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Editors
BM Prasanna, BS Vivek, AR Sadananda, Daniel Jeffers, PH Zaidi, Christian Boeber, Olaf Erenstein, Raman Babu, Sudha K Nair, Bruno Gerard, ML Jat, Natalia Palacios and Kevin Pixley

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This book includes the extended summaries of the scientific presentations made during the 12th Asian Maize Conference and Expert Consultation on "Maize for Food, Feed, Nutrition and Environmental Security" held at Bangkok, Thailand (October 30 – November 1, 2014). The Conference was co-organized by the Asia-Pacific Association of Agricultural Research Institutions (APAARI), International Maize and Wheat Improvement Center (CIMMYT), Food and Agriculture Organization of the United Nations (FAO RAP), and Department of Agriculture (DOA), Thailand. The 12thAsian Maize Conference (AMC) brought together over 300 delegates from 30 countries worldwide, including researchers, policy makers, service providers, innovative farmers and representatives of various NARS institutions, private sector, international agricultural research centres, advanced research institutions, non-governmental organizations, foundations and funding agencies, involved in maize breeding, biotechnology, production management, seed systems, and value chains. The conference features over 225 presentations, including keynote lectures, invited oral presentations, and poster presentations, besides scientific deliberations and discussions on maize research and development in Asia. The Book of Extended Summaries includes 73 reviews/research papers on a diverse range of topics, including maize drivers in Asia; maize research-for-development opportunities and challenges; strategies for enhancing genetic gains in maize breeding; new developments in production of doubled haploids in maize breeding; maize for fodder/feed, specialty corn, value-addition and processing; stress resilient maize for Asia; socioeconomics and innovative policies for enhanced maize production and impacts; impacts and strategies for adaptation of maize-based cropping systems to the changing climate in Asia; innovations and reforms for improving efficiency of maize marketing; biotechnology for maize improvement; strengthening maize seed systems; country reports from Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, Papua New Guinea, China, Philippines, Thailand, Vietnam, Myanmar, Iran and Turkey; precision-conservation agriculture for enhanced input use efficiency; adapting maize production practices to the changing climate; nutritional enrichment of maize; and enhancing gender equity and social inclusiveness.

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Maize Production in Bangladesh: Way towards Self-sufficiency

M.A. Monayem Miah[1]*, Tanvir M.B. Hossain[1] and Ranjit Kumar[2]

[1] Agricultural Economics Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur-1701;
[2] National Academy of Agricultural Research Management (NAARM), Indian Council of Agricultural Research (ICAR), Hyderabad, India; Presently at International Crop Research Institute for Semi-arid Tropics (ICRISAT), Hyderabad, India
*Corresponding author; Email: monayem09@yahoo.com

Introduction

Since the establishment of the Bangladesh Agricultural Research Institute (BARI) in 1976, maize research developed eight composites and 11 hybrids of maize. Maize was introduced as a relatively new crop in the rice-based agriculture of Bangladesh, especially in the northern region. Currently, maize is considered an important cash crop to its growers. In terms of area and production, it ranks third after rice and wheat (BBS, 2011). The area under maize cultivation is increasing steadily due to its ready market, remunerative price, lower-cost of production, and overall higher-profitability compared to that of rice and wheat (Rahman 2011; Karim et al. 2010; Moniruzzaman et al. 2009; Uddin 2008; Mohiuddin et al. 2007).

Maize plays an important role in the agrarian economy of Bangladesh. It is extensively used as one of the major ingredients of feed for poultry and fish. Maize is also used as a starch for textiles and other industries. It is consumed in many forms across the country. Because of its higher nutritional status, it could be a potential source of nutrition for malnourished people and as a supplementary food for ensuring food security for the increasing population of Bangladesh, while the dry maize plant is a good source of fuel for rural households.

In spite of its high genetic yield potential, current maize yield is not satisfactory in the country. The present yield-gap has been estimated to be 32.7 and 41.4 percent between on-farm research yield (10.94 t/ha) and potential yield (12.61 t/ha), respectively (Miah et al., 2013). Different studies (Uddin, 2008; Ferdausi, 2011; Paul, 2012) showed that farmers could not obtain higher yield due to different agro-socio-economic constraints that need to be addressed in the interest of farmers as well as for the country.

Although the growth rates of area, production, and yield of maize are excellent in Bangladesh (Miah et al., 2013), the country is still in deficit in maize production and has to import a huge quantity of maize (Bangladesh Bank, 2013) every year to fulfill its growing demand. The average share of net import of maize to its total availability and production were 45 percent and 82 percent, respectively from 2009 to 2010 (FAOStat).

Considering the above issues, an attempt was made to examine the possibilities of attaining self-sufficiency in maize production by analyzing its current status, comparative advantage, forecast on area and production, and investment opportunities in the maize sector of Bangladesh. The study outputs can be used as a guide/tool for research intervention and making policy decisions that address the target needs for maize technology development to ensure food security in Bangladesh.

Methodology

Sources of data

Both primary and secondary data were used in this study. Primary data and information were gathered through Focus Group Discussions (FGDs) with different groups of stakeholders associated with maize. Secondary data were collected from Bangladesh Bureau of Statistics (BBS), Department of Agriculture Extension (DAE), journal articles, MS/PhD theses, research reports, FAOStat and the internet.

Analysis of growth and instability:

The study analyzed annual growth rates of area, production, and yield of maize by applying the following semi-log trend equation using national-level time-series data (1990 to 2011).

$$y = e^{a+bt} \text{ or } \ln y = a + bt$$

In this formula, y refers to area, production, and yield of maize; 't' is the time, and 'a' is the constant coefficient. The slope coefficient 'b' measures the relative change in y for a given absolute change in the value of explanatory variable 't'.

The instability in area, yield, and production of maize for the period of 1990-2011 was computed by using the following Cuddy Della Valle Index.

$$CV^* = CV \times (1-R^2)^{0.5}$$

Here, CV refers to the coefficient of variation, R^2 is the estimated coefficient of multiple determinations.

Calculation of profitability and comparative advantage

Data on inputs and outputs per hectare were collected from secondary sources (Karim et al., 2010; Moniruzzaman et al., 2009; Mohiuddin, 2003; Chowdhury, 1995). Later the inputs and outputs data were multiplied by the current price of the respective inputs and outputs for a specific area and compared to the status of farm-level profitability of maize cultivation in different regions of the country.

Domestic Resource Cost (DRC) was also calculated for evaluating the comparative advantage of cultivating maize in Bangladesh. The impact of government policies on economic incentives was measured by calculating nominal and effective protection rates. The following formula was used for calculating DRC.

$$DRC = \frac{\sum D_{ij} V_i}{B_i - \sum T_{ik} V_k}$$

(j = 1-------------m; k = 1-----------n)

Where,

D_{ij} = Quantity of j^{th} domestic resources and non-traded inputs used for producing i^{th} crop per ton

V_i = Price of j^{th} domestic resources and non-traded inputs (Tk/ton)

B_i = Border price of i^{th} crop (Tk/ton)

T_{ik} = Quantity of k^{th} tradable inputs for producing i^{th} crop per ton

V_k = Border price of tradable inputs k per ton.

Finally, an ARIMA (Autoregressive integrated moving average) model was used for predicting future area, production, and yield of maize for seven-years (2014-2020). In this case, 25 years' time series data (1989-2013) from DAE were used for this purpose.

Results and discussion

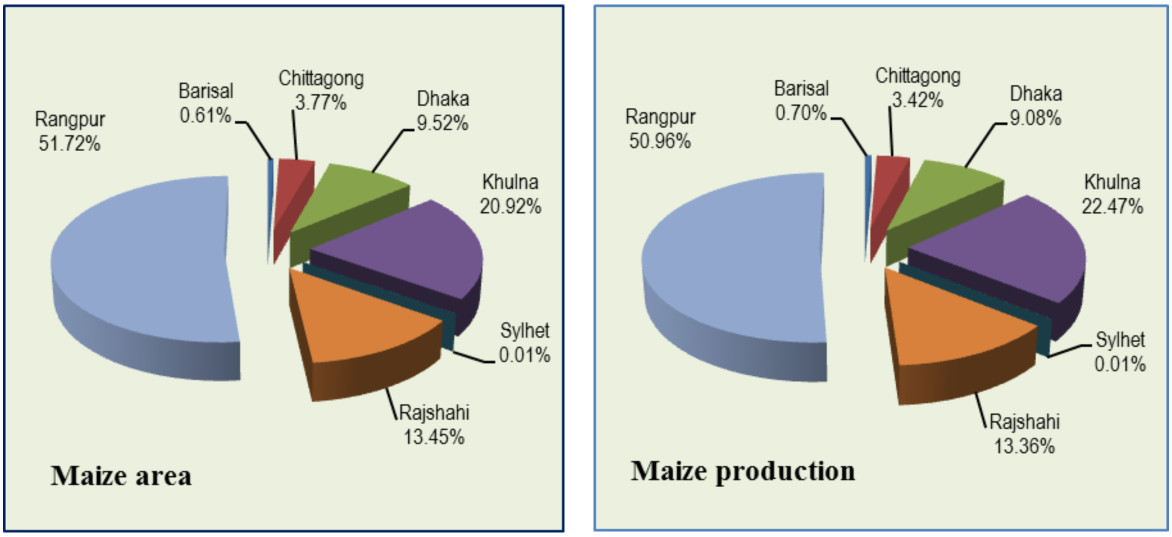
Current status of maize production

Maize is grown in almost all the areas of Bangladesh under varying environmental conditions, from subtropical low land at sea level up to high elevations. The suitable weather, friendly environment, higher return, lower cost of production, and the existing output markets encouraged farmers to cultivate maize in different seasons by replacing wheat, *Boro* rice, mustard, potato, and lentil (FGD, 2013). Total area under maize is 0.313 million hectares (ha), producing 2.183 million tons with yield of 6.98 t/ha during 2013 (DAE, 2013). Maize occupied about 1.92 percent of the cropped area in Bangladesh during 2013 (Table 1). The average area, production, and yield of maize are reported to be the highest in Rangpur and Khulna divisions compared to other divisions (Figure 1). Dinajpur, Rangpur, Chuadanga, Thakurgaon, Lalmonirhat, Manikgonj, Panchagar, Jhenaidah, Rajshahi and Bogra districts are the intensive maize growing areas of Bangladesh. These 10 districts covered more than 75 percent of the total maize area and production in 2013 (Figure 2).

Table 1. Area and production under different crops in Bangladesh during 2012/13

Major crops	Area (Million ha)	% of cropped area	Production (Million tons)
Rice	11.42	70.62	33.83
Wheat	0.42	2.60	1.25
Maize	0.31	1.92	2.17
Pulses	0.71	4.39	0.77
Oilseeds	0.76	4.70	0.89
Spices	0.51	3.15	2.98
Potato	0.44	2.72	8.60
Vegetables	0.77	4.76	13.22
Other crops*	0.83	5.13	13.20
Total	**16.17**	**100**	**76.91**

Source**:** DAE, 2013, *sweet potato, jute and sugarcane



Source: DAE, 2013 Source: DAE, 2013

Figure 1. Percent distribution of maize area and production by divisions in Bangladesh, 2012-2013.

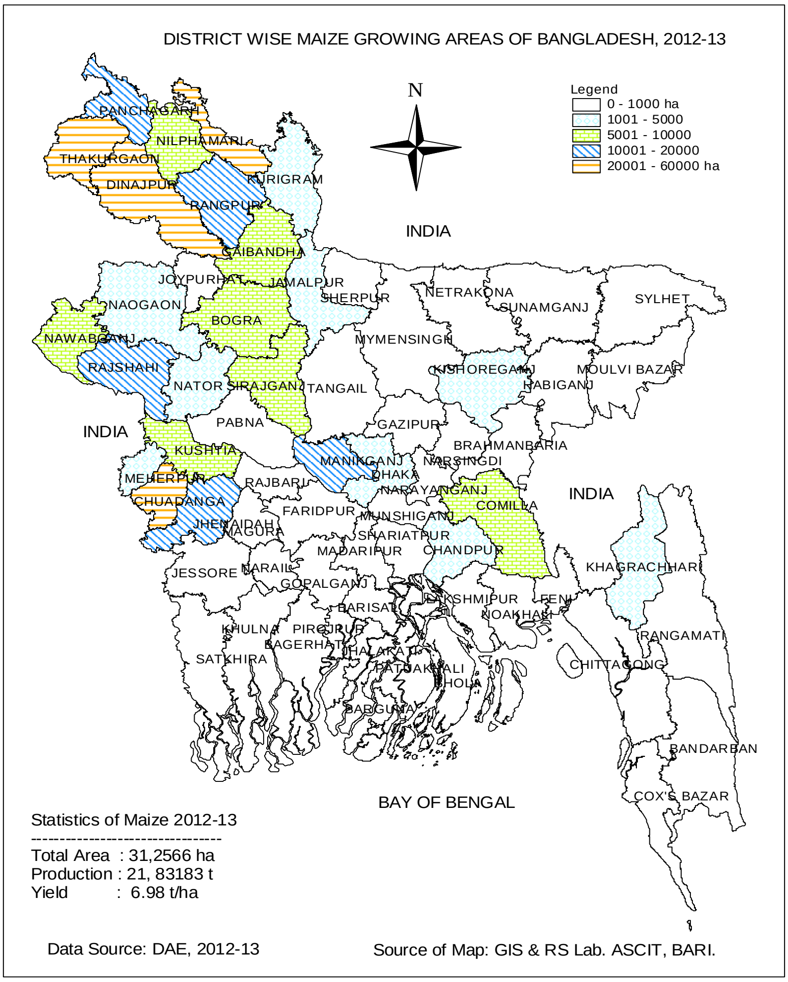


Figure 2. District-wise maize growing areas in Bangladesh, 2012-2013

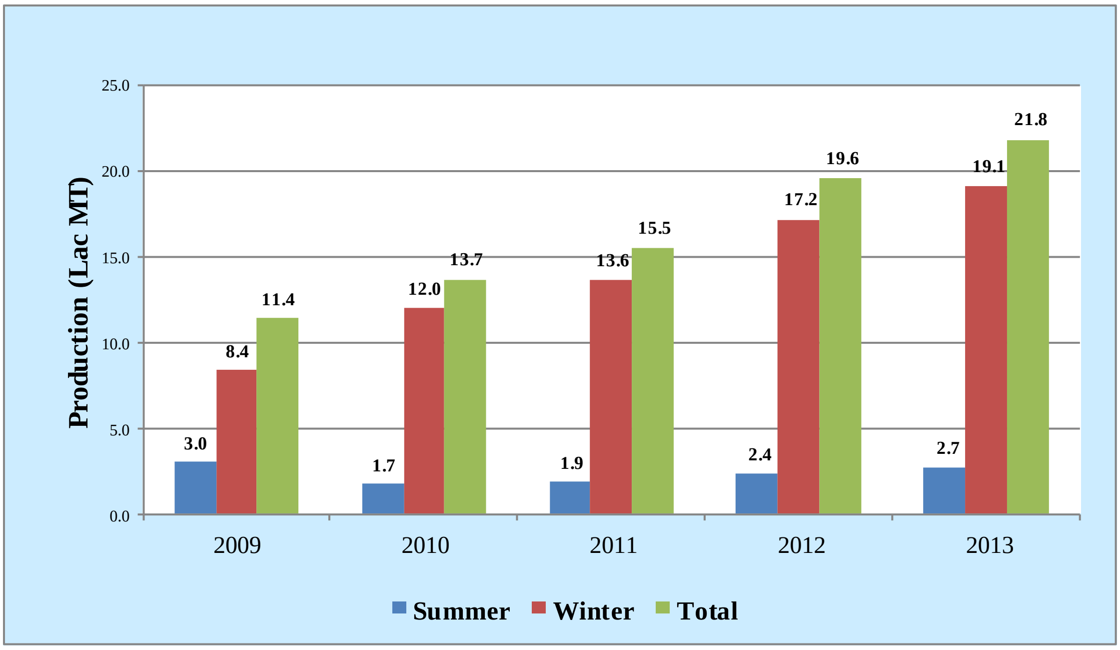


Figure 3. Maize production by season over the years. Source: DAE, 2013

Maize is grown both in winter (mid-October to mid-March) and summer (mid-March to mid-October) seasons. But, it is best adapted to the cropping pattern during the winter season. DAE (2013) statistics revealed that around 87.5 percent of maize was grown during the winter season and the remaining about 12.5 percent during the summer season in 2013 (Fig-3). Hybrid maize is grown mostly during the winter season after the harvest of T. *Aman* rice (Transplanted monsoon rice). At that time, due to the prevailing cool temperatures during early phases of crop development, the crop duration of winter hybrid maize is long i.e. around 145 days. Thus, maize- fallow- *T. Aman* is the major cropping pattern in many districts. The other maize-based intercropping systems include maize + groundnut, maize + mungbean, maize + soybean, and maize + tomato (Ali et al., 2008; Miah et al., 2013).

National data (1990-2011) show that the area and production of maize remained very low and more or less at the same level during the period from 1990 to 1999, but started increasing from 2000 and continued to increase since then. Accordingly, the production period of maize was grouped into two periods: Period I (1990-1999) and Period II (2000-2011) for analyzing the district-wise growth and instability. The results of the analysis are presented in Tables 2-3. During 1990-1999, the overall growth rates of maize area were negative with a medium-level of instability. During this period, only for Rangpur and Khulna divisions demonstrated positive growth in maize area with high instability (CDI >10%). In the next decade (2000-2011), maize area expanded rapidly in all of the divisions, except for Sylhet, due to expansion of poultry and fish farming across the country. As far as maize yield was concerned, it consistently increased during both the periods in all the divisions, barring Khulna in first period. Interestingly, the consistent growth in the crop yield was not associated with high instability, rather the variability index (CDI) ranged between 10-20 percent in all the divisions (Table 3).

Table 2. Growth and instability of maize area at division level of Bangladesh, 1990-2011

Instability	**Growth of area (1990-1999)**			
	Negative	Slow (0-3%)	Medium (3-6%)	High (6% & above)
Medium (10-20%)	Chittagong, Bangladesh	--	--	Rangpur
High (20-30%)	Rajshahi	--	--	--
Very high (>30%)	Dhaka	--	--	Khulna
Growth of area (2000-2011)				
Low (<10%)	--	--	--	Barisal, Chittagong, Dhaka, Rangpur , Bangladesh
Medium (10-20%)	--	--	--	Khulna
High (20-30%)	--	--	--	Rajshahi
Very high (>30%)	Sylhet	--	--	--

Source: Author's calculation, Note: -- indicates no division falls in the respective category

Table 3. Growth and instability of maize yield at division level of Bangladesh, 1990-2011

Instability	Growth of yield (1990-1999)			
	Negative	Slow (0-3%)	Medium (3-6%)	High (6% & above)
Low (<10%)	Khulna	Chittagong, Bangladesh	Dhaka, Rajshahi	--
Medium (10-20%)	--	Rangpur	--	--
Growth of yield (2000-2011)				
Low (<10%)	--	--	Dhaka	Chittagong , Khulna Rangpur, Bangladesh
Medium (10-20%)	--	--	--	Barisal, Rajshahi
Very high (>30%)	--	--	--	Sylhet

Source: Author's calculation, Note: -- indicates no division falls in the respective category

Economics of maize cultivation

Maize started gaining popularity as a profitable cash crop in Bangladesh, due to the concerted efforts of different public, private, national, and international organizations. Farmers especially from northern and north-western parts of the country increasingly adopted maize cultivation, as it offered higher- and stable-yield backed with remunerative market prices, resulting in better-profitability compared to other competitive crops *viz. Boro* rice and wheat (Oxfam, 2013). Most of the maize-farmers use imported hybrid maize seeds, which are mostly single-cross and a few of them are double-crosses or three-way- hybrids. The hybrid seeds of maize are sold in the market at a price ranged between Tk.150 (USD1.88) to Tk.450 (USD 5.63) per kg. Maize growers apply high doses of fertilizer in irrigated areas which help ensuring high grain yields (Ali et al., 2008). On an average, 5 ton/ha of cow-manure and chemical fertilizers in the form of urea, TSP, MoP, gypsum, zinc and borax at the rate of 462, 192, 146, 52, 5 and 3 kg/ha, respectively are applied. However, some researchers observed fertilizer doses lower than the recommended doses[2] (Karim et al., 2010; Moniruzzaman et al., 2009; and Mohiuddin et al, 2007). The average cost of maize production was Tk 88,762/ha (USD 1,138.0/ha) at different locations of Bangladesh, of which 83.4 and 16.6 percent was variable cost and fixed cost, respectively. Among different cost items, human labor was the most important cost followed by fertilizer cost (Table 4). The cost of maize production was slightly higher in the western part (Khulna division) of the country compared to the northern part (Rangpur division).

[2]Quayyum (1993) and Salahuddin (2003) recommended per ha nutrients application of N, P_2O_5, K_2O, S, Zn and B for maize crop in the proportion of 250, 120, 120, 40, 5 and 1 kg, respectively for hybrids and 120, 80, 80, 20, 5 and 1 kg, respectively for composites.

Table 4. Cost (Taka/ha) of maize production in different geographic locations

Cost items	Bogra	Chuadanga	Dinajpur	Lalmonirhat	Kishoregonj	Dhaka	Rangpur	Kustia	All
A. Variable cost (VC)									
H. labour	42,000	43,000	33,900	24,200	49,400	45,400	23,600	30,500	36,500
Tillage cost	5,239	4,692	5,614	5,988	4,491	4,117	4,892	7,485	5,315
Seed	6,408	6,392	5,299	4,919	3,500	5,733	6,066	6,566	5,610
Cowdung	1,680	1,600	4,620	3,100	2,750	0	3,900	1,200	2,356
Urea	8,880	9,260	8,860	10,140	5,260	10,380	8,380	12,760	9,240
TSP	2,975	4,500	3,425	5,825	3,100	7,400	5,650	5,450	4,791
MoP	1,808	1,344	1,760	3,664	1,376	2,592	2,688	3,488	2,340
Gypsum	144	536	760	1,593	0	488	0	0	440
Zinc sulphate	240	1,440	600	1,440	0	0	840	558	640
Borax	320	56	800	1,600	0	0	800	0	447
Pesticides	1,497	898	1,310	1,123	0	524	1,123	1,871	1,043
Irrigation	3,742	5,239	6,785	2,994	2,620	2,994	4,117	5,614	4,263
Int. on OC	989	1,042	973	879	957	1,051	819	996	963
TVC	75,923	80,000	74,706	67,465	73,454	80,678	62,875	76,489	73,948
B. Fixed cost									
Land use cost	14,970	13,722	14,970	13,722	12,475	16,217	16,217	14,970	14,814
Total cost	90,893	93,722	89,675	81,187	85,928	96,895	79,092	91,458	88,606

Source: Karim et al., 2010; Moniruzzaman et al., 2009; Mohiuddin, 2003; Chowdhury, 1995
Conversion rate 1 USD = 78.0 BDT, OC = Operating capital

The average farm level yield of hybrid maize is 7.4 t/ha and ranged from 6.6 t/ha to 8.0 t/ha. The average gross return was calculated at Tk 108,611/ha (USD 1,392.5), while per hectare gross margin and net return were estimated to be Tk 34,662 (USD 444.4) and Tk 20,004 (USD 256.5), respectively. Due to lower cost of production, the farmers of northern Bangladesh received higher gross margins compared to other part of the country. The average BCRs were 1.48 over variable cost and 1.23 over total cost basis (Table 5). Farm mechanization in maize cultivation has been adopted in recent years in the form of power tillers for land preparation and power-operated maize shellers for post-harvesting activities (Roy et al., 2007). Women are generally engaged in various post-harvest activities like shelling of maize, sun drying, winnowing, and storing (Miah et al., 2013).

Table 5. Return (Taka/ha) from maize production in different districts of Bangladesh

Particulars	Bogra	Chuadanga	Dinajpur	Lalmonirhat	Kishoregonj	Dhaka	Rangpur	Kustia	All
Yield (ton/ha)	8.00	7.69	7.99	7.91	6.70	6.83	7.41	6.55	7.39
Price (Tk/ton)	14,500	13,750	13,250	14,800	16,150	17,250	14,150	14,250	14,760
Gross return	116,000	105,738	105,868	117,068	108,205	117,818	104,852	93,338	108,611
Total variable cost (TVC)	75,923	80,000	74,706	67,465	73,454	80,678	62,875	76,489	73,949
Total cost(TC)	90,893	93,722	89,675	81,187	85,928	96,895	79,092	91,458	88,606
Gross margin	40,077	25,738	31,162	49,603	34,751	37,140	41,977	16,849	34,662
Net return	25,107	12,016	16,193	35,881	22,277	20,923	25,760	1,879	20,004
BCR on TVC	1.53	1.32	1.42	1.74	1.47	1.46	1.67	1.22	1.48
BCR on TC	1.28	1.13	1.18	1.44	1.26	1.22	1.33	1.02	1.23

Source: Karim et al., 2010; Moniruzzaman et al., 2009; Mohiuddin, 2003; Chowdhury, 1995
Conversion rate 1 USD = 78.0 BDT

Maize is a relatively more-profitable crop than the other cereal crops including rice and wheat. Among the cereal and fiber crops, blackgram is the most profitable crop due to lower cost of production, and maize stands at the third position at 2009 to 2010 prices (Figure 4). The farmers of Ghoraghat and Nawbabgonj *Upazila* under Dinajpur district mentioned that the profit of maize cultivation is about double than that from rice and wheat (FGD, 2013).

Domestic Resource Costs (DRCs) for maize production in Bangladesh were less than unity during 2007 to 2012, under import parity prices. This implies that the country had comparative advantage in maize production for import substitution and export promotion during that time. DRCs were higher than unity implying that the country had no comparative advantage in maize production during 2005 to 2006. Again, the value of DRC gradually increased from 2010 which was due to an increase in the cost of production (Fig 5).

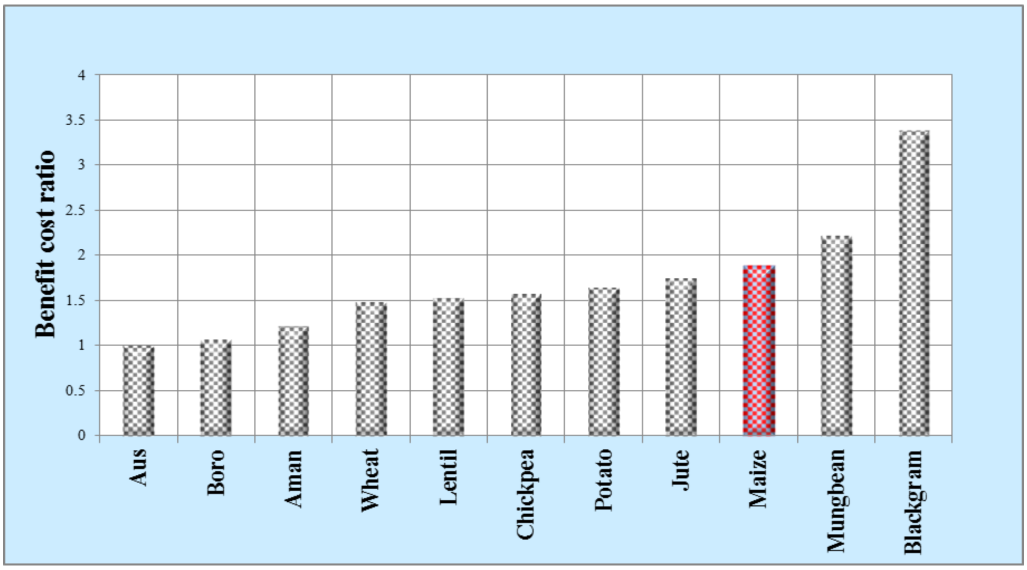
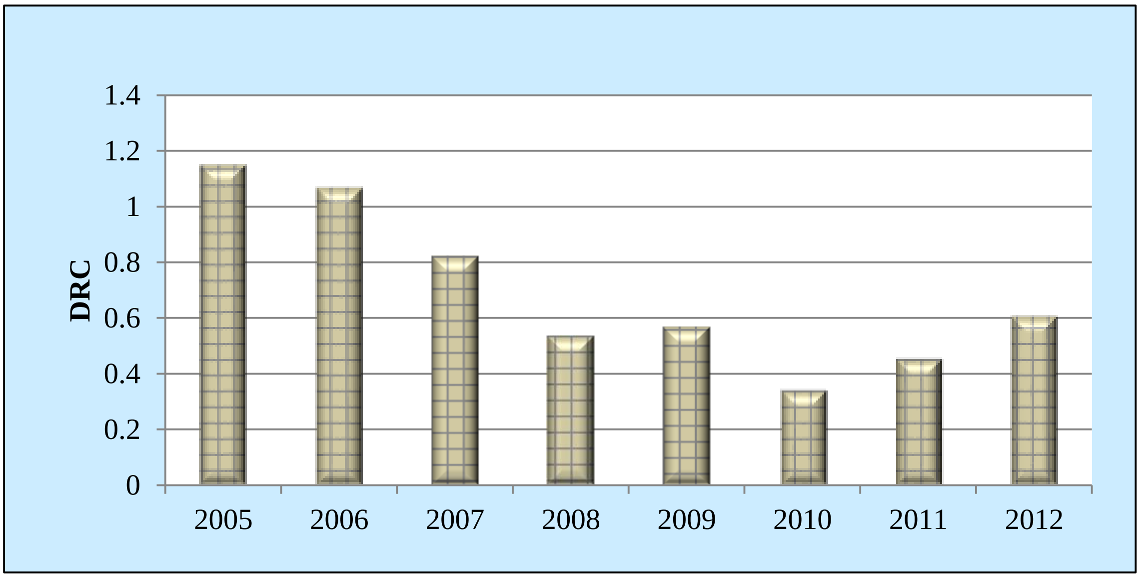


Figure 4. Relative profitability of maize cultivation



Source: Rashid et al., 2009; Author's calculation for the year 2010-2012

Figure 5. DRC of maize production, 2005-2012

Table 6 shows that the estimated nominal protection coefficients (NPCs) and nominal rates of protection **(**NRPs) for maize over the period 2005 to 2012 were less than one and negative for all the years at import parity level. It means that domestic maize production was taxed and consumers were subsidized. Again, the border price of maize at producer level measured at official exchange rate was mostly higher than the domestic producer price. Rashid et al. (2009) re-examined the estimated NPCs by working out effective protection coefficients (EPCs). The EPCs were also less than one and effective rates of protection **(**ERPs) were negative for maize production during 2005 to 2012. This also implies that the domestic market of maize was not protected. Domestic production of maize may require substantial protection in future for import substitution and export promotion.

Table 6. NRP and ERP for maize production at official exchange rate

Year	NPC	NRP	EPC	ERP
2005	0.892	-0.108	0.94	-0.05
2006	0.908	-0.092	0.95	-0.04
2007	0.790	-0.210	0.79	-0.20
2008	0.583	-0.417	0.55	-0.44
2009	0.595	-0.404	0.54	-0.45
2010	0.792	-0.208	0.85	-0.15
2011	0.861	-0.139	0.89	-0.12
2012	0.829	-0.171	0.85	-0.15

Source: Rashid et al. 2009; Author's calculation for the year 2010-2012

Demand dynamics of maize

Maize is used as different types of foods for human consumption, feed and fodder for poultry and livestock, and starch for industrial products (Kaul et al. 1987). Maize is consumed as food by incorporating it in many types of processed foods. Maize is largely used for preparing poultry and fish feed (Ali et al., 2008). The use of maize as poultry, fish and cattle feed has increased at the rate of 9.17 percent per year (Miah et al., 2013). It is one of the important ingredients of fish feed and frequently used by fish farmers in Bangladesh (Dongmeza et al., 2010). According to Chakma and Rushton (2008) there are 0.15 million commercial poultry farms in Bangladesh and the requirements of poultry feed of those farms are 2.0 million tons that are supplied from domestic sources. Bangladesh experienced Highly Pathogenic Avian Influenza (HPAI) outbreaks during 2007 and 2008, when a total of 547 commercial and 42 backyard flocks with over 1.6 million birds were culled. Therefore, the demand of maize for feed industry decreased from 3.0 million tons to 2.0-2.2 million tons (Chakma and Rushton, 2008). Dry maize contains about 66 percent starch which is widely-used in different industries: paper-making, textile, food-processing, chemistry, pharmaceutical and medicine, building materials and casting. It is also used in the deep-refining industries as raw material to produce modified starch, ethanol, sweetener, organic acid, antibiotic substances and amino acids. The use of maize in starch industry has also increased in Bangladesh.

The scientists of BARI opined that about 85 percent of maize is used for preparing poultry and fish feed and the remaining 15 percent is used as human food and other purposes. According to Poultry Feed Association of Bangladesh (PFAB) the current demand for feed is 3 million tons in the country. Based on this information, the amount of maize used in feed industries is 1.65 million tons. The demands for maize as seed and food and other purposes are 5,328 tons and 0.25 million tons, respectively. Therefore, the domestic demand for maize is estimated at 1.92 million tons per year (FGD, 2013). On the other side, the domestic production of maize is estimated at 2.18 million tons (DAE, 2013). Thus, the estimates indicate that local production of maize exceeds its local demand and there exists increasing opportunity of maize export in the country. However, Bangladesh imported about 13,000 tons in 2012 (Bangladesh Bank, 2013).

Maize Association of Bangladesh (MAB) promotes a better price for the farmers and generates a complete utilization of maize through an effective maize export. MAB also identified some countries such as Malaysia, Indonesia, Saudi Arabia and United Arab Emirates (UAE) for export promotion. Contrastingly, the poultry feed industry argues to ban maize export for an interim period to stabilize the poultry feed price and in turn, the price for eggs and meat (FGD, 2013).

Forecast of area, production and yield of maize

The maize productivity of Bangladesh is the highest (6.2 t/ha) in Asia and is steadily increasing due to favorable growing conditions during the maize growing season (October-March) and the use of hybrid seeds. Ali et al. (2008) states that almost 100 percent of the maize area in Bangladesh is planted with hybrid maize seed each year. Additionally, the investment in maize production at the farm-level and research and development (R&D) at the national-level in Bangladesh were found to be highly remunerative. The predicted area, production and yield of maize show an increasing trend (Figure 6). Considering the base-year (2013), the area under maize cultivation is expected to increase by 29.5 percent, while maize yield is expected to further improve to about 9 t/ha by the year 2020. Accordingly, the total maize production will increase to 3.5 million tons in 2020 (Table 7).

The forecasted area, production, and yield of maize are close to the reality of Bangladesh as opined by BARI scientists and the representatives of different seed companies (FGD, 2013). However, the predicted area, production, and yield show an upward pattern and the interval between the lower- and upper-limit was very close to the forecasted values (and also the forecasting error was low-insignificant).

Investment opportunities and constraints to maize production of the maize sector suggest various strengths and opportunities for increasing the area and production of maize in the near future. The **strengths** include availability of improved technology, favorable growing environment, adequate institutional supports, higher-yield and profitability, and international collaboration. There are ample **opportunities** to develop maize sector to attain self-sufficiency in maize production, ensure food security for the growing population and livelihood development of the poor farmers through access to export markets. The opportunities are: prolonged growing season, expanding potential area under maize cultivation, development of stress-tolerant varieties, availability of improved technology, promoting wide-ranging maize-based cropping patterns and contact farming, private sector involvement in post-harvest activities, availability of extension services, value-addition, capturing value and establishment of maize based industries in the country. Different private and public organizations have been conducting research to generate suitable technologies for the farmers not only to sustain maize production but also to enhance maize productivity by minimizing the yield-gap at the farm level. Investment in maize R&D is highly remunerative in Bangladesh.

However, some of the weaknesses related to availability of inputs, biotic and abiotic stresses, post-harvest management and access to institutional support needs further and continued investment to facilitate maize sector to growth. The **threatening** issues are emerging in the form of new biotic and abiotic stresses, deteriorating soil health, heavy- and continuous- rainfall, and climate variability. The other threats are heavy dependency on poultry and fish industries; high-competition with other crops; high-dependency on importation of hybrid seed; and adulterated maize seed.

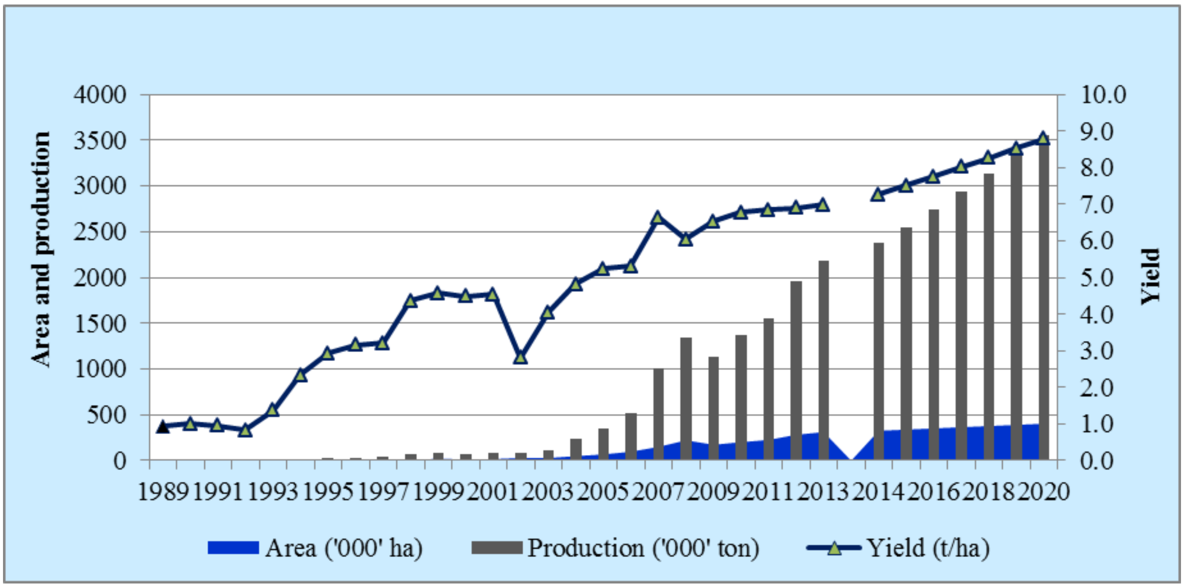


Figure 6. Forecast of area, production and yield of maize in Bangladesh
Source: Using data from DAE and http://www.moa.gov.bd/statistics/bag.htm

Table 7. Forecast of area, production and yield of maize in Bangladesh

Year	**Area**		**Production**		**Yield**	
	'000' ha	% increase from 2013	'000' ton	% increase from 2013	t/ha	% increase from 2013
2013	312.0	--	2,178.0	--	6.98	--
2014	326.7	4.7	2,371.8	8.9	7.26	4.0
2015	339.7	8.9	2,551.1	17.1	7.51	7.6
2016	352.6	13.0	2,736.0	25.6	7.76	11.2
2017	365.5	17.1	2,930.9	34.6	8.02	14.9
2018	378.3	21.3	3,128.8	43.7	8.27	18.5
2019	391.2	25.4	3,333.0	53.0	8.52	22.1
2020	404.1	29.5	3,547.8	62.9	8.78	25.8

Source: Using data from DAE and http://www.moa.gov.bd/statistics/bag.htm

Conclusions

The study was undertaken to examine the possibility of attaining self-sufficiency in maize production by analyzing its current status, profitability, comparative advantage, future projections of maize production and investment opportunities in Bangladesh. Maize is grown in almost all the areas of the country, under varying environments throughout the year. The lion's share (88%) of hybrid maize is grown during the winter season involving all categories of farmers. *Maize-Fallow-T.Aman* is the major maize-based cropping pattern. However, farmers are also integrating maize with a wide range of other traditional crops, such as potato, jute, and vegetables.

Maize cultivation gained momentum from 2000 and continues to increase. During the last decade, impressive growth rates with low-instability and robust production was due to the expansion of the poultry and fish-farming in- and stable-yield rate with fair market prices, resulting in better profitability compared to other major competitive crops. Although, the value of DRC gradually increased from 2010 due to increase in the cost of production, the country had comparative advantage in maize production. Domestic production of maize may require substantial support in the future, for import substitution and export promotion.

However, there is a contradiction between the production and requirement of maize in Bangladesh. DAE estimates revealed that local production of maize exceeds its local demand and the opportunity for maize export is promising. However, the import scenario indicates that Bangladesh is not self-sufficient in maize production and basically a net importer of maize. The forecasted area, production, and yield of maize show an increasing trend which are close to the reality of Bangladesh becoming not only self-sufficient in maize but also to become a net-exporting country. Overall SWOT analysis revealed that the strengths and opportunities of maize cultivation outweigh the weaknesses and threats of its cultivation implying that there are ample strengths and opportunities for attaining self-sufficiency in maize production in Bangladesh.

Recommendations

The following measures should be considered by the government to exploit the inherent strengths and opportunities and to overcome the weaknesses and threats in the maize sector, for attaining self-sufficiency, import-substitution and export-promotion of maize in Bangladesh.

- To increase domestic production, the country needs to ensure quality maize seed production and distribution and expand production on suitable land (Char, saline, drought, etc.), establish strong-linkages between farmers and extension agents, provide training and credit facilities to the maize farmers and promote wide-ranging maize-based cropping patterns at the farm level.
- In order to make maize marketing effective and efficient, the government should develop marketing infrastructure for maize, provide storage facilities, introduce public sector procurement, encourage maize-based food industries, and take initiatives for value addition and value-capturing.
- In order to create a favorable environment for maize export, the government should assess production and domestic requirements prior to export, ensure product quality and formulate friendly policies for exporters.
- Finally, research thrust should be given in areas such as varietal improvement (i.e. short-duration, dwarf, water logging, drought, saline tolerant, QPM, fortified, micro-nutrient enriched and sticky varieties), management practices, diseases and pest management, biotechnology, farm machinery, and food processing.

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