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AN ECONOMIC STUDY ON MAIZE PRODUCTION IN SOME SELECTED AREAS OF BOGRA DISTRICT

S Ferdausi[1], M S Islam[1], M A Khatun*[2] and M M Islam[3]

[1]*Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*
[2]*Department of Agricultural Statistics, Sylhet Agricultural University, Sylhet-3100, Bangladesh*
[3]*Department of Agicultural and Rural Development, Sylhet Agricultural University, Sylhet-3100, Bangladesh*

Abstract

The present study was undertaken to estimate the profitability and resource use efficiency under different farm size groups of maize production. In total, 65 farmers (30 small, 30 medium and 5 large) were randomly selected from five villages of Bogra district. Both tabular and statistical analyses were applied in this study. Cost and return analysis reveal that maize is a profitable crop for all categories of farmers. On an average per hectare total cost of maize production was estimated at Tk 46278 for all farmers and Tk 41263, 53554 and 48715 for small, medium and large farmers, respectively. Again, gross margins from maize production were estimated at Tk 67592, 64694 and 74089 for small, medium and large farmers, respectively. However, net returns for the farm size groups of small, medium and large were calculated at Tk 57823, 53895 and 64138 per hectare, respectively. BCR was the highest (2.40) for the small farmers followed by medium (2.01) and large (2.32) farmers, respectively. Cobb-Douglas production function analysis indicated that out of nine variables, the effects of using seed, manure, fertilizer, irrigation and insecticide had significant impact on gross return from maize production for all farmers. Efficiency analysis indicated that most of the farmers inefficiently used their inputs. The findings of the study revealed that large farmers earned higher profit than those of small and medium farmers. The study also indicated some problems and constraints of maize cultivation and suggested some recommendations to improve maize production with a view to increasing the household income and employment opportunities of the farmers.

Key words: Maize, production costs, returns, profitability, resource use efficiency

Introduction

Maize is a cereal crop newly introduced in Bangladesh to supplement food in addition to rice and wheat for human as well as feed for livestock and poultry. The commercial production of maize started in the early 90s' and since then it is booming and has become a major cash crop. Local demand for maize stands at an estimated 1200000 tonnes annually, and this demand is mostly from the poultry and fish sector. Local production is only about 902000 tonnes (BBS, 2009) and the rest are imported. So, it can be grown successfully under rain fed condition and requires less capital which may meet this additional food requirement.

The increase in food production has been neutralized by the absolute increase in demand for food due to population growth (BBS, 2011). The policy makers of Bangladesh are always facing problems to make policies regarding the solution of the problem of malnutrition and food insecurity. An estimated 27 million ultra-poor people survive on less than 1805 kcal per day and risk losing life and livelihoods to recurrent natural disasters (BBS, 2011).

Maize is one of the most important cereals crops and it is one of the leading crops in the world. It is not only highly productive but also nutritious crop used as a human food, feed for poultry and fodder for livestock. Maize has a great prospect in Bangladesh. Production strategies require to be formulated in a manner so as to increase food production and concurrently face other problems like feed, fodder and fuel shortage. The rate of adoption and sustainability of maize depends upon its economic profitability. Economic viability is one of the important criteria for assessing the suitability of a new crop technology.

In agriculture community of Bangladesh, maize farmers are not very aware of the benefits of maize cultivation and are afraid to invest in maize cultivation due to insufficient information on maize farming and marketing techniques. While making production decision, they consider cost of production against the yield of the crop since the farmer in rural setting are often victims of risk and uncertainty. A good number of studies (Haque, 2009; Hasan, 2008; Uddin,

***Corresponding author: M A Khatun,** Department of Agricultural Statistics, Sylhet Agricultural University, Sylhet-3100, Bangladesh, email: asmakhatun_2000@yahoo.com.*

2008; Ahmed and Jahan, 2007; Shohag, 2006; Islam,2006; Mohiuddin, 2003; Hossain *et al.* 2002; Noveoselov, 2002; Islam, 2001; Haque, 1999; Haque and Raha, 1997; Ashraf and Rahman, 1995; Islam and Haque, 1995; Shahidullah *et al.* 1995; Rahman, 1995; Hussain *et al.* 1994; Bakshi, 1990) were conducted on maize production as a whole but a little research conducted on profitability of maize production. The present study was, therefore, undertaken to determine the profitability and resource use efficiency of maize production on the basis of farm size and to provide valuable information and may be useful for formulating appropriate policy for widespread cultivation of maize in Bangladesh. Further it aims to identify major constraints faced by the farmers in production of maize in the study area.

Materials and Methods

Although maize is grown all over Bangladesh, the district Bogra is one of the important districts where it is grown quite extensively. So, on the basis of higher concentration of maize production, Sherpur upazila of Bogra district was purposively selected for the study. Maize is scattered grown throughout the upazila, but only 5 villages namely Tajpur, Salpa, Mirjapur, Gopalpur and Khanpur of three unions namely Kusombi, Mirjapur and Khanpur were selected purposively. The main reasons for the selecting above five villages were a large number of maize growers were present in this area, about 80 percent of total farmers of the village were involved in maize cultivation, cooperation from the respondents seemed to be high for collection of reliable data etc. Data were collected during the month of August to September in 2011. It was not possible to conduct survey all the farmers due to limitations of time and resources. The total maize farmers of the selected area was 232 among them a sample of 65 (small 30, medium 30, large 5) farmers were chosen randomly for the present study. Data were collected by the researcher herself by comprehensive interview schedules. In this study, simple profit equation was used for calculating profitability of maize. The profit function is as follows:

$\Pi = \Sigma P_{1i} Q_{1i} - TC$

Where, P_{1i}= Price of main product

Q_{1i}= Quantity of main products

TC= Total Cost

Specific model is as follows

Simple statistical techniques as well as Cobb-Douglas production function was chosen on the basis of best fit and significant result on output. The specification of the Cobb-Douglas production function was as follows:

$$Y_i = a\, X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} X_9^{b9} e^{ui}$$

In the linear form it can be written as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + b_9 \ln X_9 + u_i ;$$

Where,

Ln = Natural logarithm

Y= Return per hectare in Tk

X_1=Plot size (ha)

X_2= Human labour cost (Tk ha^{-1})

X_3= Power tiller cost (Tk ha^{-1})

X_4= Seed cost (Tk ha^{-1})

X_5= Manure cost (Tk ha^{-1})

X_6= Fertilizer cost (Tk ha^{-1})

X_7= Irrigation cost (Tk ha^{-1})

X_8=Insecticide cost (Tk ha^{-1})

X_9= Seed cost (Tk ha^{-1})

a= Constant or intercept term

$b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9$ = production coefficient of the respective input variable to be estimated and

u_i=error term.

The resources are considered to be efficiently used to result in attaining the maximum profit when the ratio of marginal value product (MVP) to marginal factor cost (MFC) approaches one. When the marginal physical product (MPP) is multiplied by the product price, it is called marginal value product (MVP). Marginal factor cost is the price of one unit of input. The optimum use of a particular input would be ascertained by the equation of equality of MVP and MFC,

i.e., $MVP_{xi}/MFC_{xi} = 1$

Results and Discussion

Profitability of maize production

Farmers had to pay cash for the purchased inputs like hired labour, power tiller, seed, organic and inorganic fertilizers, insecticides, irrigation charge etc. In order to calculate the cost of purchased inputs, the prevailing wage rate in the market for hired labour was considered as the opportunity cost of family supplied labour and in the study area average wage rate was Tk 200 per man-day. The uses of human labour in maize production per hectare were estimated at 75, 107 and 105 man-days for small, medium and large farmers, respectively. The total cost of human labour per hectare was estimated to be Tk 15032, 21320 and 20548 for small medium and large farmers, respectively (Table 1).

Table 1. Per hectare human labour cost of maize production

Items of operation	Small farmers		Medium farmers		Large farmers		All farmers	
	Human labour (man-days)	Total cost (Tk ha^{-1})	Human labour (man-days)	Total cost (Tk ha^{-1})	Human labour (man-days)	Total cost (Tk ha^{-1})	Human labour (man-days)	Total cost (Tk ha^{-1})
Land preparation	12	2405	17	33375	16	3194	15	3012
Cleaning, seed sowing	14	2800	19	3792	17	3398	16	3188
Weeding and earthing up	15	3010	18	3576	18	3606	18	3592
Fertilizers and insecticide application	5	1000	9	1809	8	1612	5	1022
Irrigation	2	400	3	612	3	596	3	618
Harvesting	12	2406	19	3784	20	4016	16	3184
Carrying and drying	5	1000	10	2000	12	2392	8	1608
Shelling and storing	10	2008	12	2389	12	2396	10	1994
Total	**75**	**15033**	**107**	**21320**	**105**	**20548**	**91**	**17832**

Source: Field survey, 2011

Per hectare cost of power tiller for small, medium and large farms were Tk 2789, 3459 and 3260, respectively and all of these costs constituted 6.76, 6.46 and 6.69 percent of the total cost, respectively. Cost of seed varied widely depending on its quality and availability of seed. Per hectare total cost of seed for maize production were calculated Tk 2520, 3613 and 3087 for small medium and large farmers, respectively which covered 6.11, 6.75 and 6.34 percent of the total cost, respectively. However overall cost of seed for maize production was calculated Tk 3069 per hectare, which covered the 6.63 percent of the average total cost. Per hectare cost of cow dung for small, medium and large farmers were Tk 1399, 2720 and 1751, respectively which represents 3.39, 5.09 and 3.59 percent of the total cost, respectively. Farmers used different kind of inorganic fertilizers in producing maize. In the study areas farmers commonly used Urea, TSP, MP, Gypsum and Borax for maize production. Per hectare cost of fertilizers were Tk 4868, 6494 and 5518 for small, medium and large farmers, respectively which constituted 11.79, 12.13 and 11.33 percent of the total cost, respectively. However overall cost of fertilizer for maize production was calculated Tk 5669 per hectare, which covered the 12.25 percent of the average total cost. Per hectare cost of insecticides were Tk 690, 741 and 647 for small, medium and large farmers, respectively which constituted 1.67, 1.38 and 1.33 percent of the respective total cost. Per hectare cost of irrigation for maize production were amounted Tk 4192, 4407 and 3953 for small, medium and large farmers which shared 10.16, 8.23 and 8.11 percent of the total cost, respectively (Table 2).

Table 2. Per hectare cost of maize production for all categories of farmers

Cost items	Small farmers (Tk ha^{-1})	Medium farmers (Tk ha^{-1})	Large farmers (Tk ha^{-1})	All farmers (Tk ha^{-1})
A)Variable cost				
Labour	15032	21320	20548	17833
Power tiller	2789	3459	3260	3134
Seeds	2520	3613	3087	3069
Manure	1399	2720	1751	2036
Fertilizers	4868	6494	5518	5669
Insecticides	690	741	647	710
Irrigation	4192	4407	395	4273
Total variable cost	**31494**	**42755**	**38764**	**36724**
B)Fixed cost				
Interest on operating capital	787	1069	969	918
Land use cost	8982	9730	8982	8636
Total fixed cost	**9769**	**10799**	**9951**	**9554**
Total cost(A+B)	**41263**	**53554**	**48715**	**46278**

Source: Field survey, 2011

Fixed costs included land use costs, interest on operating capital, repairing and depreciation, costs of tools and equipment etc. Interest on operating capital was computed by taking all variable cost incurred for all field operation. The estimated costs were Tk 787, 1069, and 969 for small, medium and large farmers, respectively. Interest on operating capital was charged for 6 months. The cost was calculated at the rate of 10 percent per annum. Considering all the sample farmers per hectare average land use cost was Tk 8636 which shared 18.66 percent of the total cost of maize production (Table 2). Land use cost was estimated for 6 months period as per the prevailing rate in the study areas.

Gross margin is obtained by deducting total variable cost from gross return. Per hectare gross margin were estimated at Tk 67592, 64694 and 74089 for small, medium and large group of farmers, respectively (Table 3). However, average per hectare gross margin of producing maize was calculated at Tk 70018. Per hectare net returns were calculated at Tk 57823, 53895 and 64138, respectively for farm size groups of small, medium and large, and its average net return per hectare was Tk 60464. The result presented in the table indicates that maize is a profitable crop but there is a difference in profitability among individual farm groups. Per hectare benefit cost ratio were estimated at 2.40, 2.01, and 2.32 for small medium and large group of farmers, respectively. However, average per hectare benefit cost ratio of producing maize was calculated at 2.31 (Table 3). It can be seen from the Table 3 that the large farmers are making the highest amount of profit while the medium farmers are earning the lowest amount of profit from their maize production (Fig. 1).

Factors affecting gross return of maize production

To determine the effects of the explanatory variables, linear and Cobb-Douglas model were initially estimated for maize production. Some of the key variables are explained below.

Seed cost (X_4): The regression coefficients of seed cost for maize production were -0.079, -0.396 and -0.270 for small, medium and all farmers, respectively. The coefficients of seed cost were negative and significant at one percent level for medium and all farmers. The coefficients indicate that an increase in one percent of seed cost, remaining other factors constant, would result in a decrease in the gross return by 0.396 and 0.270 percent for medium and all farmers, respectively. However the coefficient of seed cost for small farmer was not statistically significant (Table 4).

Manure cost (X_5): For small and all farmers the coefficients were significant at one percent level and for medium farmer the coefficient was significant at five percent level. It indicate that holding other factors constant one percent increase in cost of manure would increase the gross return by 0.165, 0.106 and 0.139 percent for small, medium and all farmer, respectively (Table 4).

Fertilizer cost (X_6): Table 4 shows that the regression coefficient of fertilizer cost was positive for all farmers and significant at ten percent level which indicates that holding other factors constant, one percent increase in fertilizer

cost would increase the gross return by 0.073 percent. However, the coefficients of fertilizer cost 0.001 and 0.116 for small and medium farmers were not statistically significant.

Table 3. Per hectare costs and returns of producing maize production

Particulars	Small farmers	Medium farmers	Large farmers	All farmers
Yield (kg)	4991	5467	5783	5528
Gross return (Tk)	99086	107449	112853	106742
Total variable cost (Tk)	31494	42755	38764	36724
Total cost (Tk)	41263	53554	48715	46278
Gross margin (Tk)	67592	64694	74089	70018
Net return (Tk)	57823	53895	64138	60464
BCR (undiscounted)	2.40	2.01	2.32	2.31

Source: Field survey, 2011

Irrigation cost (X_7):For medium and all farmers the coefficients were significant at one percent level and that for small farmer the coefficient was significant at ten percent level. It indicate that holding other factors constant one percent increase in cost of irrigation would increase the gross return by 0.063, 0.193 and 0.112 percent for small, medium and all farmer, respectively (Table 4).

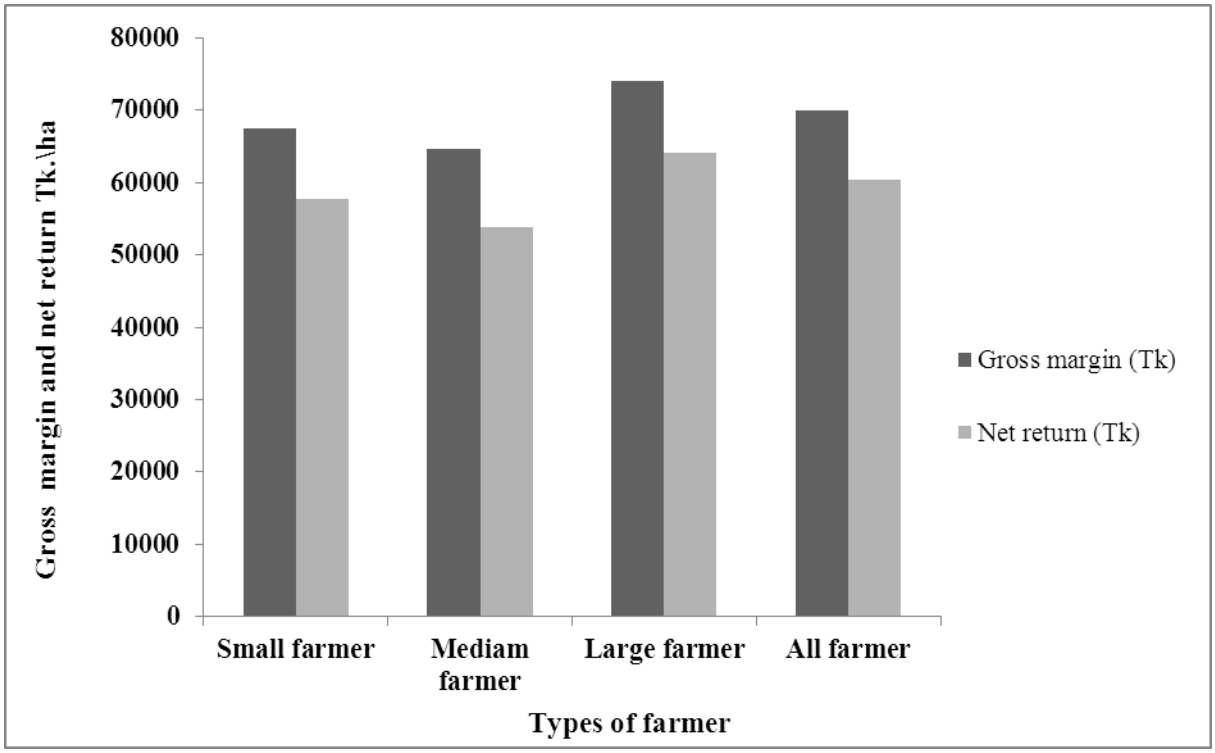

Fig. 1. Gross margin and net return of different categories of maize farmers

Insecticide cost (X_8): The regression coefficients of insecticide cost for maize production were positive and significant for small, medium and large farmers, respectively. For medium and all farmers the coefficients were significant at ten percent level and for small farmer at five percent level. It implies that one percent increase in cost of insecticide would increase the gross return by 0.132, 0.133 and 0.036 percent for small, medium and all farmers, respectively keeping other factor constant (Table 4).

Seed rate (X_9): Table 4 shows that the magnitudes of the coefficients of seed rate for maize production were positive and significant for medium and all farmers, respectively. For medium and all farmers the coefficients were significant at ten percent and one percent probability level, respectively. It indicates that holding other factors constant one percent increase in seed rate would increase the gross return by 0.305 and 0.314 percent for medium

and all farmers, respectively. For small farmer the coefficient of seed rate was 0.170 which was not statistically significant.

Table 4. Estimated values of coefficient and related statistics of Cobb-Douglas production function model for maize production

Explanatory variable	Small farmer	Medium farmer	All farmer (Small farmer +Medium farmer +Large farmer)
Intercept	8.723	8.406	9.477
	(0.912)	(1.917)	(0.476)
Farm size (X_1)	- 0.047	0.10	- 0.007
	(0.061)	(0.039)	(0.016)
Human labour cost (X_2)	0.025	0.169	0.045
	(0.093)	(0.173)	(0.053)
Power tiller cost (X_3)	0.049	- 0.055	0.021
	(0.063)	(0.085)	(0.042)
Seed cost (X_4)	- 0.079	- 0.396***	- 0.270***
	(0.173)	(0.128)	(.071)
Manure cost (X_5)	0.165***	0.106**	0.139***
	(0.045)	(0.043)	(0.026)
Fertilizer cost (X_6)	0.001	0.116	0.073*
	(0.116)	(0.144)	(0.060)
Irrigation cost (X_7)	0.063*	0.193***	0.112***
	(0.041)	(0.066)	(0.028)
Insecticide cost (X_8)	0.132**	0.133*	0.036*
	(0.066)	(0.080)	(0.033)
Seed rate (X_9)	0.170	0.305*	0.314***
	(0.155)	(0.231)	(0.080)
R^2	0.701	0.542	0.658
F-value	8.571***	5.136***	11.772***
Returns to scale	0.479	0.671	0.463

Source: Field survey, 2011
Note: Figures within the parenthesis indicate standard errors.
****Significant at 1% level*
***Significant at 5% level*
**Significant at 10% level*

The coefficients of multiple determinations R^2 of the model were 0.70, 0.54 and 0.66 for small, medium and all farmers, respectively. R^2 of 0.70 for small farmer in maize production indicate that about 70 percent of variations in gross return from maize production have been explained by the explanatory variables, which were included in the model (Table 4).

R^2 of 0.54 for medium farmer indicate that about 54 percent of total variations in gross return from maize production could be explained by the explanatory variables included in the model. R^2 of 0.66 for all farmers indicate that about 66 percent of total variations in gross return from maize production could be explained by the explanatory variables included in the model (Table 4).

The F-values of the estimated production function were significant at one percent probability level for small, medium and all farmers, respectively (Table 4), which implies good fit of the models. That is, all explanatory variables included in the model were important for explaining the variation of maize production.

The summation of the estimated coefficient was 0.479, 0.671 and 0.463 at one percent level of significance for small medium and all farmers, respectively (Table 4) which indicated that the decreasing returns to scale.

The geometric mean value of gross return for all farmers was 109097.79 and Table 5 shows that the ratio of MVP and MFC for manure, fertilizer, irrigation and insecticide were positive and more than one, which implied that, more profit could be obtained by increasing the use of these inputs. This indicated that these inputs were being allocated efficiently and maize crop farmers could enhance their income through more intensive use of these inputs on their

farm. The ratio of MVP and MFC for seed was negative indicating that maize crop producers would be losing by applying additional dose of this input in the production process. The ratio for human labour and power tiller were less than one but positive, which indicated that farmers should limit the use of these resources (Table 5).

With regard to the major problems faced by the farmers, the findings revealed that low output price, low seed quality, lack of marketing facilities, high price of fertilizers and other important inputs, infestation of insects and diseases etc. were the major obstacles which stand in the way of maize production in the study area.

Table 5. Ratio of marginal value products (MVPs) and marginal factor costs (MFCs) of different inputs incurred in the production function of maize for all farmers

Inputs	Geometric mean	Coefficient	The ratio of MVP_{xi} and MFC_{xi}
Human labour	17326.63	0.045	0.28
Power tiller	3010.92	0.021	0.76
Seed	2921.93	-0.270	-10.08
Manure	1958.63	0.139	7.74
Fertilizer	5541.38	0.073	1.43
Irrigation	3904.95	0.112	3.13
Insecticide	632.70	0.036	6.21

Source: Field survey, 2011

Since maize is a relatively new crop in Bangladesh but its production is profitable. It was observed that large farmers earned higher profit compared to small and medium farmers. There are remarkable variations in input use particularly labour, irrigation, insecticides, manure, fertilizer etc. and other practices in the study area. The findings of the study indicated that the effects of increasing cost for using seed, manure, fertilizer, irrigation and insecticide had significant impact on gross return from maize production for all farmers. So the government should provide all possible help to supply required inputs and other necessary support to the farmers to increase maize production significantly. After cultivation of maize, total household income of rural people increased significantly which enabled them to spend more on the basic items such as food, education, clothing, health care and housing compared to before. It indicates that livelihood and standard of living of maize farmers improved to some extent. If modern inputs and production technology can be made available to the farmers in time, yield and production of maize may be increased which can help the farmers to increase income and improve livelihood conditions. Maize farmers were not aware about the efficient use of resources. To increase the productivity of maize government, DAE, farmers' cooperative organization and other related institutions should provide training the farmers by extension service people to make the farmers aware about the efficient use of their inputs. Farmers did not follow the appropriate doses of fertilizer; they were suffered from seed adulteration. So the government, NGO and other related institutions should take initiatives to control the problems and will offer new dimension or policies to solve these problems.

References

Ahmad F and Jahan M A H S. 2007. Maize-pea intercropping as influenced by planting system and row arrangement. Bangladesh J. Agri. Econ. 5: 37-41.

Ashraf M A and Rahman M. 1995. Comparative trial of maize, wheat and barley in stress situation. On-Farm Research Division, BARI, MSFSCIP, KURIGRAM, Research, Research Report. pp. 1994-95.

Bakshi B C. 1990. An economic study of winter maize production in some selected areas of Mymensingh district. MS Thesis, Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

BBS. 2009. Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics, Statistic Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

BBS. 2011. Sixth Five Year Plan of Bangladesh, Bangladesh Bureau of Statistics, Statistic Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Haque A B M M and Raha S K. 1997. The Maize marketing in Bangladesh- a micro level study. Bangladesh J. Agri. Econ. 20:107-114.

Haque M N. 2009. A comparative economic analysis of hybrid maize Uttaran and 900 M cultivation in an area of Sherpur upazila in Bogra district. MS Thesis. Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

Haque N. 1999. An economic study of maize and its competitive crops; a study in Sherpur thana of Bogra district. MS Thesis. Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

Hasan M F. 2008. Economic efficiency and constraints of maize production in the northern region of Bangladesh. J. Innov. Dev. Strategy. 2:18-32.

Hossain M I, Miah M A M and Akbar M A. 2002. Impact of maize research and extension in Bangladesh. Bangladesh J. Agri. Econ. 25:17-33.

Hussain M S, Islam M N, Rahman M M and Anwar M. M. 1994. Comparative study on hybrid and composite variety of maize in selected areas of Banbladesh. BARI, Joydebpur, Gazipur.

Islam K M N. 2001. Demand projections for poultry feeds, implications for wheat and maize production in Bangladesh, Bangladesh J. Agri. Econ. 24:1-19.

Islam M M. 2006. Impact of maize production on income and livelihood of farmers: a study in a selected area of Lalmonirhat district. MS Thesis, Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

Islam M F and Haque M F. 1995. Integrating maize into existing cropping system. Opportunities and constraints in existing agro-economic niches. On Farm Research Division, BARI, Joydebpur, Gazipur.

Mohiuddin M. 2003. Efficiency and sustainability of maize cultivation in an area of Bangladesh, MS Thesis, Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

Novoselov S N. 2002. The Use of Maize in Food Industry, Pishchevaya Pronyshlemistp. pp. 64-65.

Rahman M S. 1995. A Comparative yield trial of maize, barley and wheat in stress situation, OFRD, BARI, BARIND Station, Luxmipur, Bhatpara, Rajshahi, Res. Rep. 1994-95.

Shohag M S I. 2006. Production and marketing of maize in a selected area of Gaibandha district, MS Thesis, Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.

Shahidullah M, Rahim M A and Rahman A K M. 1995. Trial on potato intercropped with maize and khira, OFRD BARI, Agricultural Research Station, Bogra.

Uddin H. 2008. An economic study on maize production under different farm size groups in a selected area of Bangladesh, MS Thesis. Dept. Agri. Econ. BAU, Mymensingh, Bangladesh.