AGRO-ECONOMIC ANALYSIS OF MAIZE PRODUCTION IN BANGLADESH: A FARM LEVEL STUDY

MONLRUZZAMAN[1], M. S. RAHMAN[2], M. K. KARIM[3] AND Q. M. ALAM[4]

Abstract

The study was carried out in four major maize growing areas namely Chuadanga, Dinajpur, Bogra and Lalmonirhat during 2006-2007 to know profitability level of maize production in Bangladesh. A total of 200 randomly selected maize growers taking 50 from each location were interviewed using pre-designed interview schedule. The average yield was found to be 8.00 t/ha. The average costs of maize production were Tk 44197, Tk 33195 and Tk 24441 per hectare on total cost, variable cost and cash cost basis respectively and gross return was Tk 69773 per hectare. The gross margin was Tk 36578/ha on total variable cost (TVC) and Tk 45332/ha on cash cost basis. The net return was observed to be Tk 25575 per hectare. Benefit cost ratios were calculated as 1.58, 2.10 and 2.85 on total cost, variable cost and cash cost basis respectively. As a result, maize cultivation was more profitable. Lack of capital and high price of TSP were the main constraints to its higher production.

Kew Words: Maize, production, agro-economic.

Introduction

Maize is one of the oldest and most important crop in the world. It is the highest yielding grain crop having multiple uses. The average yield of maize in 2003 in the world was 4.47 tons per hectare as compared to 2.67 and 3.84 tons per hectare for wheat and rice (paddy), respectively (FAO, 2004). Now maize has become an important cereal crop in Bangladesh. The area, production, and yield of wheat and maize from 1999-00 to 2005-06 are presented in Table 1. It is revealed from the table that area, production, and yield of wheat are decreasing in each year from 1999-00 to 2005-06, while it is increasing for maize in each year during the same period. Its position is 1st among the cereals in terms of yield [(maize: 5.30 mt/ha; wheat: 1.60 mt/ha and rice: 2.52 mt/ha), BBS (2006)] but in terms of area and production, it ranks 3rd just after rice and wheat. Because of more nutritious status, it could be good source of nutrients for under nourished and mal-nourished population in Bangladesh. It is now widely used in the poultry farms as feed and also used for human consumption in roasted and fried form.

[1&4]Scientific Officer and Chief Scientific Officer, Agricultural Economics Division, respectivety, [2]Senior Scientific Officer (Agricultural Economics), Farm Division, and [3]Principal Scientific Officer (Agricultural Economics), HRC, BARI, Gazipur, Bangladesh.

Table 1. Area, production and yield of wheat and maize over the period from 1999-2000 to 2005-2006.

Year	Wheat			Maize		
	Area (ha)	Production (mt)	Yield (mt/ha)	Area (ha)	Production (mt)	Yield (mt/ha)
1999-00	832000	1840000	2.21	3161	4075	1.29
2000-01	772000	1673000	2.17	4901	10350	2.11
2001-02	742000	1606000	2.16	19972	64335	3.22
2002-03	706000	1507000	2.13	29059	117255	4.04
2003-04	567000	1248000	2.20	50030	241460	4.83
2004-05	558000	976000	1.75	66803	356280	5.33
2005-06	481000	772000	1.60	98408	521525	5.30

Source: BBS (2003, 2006)

Demand for maize is increasing day by day in the world as well as in Bangladesh due to its diversified uses. If the rigid food habit of Bangladeshis is to be diversified from rice to maize, it would probably be possible to reduce food shortage to a great extent. Because, it is a high yielding and low-cost crop compared to rice and wheat. So, comprehensible plan is needed to make the crop popular and sustainable.

Bangladesh is one of the developing countries of the world. Almost half of the people of this country are still below the poverty level in terms of calories intake (2122 k. cal/day/person). So, the policy makers of Bangladesh are facing problems to make policies regarding the solution of the problem of malnutrition. Thus, if maize can be adopted in the existing cropping pattern, the food deficiency and required nutritional intake of the low income-earning people can be overcome substantially. But the rate of adoption and sustainability of maize depends largely on its economic profitability. Since studies regarding economic profitability of maize are very few, this study will provide valuable information that may be useful both of different levels of GOs and NGOs policy makers for formulating appropriate policy for widespread cultivation of maize in Bangladesh. With this view in mind, the study was undertaken to know agronomic practices, input use, cost and return of maize cultivation as well as to fmd out constraints to its higher production.

Materials and Method

The study was conducted in four major maize growing districts, namely Chuadanga, Dinajpur, Bogra, and Lahnonirhat based on intensity of maize area. The selected four districts covered 61 percent of total maize areas of the country.

At first, a list of all maize growers was collected from each area and then a total of 200 maize growers taking 50 from each area were selected randomly from the lists for the study. Data were collected from the sampled maize growers by survey method with the help of pre-tested interview schedule during 2006-2007. The collected data were summarized and analyzed by tabular methods using average, percentage, ratios, etc.

Results and Discussion

Agronomic practices

Ploughing: In the study areas, most of the farmers used power tiller for land preparation and a very little percent of farmers used country plough and tractor. They applied ploughing by 3 - 6 times. On an average, 45% farmers ploughed their maize plot 4 times, 29 % farmers ploughed 5 times, 21% farmers ploughed 6 times and 5% farmers ploughed 3 times (Table 2).

Table 2. Dislribution of sampled farmers according to number of ploughings done.

Locations	Number of ploughings used (% of farmer)				
	3	4	5	6	All
Chuadanga	12	50	30	06	100
Dinajpur	08	64	22	06	100
Bogra	0	06	32	62	100
Lalmonirhat	0	60	30	10	100
All Areas	05	45	29	21	100

Variety: Various types of maize variety were used in the study areas. It is revealed in Table 3 that on an average, 49% farmers sowed 900M variety of maize and it followed NK 40 (19%), Pacific 60 (19%), Pacific 11(11%) and Pacific 984 (2%).

Table 3. Distribution of sampled farmers according to variety used .

Locations	Variety used (% of farmers)					
	900 M	NK 40	Pacific 11	Pacific 60	Pacific 984	All
Chuadanga	42	20	06	24	8	100
Dinajpur	48	48	02	02	0	100
Bogra	46	02	02	50	0	100
Lalmonirhat	60	06	34	0	0	100
All Areas	49	19	11	19	2	100

Sowing time: Farmers in the study areas started maize seed sowing on 3 weeks of October and it continued upto the last week of December. Sixty eight percent Chuadanga farmers sowed maize seed on 3rd week to 4th week of November, 64% Dinajpur farmers sowed maize seed on 2nd week to 3rd week of December, 70% Bogra farmers sowed during 3rd week to 4th week of October, 68% Lalmonirhat farmers sowed during 2nd week to 3rd week of December (Table 4). It is found that Chuadanga and Bogra farmers followed early sowing time and Dinajpur and Lalinonirhat farmers followed late sowing time.

Table 4. Distribution of sampled farmers according to sowing date.

Sowing date	Location (% of farmer)				
	Chuadanga	Dinajpur	Bogra	Lahnonirhat	All Areas
3rd week of October	06	0	44	0	13
4th week of October	02	0	26	0	07
1st week of November	0	0	02	0	01
2nd week of November	20	0	20	0	10
3rd week of November	40	06	08	02	14
4th week of November	28	08	0	16	13
1st week of December	04	12	0	14	08
2nd week of December	0	34	0	34	17
3rd week of December	0	30	0	34	16
4th week of December	0	10	0	0	03
All	100	100	100	100	100

Harvesting time: It was found in Table 5 that 80% Chuadanga farmers harvested maize on 2nd week to 4th week of April, 56% Bogra farmers harvested on 3rd week to 4th week of March, 62% Dinajpur farmers harvested on 3rd week to 4th week of May and 78% Lalmonirhat farmers harvested 4th week of May to 1 week of June.

Crop duration: The average crop duration of maize was found 157 days. The highest crop duration was also found in Lalmonirhat (168 days) followed by Dinajpur (163 days), Bogra (151 days), and Chuadanga (147 days) (Table 5).

Table 5. Distributiøn of sampled farmers according to harvesting date and crop duration.

Sowing date	Location (% of fanner)				
	Chuadanga	Dinajpur	Bogra	Lahnonirhat	All Areas
3rd week of March	08	02	30	0	10
4th week of March	08	0	26	0	9
1st week of April	0	02	10	0	3
2nd week of April	32	04	28	0	16
3rd week of April	12	0	06	0	4
4th week of April	36	02	0	0	10
2nd week of May	04	14	0	0	4
3rd week of May	0	32	0	12	11
4th week of May	0	30	0	56	22
1st week of June	0	10	0	22	8
2nd week of June	0	04	0	10	3
All	100	100	100	100	100
Crop duration (day)	147	163	151	168	157

Inputs use

Human labour was the most important input in the production of maize. Human labour was employed in land preparation, fertilizing, intercultural operations, irrigating, insecticide, and pesticide use, harvesting, and post-harvest activities. The average human labour used for producing maize was found 144 man-days/ha in which 46% was family supplied and 54% was hired labour (Table 6). The average mechanical power was Tk. 3062 per hectare in which 21% was home supplied and 79% was purchased. On an average, the quantity of maize seeds used by the farmers was 20.32 kg/ha. Manure is the most important source to increase organic matter in the soil. All the farmers of Dinajpur and Lalmonirhat used cowdung but few farmers in Bogra and Chuadanga used cowdung. The farmers used cowdung from own source. The average quantity of cowdung was 5.5 t/ha. The highest (9.2 t/ha) use was found in Dinajpur area and lowest use was in Chuadanga area (3.2 t/ha). Farmers in the study areas used chemical fertilizers, namely urea, TSP, MP, gypsum, zinc sulphate, and borax. The average quantities of urea, TSP, MP, gypsum, zinc sulphate, and borax used in maize cultivation were found to be 464, 144, 113, 89, 8, and 4 kg per hectare, respectively. Majority of the Bogra farmers used only mixed fertilizers instead of TSP and MP and it was 400 kg/ha. Some farmers in Lalmonirhat used lime

amounting 346 kg/ha. The application of manures and fertilizers was varied among the areas as well as among the farmers.

Table 6. Per heetare use of inputs in maize production.

Items	Chuadanga	Dinajpur	Bogra	Lalmonirhat	All Areas
Human Labour(man-day):					
Own	77	42	88	57	66(46)
Hired	95	71	80	64	78 (54)
Total	172	113	168	121	144(100)
Mechanical cost (Tk):					
Own	364	566	1147	538	654 (21)
Hired	2978	2080	2235	2338	2408 (79)
Total	3342	2646	3382	2876	3062 (100)
Seed (kg)	20.62	20.38	21.36	18.92	20.32
Cow dung (ton)(Own)	3.20	9.24	3.36	6.20	5.50
Urea (kg)	463	443	444	507	464
TSP (kg)	180	137	25	233	144
MP(kg)	84	110	27	229	113
Mixed (kg)	0	0	400	0	100
Gypsum (kg)	67	95	18	177	89
Zinc(kg)	12	5	2	12	8
Borax (kg)	0.35	5	2	10	4
Lime (kg)	0	0	0	346	87

Figures in the parentheses indicate percent of total

Profitability level of maize cultivation

Cost: The cost of production was calculated on total cost, variable cost, and cash cost basis. Variable cost included the cost of human labour, mechanical power, seed, manure, fertilizers, insecticides, irrigation, and machine charge. Human labour cost was the major (25%) among the total cost items. The average costs of maize production were Tk. 44197, Tk. 33195 and Tk. 24441 per hectare on total cost, variable cost, and cash cost basis, respectively (Table 7). Gross cost slightly varied among the areas.

Table 7. Cost of production of maize (Tk/ha).

Items	Chuadanga	Dinajpur	Bogra	Lalmonirhat	All Areas
Human Labour:					
Own	5606	3406	6611	4584	5052
Hired	6917	5759	6010	5148	5959
Total	12523	9165	12621	9732	11010
Mechanical cost:					
Own	364	566	1147	538	654
Hired	2978	2080	2235	2338	2408
Total	3342	2646	3382	2876	3062
Seed (purchased)	3174	3760	3060	3233	3307
Cowdung(Own)	1258	3188	1170	2138	1939
Urea	2821	2765	2774	3269	2907
TSP	3283	2006	356	3474	2280
MP	1224	1543	368	3405	1635
Mixed	0	0	5161	0	1290
Gypsum	288	359	83	698	357
Zinc	879	254	96	680	477
Borax	24	281	61	583	237
Lime	0	0	0	867	217
Total fertilizers	8519	7208	8899	12976	9401
Insecticide	202	51	668	525	362
Irrigation:					
Own	874	1897	1064	606	1110
Hired	2794	869	1575	2822	2015
Total	3669	2766	2639	3428	3126
Machine cost	760	839	1270	1093	991
Intt. on op. capital	585	518	590	630	581
Landuse cost	9880	13338	9319	9148	10421
Gross cost:					
Total cost basis	43912	43479	43618	45779	44197
Total variable cost	33447	29623	33709	36001	33195
Cash cost basis	25344	20566	23717	28135	2444

Yield: The average yield was found 8.00 t/ha. The yield found in Bogra, Dinajpur, Chuadanga, and Lalmonirhat area was 8.40 t/ha, 7.99 t/ha, 7.69 t/ha, and 7.91 t/ha, respectively. Moreover, the farmers obtained a large volume of stover. It was difficult to estimate its value because it was not sold in the market. Poor men collected it from the field without payment and used it as fuel. In some areas, rachises (cobs without grain) were sold in cash and the average return from it was Tk. 1145 per hectare (Table 8).

Return: The average gross return from grain and stover was Tk. 69773 per hectare, of which 98 % was received from grain. The gross return received by the farmers of Bogra, Dinajpur, Chuadanga, and Lalmonirhat area was Tk. 75957/ha, Tk. 62282/ha, Tk. 76186/ha, and Tk. 64665/ha, respectively. The average gross margins on total variable cost and cash cost basis were Tk. 36578/ha and Tk. 45332/ha, respectively. Bogra and Chuadanga farmers received higher gross margin than that of Dinajpur and Lalmonirhat farmers in both total variable and cash cost basis. The average net return was Tk. 25575 per hectare. The net return of Bogra, Dinajpur, Chuadanga, and Lalmonirhat areas was Tk. 32339/ha, Tk. 18803/ha, Tk. 32274/ha, and Tk. 18886/ha, respectively. On an average, benefit cost ratios were found 1.58, 2.10, and 2.85 for total cost, variable cost, and cash cost basis, respectively, which represents that one taka invest in maize production provides returns Tk. 1.58 to Tk. 2.85 based on in different costs basis. The average return to labour was calculated at Tk. 253 per day on total cost basis, which is much higher than the existing per day wage rate of Tk. 80 (Table 8). The farmers in Chuadanga and Bogra received higher returns than that of Dinajpur and Lalmonirhat farmers. Because, they sold maize early and in early price was high.

Table 8. Yield, return and profitability of maize production.

Items	Chuadanga	Dinajpur	Bogra	Lalmonirhat	All Areas
Yield (t/ha):	7.69	7.99	8.00	7.91	8.00
Gross Return (Tk/ha):					
Grain	76186	61105	74465	62756	68628
Stover	0	1177	1492	1909	1145
Total	76186	62282	75957	64665	69773
Gross cost (Tk/ha):					
Total cost basis	43912	43479	43618	45779	44197
Total variable cost	33447	29623	33709	36001	33195
Cash cost basis	25344	20566	23717	28135	24441
Gross Margin(Tk/ha):					
Total variable cost	42739	32659	42248	28664	36578
Net return (Tk/ha	32274	18803	32339	18886	25575
Benefit Cost Ratio:					
Total cost basis	1.73	1.43	1.74	1.41	1.58
Total variable cost	2.28	2.10	2.25	1.80	2.10
Cash cost basis	3.01	3.03	3.20	2.30	2.85
Returns to labour (Tk/man-day)					
Total cost basis	260	248	268	237	253

Comparative economics of maize and wheat cultivation

According to national statistics, it is revealed from the Table 1 that the area, production and yield of wheat are decreasing in each year from 1999-00 to 2005-06, while it is increasing for maize in each year during the same period. It is also revealed that the area and production of wheat were found to be decreasing (Hasan, 2006). Kabir *et al.* (2005) reported that gross margin and benefit cost ratio of wheat were Tk. 11063 per hectare and 1.67, respectively, while Tk. 21091 per hectare and 1.90 in case of maize, respectively. It is found here that the profitability of maize was higher compared to wheat.

Constraints to maize production

The maize farmers were asked to respond about the constraint of maize production. In this regard, more than one answer was given by the respondents. It is revealed from the Table 10 that lack of capital was the first ranked constraint to maize production. It followed by high price of TSP, low price of maize, high price of good seed, disturbance of bird, dog, and foxes, lack of space for maize drying, lack of good seed and lack of knowledge.

Table 10. Constraints to maize production.

Constraints	Rank Value				
	Chuadanga	Dinajpur	Bogra	Lalmonirhat	All Areas
1. High price of TSP	2	1	5	2	2
2. Lack of Capital	4	1	3	1	1
3. Low price of Maize	0	3	2	2	3
4. Lack of good seed	3	0	0	0	7
5. High price of good seed	1	2	1	3	4
6. Disturbance of Bird, Dog and Foxes	0	4	4	0	5
7. Lack of space for maize drying	5	0	0	1	6
8. Lack of knowledge	0	0	0	4	8

Conclusions and Recommendations

Maize is a highly profitable crop on the basis of its return to investment. Modem inputs and production technology can help the farmers to increase income through increased yield and improve their socio-economic conditions. Maize can help in improving the nutritional status of the rural people. Production of maize can increase the income and employment opportunities of the farmers due to its diversified uses. Lack of capital and high price of TSP were the main constraints to its production

Since seed played a significant role on maize yield, so it should make improved seed available to the farmers at reasonable price through research institutions, DAE and other related GO/NGO institutions. Improved or hybrid maize production technologies should be available to the farmers by training through Government and Non-government Organization. In-depth economic study should be taken for development of maize.

References

BBS 2003. Yearbook of Agricultural *Statistics* of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh. Dhaka.

BBS 2006. Yearbook of Agricultural Statistics of Bangladesh. Bangladesh Bureau of *Statistics,* Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

FAO. 2004. Production Yearbook Vol. 57- 2003. FAO Statistics Series, No. 177, Food and Agricultural Organization of the United Nations. Rome, Italy.

Hasan, Md. Kamrul. 2006. Yield gap in wheat production: a perspective of farm specific efficiency in Bangladesh. Ph. D. dissertation, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh.

Kabir, M. Jahangir, Md. Elahi Baksh and M.A. Sufian. 2005. Comparative economic analysis of wheat, maize and *boro* rice cultivation under light soil in northern Bangladesh. Annual report 2004-05, Wheat Research Centre, Bangladesh Agricultural Research Institute, Noshipur, Dinajpur-5 200.