Table 01).

Occupation: Char sugarcane farmers were involved in various types of activities such as agriculture, business, service and others. Table 01 shows the occupational status of char sugarcane farmers. It represents that agriculture (85%) was the main occupation of char sugarcane farmers. only few farmers were involved in business and service.

Farming experience: Farm experience is a crucial factor to ensure farm productivity. In the study area it was found that average experience of sugarcane farmers of char to produce sugarcane were 10.16 years per persons per farm (Table 01).

Family size: The family size included the number of adult male, adult female and children of the respondent. Average family size was 5.7 persons per family (Table 01) for char sugarcane farmers which are higher than national average of 4.5 (BBS, 2012).

Farm size: In the study area char sugarcane farmers were categorized into three classes on the basis of their average land holding. Three classes were: small farmer (average land holding 0.05-2.49 acre), medium farmer (average land holding 2.50-7.49 acre) and large farmer (average land holding above 7.50 acre) (BBS, 2013). Table 01 represents that 51.7% char sugarcane farmers were small in size, 41.7% were medium and 6.6% were large farmers.

Table 01. Socio-economic profile of char sugarcane growing farmers in the study areas

Items	Gaibandha (n=30)	Kurigram (n=30)	All areas (n=60)
1. Age (% of farmers)			
20-35 years	23.3 (7)	10.0 (3)	16.7 (10)
36-50 years	46.7 (14)	43.0 (13)	45.0 (27)
51-65 years	30.0 (9)	23.3 (7)	26.7 (16)
66-80 years	0.0 (0)	23.3 (7)	11.7 (7)
2. Literacy level (%)			
Illiterate	16.7 (5)	20.0 (6)	18.3 (11)
Primary (Class 1-5)	53.3 (16)	46.7 (14)	50.0 (30)
Secondary (Class 6-10)	26.7 (8)	23.3 (7)	25.0 (15)
Higher Secondary (HSC)	3.3 (1)	6.7 (2)	5.0 (3)
Degree and above	0.0 (0)	3.3 (1)	1.7 (1)
3. Occupation (%)			
Agriculture	83.3 (25)	86.7 (26)	85.0 (51)
Agriculture + Business	13.3 (4)	6.7 (2)	10.0 (6)
Service+ Agriculture	3.3 (1)	3.3 (1)	3.3 (2)
Others	0.0 (0)	3.3 (1)	1.7 (1)
4. Average length of experience (Years)	12.77	7.54	10.16
5. Family size (persons/family)	5.57	5.83	5.7
6. Farm size on land holding basis (%)			
Small Farmers (0.05-2.49acre)	53.3 (16)	50.0 (15)	51.7 (31)
Medium Farmers (2.50-7.49acre)	36.7 (11)	46.7 (14)	41.7 (25)
Large farmers (above 7.50acre)	10.0 (3)	3.3 (1)	6.6 (4)

Cost and profitability of sugarcane cultivation in char lands

The cost of production included different variable cost items like human labor, animal labor, seedlings, fertilizer, insecticides, irrigation, carrying cost etc. Both cash expenditure and family supplied inputs (labor, land) were included in the analysis. Cost of land use was calculated on the basis of lease value of land. Table 02 shows that cost of sugarcane production in char area was Tk. 113976.5 per hectare of which 85.4% were variable cost and 14.6% were fixed cost. Higher production cost was observed in Gaibandha district (Tk. 121113) followed by Kurigram district (Tk. 106840). The higher variable cost

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was incurred for human labor (41.7%) followed by sett cost (13.3%), fertilizer cost (12.4%), irrigation cost (7%), Tractor/Animal labor (6%), insecticide cost (4.0%) and carrying cost (1.1%) (Table 02).

The average return of sugarcane cultivation in char lands of Gaibandha and Kurigram districts are shown in Table 03. The average yield of sugarcane cultivation was 62.04 tha^{-1} and per ton sugarcane price was calculated Tk. 2,750 in the study area. The total return was Tk. 176288.5 per hectare which was higher in Gaibandha district (Tk. 211784) followed by Kurigram district (Tk. 140673). The benefit cost ration (BCR) over variable cost was calculated 1.8 which was higher in Gaibandha district 2.06 followed by Kurigram district 1.53.

Table 02. Cost of sugarcane cultivation in char areas of Bangladesh (Tk./ha)

Particulars	Gaibandha (n=30)	Kurigram (n=30)	All areas (n=60)
A. Variable cost	102588 (84.7)	92020 (86.1)	97304 (85.4)
Human labor	51000 (42.1)	44000 (41.2)	47500 (41.7)
Tractor/Animal labor	7637 (6.3)	5987 (5.6)	6812 (6.0)
Sett	14100 (11.6)	16200 (15.2)	15150 (13.3)
Fertilizer	12423 (10.3)	15825 (14.8)	14124 (12.4)
Urea	4397 (3.6)	2996 (2.8)	3696.5(3.2)
TSP	2718 (2.2)	2065 (1.9)	2391.5(2.1)
MOP	2311 (1.9)	1376 (1.3)	1843.5(1.6)
Gypsum	1022 (0.8)	959 (0.9)	990.5(0.9)
ZnSO4	1235 (1.0)	588 (0.6)	911.5(0.8)
Boron	600 (0.5)	100 (0.1)	350(0.3)
Magnesium	140 (0.1)	141 (0.1)	140.5(0.1)
Organic	0 (0.0)	7600 (7.1)	3800(3.3)
Pesticide/insecticide	5410 (4.5)	3675 (3.4)	4542.5 (4.0)
Regent	822 (0.7)	681 (0.6)	751.5(0.7)
Furadon	3064 (2.5)	2473 (2.3)	2768.5(2.4)
Bavistin	1524 (1.3)	521 (0.5)	1022.5(0.9)
Irrigation	10518 (8.7)	5356 (5.0)	7937 (7.0)
Carrying	1500 (1.2)	977 (0.9)	1238.5(1.1)
B. Fixed cost			
Land use cost	18525 (15.3)	14820 (13.9)	16672.5 (14.6)
C. Total Cost (A+B)	121113	106840	113976.5

Table 03. Profitability of sugarcane cultivation in char areas (Tk./ha)

Particulars	Gaibandha (n=30)	Kurigram (n=30)	All areas (n=60)
Total cost (Tk./ha)	121113	106840	113976.5
Variable cost	102588	92020	97304
fixed cost	18525	14820	16672.5
Yield (ton/ha)	75.52	48.56	62.04
Price (Tk./ton)	2750	2750	2625
Return (Tk./ha)	207680	133540	170610
Average Seed sell (Tk./ha)	4104	7133	5618.5
Total Return	211784	140673	176228.5
Net return (Tk./ha)	90671	33833	62252
BCR over variable cost	2.06	1.53	1.81
BCR over total cost	1.75	1.32	1.55

Factors affecting sugarcane production in char areas

In order to determine the factors affecting in sugarcane production, Cobb-Douglas production function was used. Table 04 shows the estimated values of coefficient and related statistics of Cobb Douglas production function. The variables like human labor, Urea, TSP and irrigation were positively significant at 5% and 10% level indicated that 1% increase in human labor, Urea, TSP and irrigation

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would increase the return of sugarcane 0.29%, 0.11%, 0.17% and 0.07% respectively keeps other factors remaining constant. Variable organic fertilizer was negative and significant at 1% level implies that 1% increase in organic fertilizer would decrease the return of sugarcane 0.02% keeping other factors constant. The value of coefficient of determination (R^2) was 0.71 which indicates that 71% of the variation in gross return of sugarcane production in char areas was explained by the independent variables included in the model. F-value was positive and significant implying that the variation in return from sugarcane production in char areas mainly depends upon the independent variables in the model. Nazir et al. (2013) also reported almost similar results.

Table 04. Estimated coefficient and their related statistics of sugarcane cultivation in char areas

Regression Variables	Regression co-efficient	Standard error	t-values	R^2	Adjusted R^2	F-value
Constant	4.391	3.017	1.456			
human labor (X_1)	0.285**	0.117	2.443			
Tractor/Animal labor (X_2)	0.023	0.077	0.306			
Sett (X_3)	0.172	0.255	0.675			
Urea (X_4)	0.112*	0.057	1.943			
TSP (X_5)	0.174**	0.075	2.331	0.71	0.64	10.45
MOP (X_6)	0.047	0.055	0.847			
Gypsum (X_7)	-0.040	0.029	-1.397			
$ZnSO_4$ (X_8)	0.004	0.010	0.442			
Organic fertilizer (X_9)	-0.019***	0.007	-2.854			
Pesticide (X_{10})	-0.020	0.017	-1.178			
Irrigation (X_{11})	0.069**	0.027	2.541			

***, ** and * show the values that are statistically significant at 1 percent, 5 percent and 10 percent significant levels respectively. Source: Field survey, 2015.

Table 05. Constraints of sugarcane cultivation in char lands

Constraints	Gaibandha (n=30)	Kurigram (n=30)	All areas (n=60)
1. Technical Constraints (% of farmer response)			
Lack of improved sugarcane variety suitable to climate change	53.3 (16)	60.0 (18)	56.7(34)
Lack of clean seed	66.7 (20)	83.3 (25)	75.0 (45)
Infestation of disease and pests	73.3 (22)	76.7 (23)	75.0 (45)
Lack of irrigation facility	76.7 (23)	83.3 (25)	80.0 (48)
Lack of training facility	63.3 (19)	70.0 (21)	66.7 (40)
Scarcity of labor	33.3 (10)	40.0 (12)	36.7 (22)
Lack of credit facility in pick period	76.7 (23)	80.0 (24)	78.3 (47)
Lack of adequate crusher machine	93.3 (28)	96.7 (29)	95.0 (57)
2. Marketing Constraints (% of farmer response)			
Low price of sugarcane	90.0 (27)	93.3 (28)	91.7 (55)
Lack of transport facility	80.0 (24)	86.7 (26)	83.3 (50)
Lack of communication facility	73.3 (22)	80.0 (24)	76.7 (46)
Large number of middlemen	56.7 (17)	66.7 (20)	61.7 (37)
Outside of sugar mills area	66.7 (20)	93.3 (28)	80.0 (48)
3. Social Constraints (% of farmer response)			
Lack of money	86.7 (26)	96.7 (29)	91.7 (55)
Thief problems	53.3 (16)	66.7 (20)	60.0 (36)
Animal problems	60.0 (18)	76.7 (23)	68.3 (41)
Political disorder	20.0 (6)	30.0 (9)	25.0 (15)

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Constraints of sugarcane cultivation in char areas

The farmers of char lands were affected in various problems during sugarcane cultivation. The constraints of sugarcane cultivation in char lands are categorized into three items: Technical constraints, marketing constraints and social constraints. Table 05 illustrates that 80% farmer in the study area faced irrigation problem and during post-harvest period 95% farmer faced crusher machine problem. Lack of clean seed (75%), disease and pest problems (75%), lack of training facility (66.7%), lack of credit facility in pick period (78.3%) were major technical problems in the study areas. In case of marketing constraints, 91.7% farmer in char land supposed that price of sugarcane is low. Lack of transport facility (83.3%), lack of communication facility (76.7%), and large number of middlemen (61.7%), outside of sugar mills area (80%) were the main marketing problems of char areas. Lack of money (91.7%) and animal problems (68.3%) were the major social constraints.

IV. Conclusion and recommendation

Sugarcane cultivation shows the right path to the char farmers to uproot the poverty from char areas of Bangladesh. Char sugarcane farmers are now financially sound and there living standard are changing quickly in recent years. Cost and benefit ratio showed that sugarcane is now one of the leading cash crops in char areas. Intercropping with sugarcane is more profitable than sole sugarcane cultivation (Alam et al., 2007). Intercropping with sugarcane should be increased in char areas. Early plantation (October-November) increases cane yield of sugarcane. Ali, (1986) reported that early planting (October-November) produced 25.35% higher cane yields over late planting (February-March). Among various factors, insect pests inflict considerable losses which are estimated to be around 20% in cane yield and 15% in sugar recovery (Avasthy, 1983). Necessary steps should be taken to control insects and pests in char areas. Bangladesh Sugarcane Research Institute has adopted a pilot project to enhance employment opportunity of char dwellers in greater Rangpur districts through sugarcane cultivation. This project is working successfully with char sugarcane farmers and achieved good prosperity. Cultivation of sugarcane in char areas helps a lot to remove the word ‘‘Monga’’ from the northern part of Bangladesh. People are working round the year in sugarcane field and they are earning handsome amount of money every month in char areas. Disease free clean seed and modern production technology should be disseminated in char areas. Proper management practice will help sugarcane farmer to earn more profit in char areas.

Following activities should be done for the improvement of char sugarcane cultivation:

i. BSRI released high yielding sugarcane verities should be disseminated in char areas which can sustain adverse environmental condition.
ii. Disease free clean seed should be provided among the char sugarcane farmers so that yield of sugarcane increases in the char areas.
iii. Sugar mill zone area should be extended to the char areas so that farmers can easily supply their sugarcane to the mill authority.
iv. Price of sugarcane is very low. Price of sugarcane should be increased to enhance the interest of the farmers toward sugarcane cultivation.
v. Mortgage free credit facility should be provided to the farmer in char areas. Credit system of our country is very poor.
vi. Deep shallow tube-well should be introduced to reduce irrigation problem in char areas.
vii. Intercrop packages which are suitable for char areas should be developed for increasing profitability of sugarcane cultivation.
viii. Training on modern sugarcane production technology should be increased in char areas.
ix. Integrated pest management (IPM) system should be developed for controlling sugarcane insects and pests in the char areas.
x. Crusher machine should be provided to the char sugarcane farmers at installment basis with low interest rate to reduce the oppression of owner of crusher machine.
xi. Transportation and communication system should be developed for better marketing system.
xii. BSRI released various machineries like BSRI developed power crusher, BSRI developed power tiller operated trencher, BSRI developed pedal pump, BSRI developed mini hot water

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treatment plant, BSRI developed bud chip cutter etc. should be disseminated in the char areas for getting better result.

xiii. Political disorder should be reduced for smooth progress of sugarcane, and

xiv. Awareness among char sugarcane farmers should be developed to minimize various social constraints.

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