



Profitability Analysis of BRRI Dhan 29 in Some Selected Areas of Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author MSM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author MIK managed the analyses of the study. Authors AKMGK and MSI managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to analyse profitability of HYV Boro during the 2016 Boro season. BR-29 variety was selected for analysis as this variety is dominated among all Boro varieties in the study area. A total of 75 farmers were randomly selected from seven villages of Islampur Upazilla under Jamalpur district that produced BR-29 boro variety. Primary data collection was done from the randomly selected farmers. Functional analysis of cost and return were performed in this study. Cobb-Douglas production function was also used to determine the individual input effects on BR-29 production. Human labor, land cultivation, seed, fertilizer, manure, irrigation and pesticides were seven variables used. It was observed from the result that majority of the variables had shown

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significant impact on BR-29 Boro production value. This study also identified some problems faced by the farmers in producing BR-29 Boro rice. These were low price of output, scarcity and high wage rate of human labour, high irrigation cost, lack of credit facilities etc. Therefore, more research and extension are suggested to solve the farmers' problems to increase production of Boro rice and to ensure food security in Bangladesh.

Keywords: BR-29; Cobb-Douglas production function; profitability; food security.

1. INTRODUCTION

Bangladesh is a developing country with an estimated 2019 population of nearly 168.07 million in an area of 147,570 square kilometers. The density of population is the highest (1,115.62/square kilometer) in the world [1]. Bangladesh being an agricultural country, its economy is substantially agro based. Agriculture is the well-recognized driving force of the economy of Bangladesh. The importance of crop sector in agriculture of Bangladesh needs no emphasizing. Three types of rice namely Aus, Aman and Boro covering 1.15, 5.51 and 4.68 million hectares of land found in Bangladesh, respectively [2]. Rice is the staple food of 155.8 million people in Bangladesh [3]; it supplies 69.8% of the total caloric intake and more than 58% of the protein intake [4]. Rice production is the largest contributor to farm income, while related trade and commerce are important sources of rural non-farm income [5]. Bangladesh is the fourth largest rice producer in the world [6].

In the past, the country was largely dependent on importation of food grains with its deficit production. This was due to pressure of increasing population. But in recent years a remarkable change in rice production has already been observed in Bangladesh after introducing of HYV varieties of rice which has made remarkable progress in achieving its food security. Bangladesh Rice Research Institute (BRRI) has developed and released 46 Modern Varieties (MVS) having potential to produce 2.0 or more times yield than those of traditional varieties. Among the varieties Boro HYV BRRI dhan 29, released in 1994 has high performance in respect of yield, quality, insect and disease resistance and this Boro rice is grown during November to February where seedlings are raised in a seedbed and transplanted in the main field [7]. The variety is Moderately resistance to leaf blight, sheath blight and has an average yield of 7.5 ton/ha [8].

Boro is the common rice crop in Bangladesh. Structural change in input and output prices of

rice in Bangladesh is dependent on Boro season which made rice production a function of input supply and prices of both outputs and inputs rather than vagaries of nature. As Boro is the main rice crop in Bangladesh, stability of farm income is largely dependent on profitability from Boro production. Therefore, main focus of this study is to analyse profitability of Boro production in 2016 season.

The objectives of this study is to analyze profitability of BR-29 in 2016 Boro season, to identify major problems faced by BR-29 producing farmers and to suggest some recommendations for policy makers.

2. METHODOLOGY

Researchers follow a set of tools and techniques in order to fulfill the aims and objectives of the study. Researchers further try to find unbiased results of their studies within limited time, money and personnel. Farm management research by its very nature essentially involves primary data collected from the farmers. The type of primary data to be collected depends upon the nature of the study and its objectives. The present study was based on a field survey where primary data were collected from BR-29 growers. Methodology mainly covers selection of the study area, selection of the samples, preparation of the survey questionnaire, and collection of the data, tabulation, analysis and interpretation of the data.

2.1 Study Area

Islampur Upazila, located in between 24°57' and 25°10' north latitudes and in between 89°38' and 89°56' east longitudes covers an area of 343.02 sq km [9]. Average temperature of this area ranges from 10.8°C to 22.2°C. The average rainfall of this site is recorded 2153 ML. Its average humidity is 79.3% [10].

2.2 Sampling Technique

It was impossible to interview all the BR-29 growers in the study area due to limitations of time and resources. Considering time, availability

of fund and manpower, a limited number of farmers were selected randomly. For sampling, at first a list of BR-29 growers in a village was prepared. From a list of farmers of a village, 10-12 farmers were randomly selected. 75 farmers were selected from the randomly selected seven villages of Islampur Upazilla of Jamalpur district. Profitability of any enterprise varies due to managerial capacities of different farmers. To control the management factor, farmers who produced BR-29 in 2016 Boro season were chosen for this study.

2.3 Analytical Technique

In the present study the statistical techniques were also used to supplement the tabular technique. Simple descriptive statistics like frequency, arithmetic mean, percentages and ratios were used and interpretation and discussion of the findings were presented in simple terms.

2.3.1 Cobb-Douglas production function

Cobb-Douglas production function model was also used to identify the effect of key factors on production of BR-29.

The analysis was done for the production of BR-29 in 2016 Boro season. The formulation of the Cobb-Douglas production function is as follows:

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} e^{u_i}$$

In the linear form it can be written as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + \dots + U_i$$

Where,

Y= Gross return of BR-29 Boro rice production (Tk/acre)

a= Constant or intercept

X₁= Cost of human labour (Tk/acre)

X₂= Cost of land cultivation (Tk/acre)

X₃= Cost of seed (Tk/acre)

X₄=Cost of fertilizer (Tk/acre)

X₅= Cost of manure (Tk/acre)

X₆= Cost of irrigation (Tk/acre)

X₇= Cost of pesticide (Tk/acre)

ln= Natural logarithm

b₁, b₂ ...b₇ are co-efficient of respective variables

2.3.2 Gross return (GR)

The value of Gross return was formulated by multiplying the total volume of an enterprise

output by the average price in the harvesting period. The following equation was used to estimate GR:

$$GR_i = \sum_i^n Q_i P_i$$

Where,

GR_i = Gross return from *i*th product (Tk/acre);

Q_i = Quantity of the *i*th product (kg/acre);

P_i = Average price of the *i*th product (Tk/kg);

and *i* = 1, 2, 3 n.

2.3.3 Net Return (NR)

The analysis of net return analysis comprises fixed costs; cost of land rent, interest on operating capital etc. The values of net return were calculated by deducing both costs (variable and fixed) from gross return value. To calculate the net return value of BR-29 Boro production, the following equation was used in the present study:

$$NR = GR - TC$$

NR= Net return (Tk/hectare)

GR = Gross return (Tk/hectare); and

TC = Total cost (Tk/hectare) In this study, cost and return analysis was done on both variable and total basis.

The following profit equation was developed to assess the profitability of fish production:

$$\pi = \text{Gross return} - (\text{Variable cost} + \text{Fixed cost})$$

Here, π= Profit per hectare;

2.3.4 Benefit-cost ratio (BCR)

The benefit cost ratio (BCR) is a relative measure which compares the benefit of per unit of cost. BCR was estimated as a ratio of gross return and gross costs. The formula of calculating BCR (undiscounted) is shown as below:

$$BCR = \frac{\text{Gross Benefit}}{\text{Gross Cost}}$$

- If a project has a BCR greater than 1.0, it is expected to deliver a positive net present value to a firm and its investors.
- If a project's BCR is less than 1.0, the project's costs outweigh the benefits and it should not be considered.

3. RESULTS AND DISCUSSION

3.1 Profitability Analysis

This section mainly deals with the pricing procedures for items of costs and returns of BR-29 Boro production. In calculating profit or loss of an enterprise or relative profitability of different crops costing of inputs and valuation of output is essential. Farmers in the study area used both purchased and home supplied inputs for the production of BR-29 Boro rice, which were valued at the prevailing market rate during survey period or at the price paid by the farmers. The output was also valued at the prevailing market price. Purchased input such as seed, fertilizer, irrigation, pesticides, hired labour etc. involved direct expenses and therefore, pricing of these inputs was easy. Since no cash payment was made for the home supplied inputs, the costs of these inputs were estimated by using the opportunity cost principle. For analytical advantage, the cost items were classified under the following headings; human labour, animal labour, power tiller, seed, fertilizer, manure, pesticides, irrigation, land use cost and interest on operating capital.

Table 1 shows that average yield of BR-29 in Jamalpur district was 3000 kg/acre. The gross returns (including by product) from BR-29 were estimated Tk. 56750.00. The average net returns per acre was found to be Tk. 10875.00 for BR-29.

On the basis of gross costs per hectare, production cost of BR-29 was estimated at Tk. 45875.00. Results in Table 1 shows that BCR of BR-29 rice production showed 1.23 that Tk. 1.23 would be earned by spending each Tk. 1.00 investing in the rice production. So, it is clear that BR-29 rice production is profitable in the study area.

Table 1. Per acre cost and returns of BR-29 in the study area

Particulars	Unit	Results
Gross Cost (GC)	Tk.	45875.00
Main product (paddy)	kg	3000.00
Per unit price of paddy	Tk./kg	16.00
Value of product	Tk.	48000.00
Value of by-product	Tk.	8750.00
Gross Return (GR)	Tk.	56750.00
Net Return (NR)	Tk.	10875.00
Benefit Cost Ratio (BCR)	-	1.23

Source: Field Survey, 2016

3.1.1 Factors affecting gross return of selected rice production

The effects of the explanatory variables were determined using linear and Cobb-Douglas model to estimate BR-29 rice production. Some of the key variables are as follows:

Human labor cost (X_1): The human labor cost coefficient was 0.410 showing positive significant relation at five percent level of significance. The coefficient indicates other factors constant, 1% human labor cost increase would change the gross return by 0.337 percent (Table 2).

Land cultivation cost (X_2): The regression coefficient for land cultivation cost was positive at five percent level of significance (Table 2). It showed that 1 percent increment in the land cultivation cost, keeping other factors constant would increase the gross return by 0.333 percent.

Seed cost (X_3): The regression coefficient of seed cost was positive for BR-29 rice and significant at five percent levels. It indicated that 1 percent seed cost increment, while the other factors were constant, would increase the gross return by 0.554 (Table 2).

Fertilizer cost (X_4): For BR-29, the coefficient was positive and significant at one percent levels of significance indicated that 1 percent cost of fertilizer increase, while other factors were constant, would increase the gross return by 0.061 percent (Table 2).

Manure cost (X_5): Regression coefficient of manure cost was found to be positive and statistically insignificant, indicating 1 percent increment in manure cost, while other factors were constant, would increase the gross returns by 0.010 percent (Table 2).

Irrigation cost (X_6): Regression coefficient of irrigation cost was found to be negative and statistically insignificant. It indicated that 1 percent increase in irrigation cost, while the other factors were constant would decrease gross returns by 0.345 percent (Table 2).

Pesticides cost (X_7): For BR-29 rice, the coefficient was negative and statistically significant at 1% level of significance. It implies that 1 percent increase in the cost of pesticide, holding other factors constant, would decrease gross return by 0.047 percent for BR-29 rice (Table 2).

The coefficients of multiple determinations, R^2 value of the model was 0.976 indicating that about 97.6 percent of change in gross return could be explained by the explanatory variables, which shown in the model. The value of adjusted $R^2 = 0.974$ indicates that the degrees of freedom (df) adjusted R^2 , explanatory variables in the model explains the 97.4 percent of the total variations in gross returns from BR-29 (Table 2).

The F-values of the equation derived for BR-29 was 393.67 which implies that all explanatory variables were important for explaining the variations in gross returns of BR-29 in the study area (Table 2).

The summation of all regression coefficients of estimated production functions of BR-29 was 0.98 were found <1 , indicating that selected rice growers allocated their resources in the rational stage of production (Stage II) respectively, where diminishing returns to scale exists.

3.2 Problems and Constraints of BR-29 Boro Production

Farmers faced a lot of problems and constrains in producing BR-29 Boro rice. In the present study, an effort has been made to identify and analyze the major problems and constraints faced by the farmers in producing BR-29 Boro rice in the study area. Some major problems and constraints which the farmers emphasized upon are discussed below:

Table 2. Estimated values of co-efficient and related statistics of Cobb-Douglas production function model for BR-29 Boro production

Explanatory variables	Results
Constant	3.499
Cost of Human labour (X_1)	0.410 ^{**} (0.201)
Cost of Land cultivation (X_2)	0.333 ^{**} (0.162)
Cost of Seed (X_3)	0.554 ^{**} (0.226)
Cost of Fertilizer (X_4)	0.061 [*] (0.031)
Cost of Manure (X_5)	0.010 (0.009)
Cost of Irrigation (X_6)	-0.347 (0.275)
Cost of Pesticides (X_7)	-0.047 [*] (0.027)
R^2	0.976
R^2 (Adjusted)	0.974
F- value	393.67
Return to scale	0.98

Note: * Significant at 1% level, ** Significant at 5% level, *** Significant at 10 % level; Figures in the parentheses indicate standard error

Table 3. Problems faced by BR-29 growers

Problems and constraints	Number of farmers	% of total farmers
i. Low output price	70	93
ii. Scarcity of human labour	60	80
iii. High irrigation cost	52	69
iv. Load shading of electricity	40	53
v. Scarcity of animal labour	44	58
vi. Lack of capital	45	60
vii. Lack of manure	45	40

Source: Field Survey, 2016

4. CONCLUSION AND RECOMMENDATIONS

BR-29 Boro production in Islampur upazila of Jamalpur district is found to be profitable. Though BR-29 provides more benefits to the farmers, they were facing some problems which need attention from government. On the basis of the findings of the study the following recommendations are made for the improvement of existing BR-29 Boro rice production.

- The policy makers should think to introduce agricultural mechanization in the study area.
- During the harvest time farmers get very low prices for their product so proper price should be ensured in harvesting time.
- There is a price support programme for paddy in this country. It must be implemented effectively during the harvesting period of paddy.
- Credit facility should be provided to the farmers for applying recommended doses of seed, fertilizer, irrigation etc. so that yield of BR-29 Boro rice can be increased.
- Extension services and its linkage with farmers should be improved to make available knowledge to the farmers.

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COMPETING INTEREST

Authors have declared that no competing interests exist.

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