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MAIZE PRODUCTION AND MARKETING IN BANGLADESH: AN INDICATIVE EXERCISE

MD. ABUL QUASEM

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FMRSP Working Paper No. 14

FMRSP Bangladesh
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EXECUTIVE SUMMARY

Maize is a versatile crop and is more nutritious than rice in terms of protein, phosphorus, fat content and also in trace elements like magnesium, potassium and sulphur. It has an insignificant coverage of only 0.2 per cent of rice and three per cent of wheat acreage. With the introduction of high yielding seeds, its area and production have been expanding fast and it reached the level of 65,000 tons in 1997/98 from cultivation of 15,000 hectares of land. Among different districts of the country, Dinajpur, Rangpur, Bogra, Kushtia, Chuadanga and Dhaka are observed to be more progressive in maize cultivation.

Maize can be cultivated in all three seasons of the year but winter is deserved to be more predominant. In the currently undertaken field survey covering four maize villages pre- monsoon i.e. Aus season has the largest acreage under maize. Among these four villages, hybrid maize is more important in two commercial villages of Birganj in Dinajpur and Savar in Dhaka and the composite in two other traditional villages (Jessore and Syedpur). Hybrid yields 5.4 tons per hectare which is higher by 34% over the composite variety. Despite higher yields from hybrid seeds, farmers prefer composite seeds because of easy availability, lower price and known quality.

Maize fits well-fitted in the existing cropping patterns of the country. The major cropping patterns with pre-monsoon maize at Birganj are: Potato + Maize + Local T. Aman/Fallow while at Jessore are Potato + Maize + HYV Aman. In Savar such pattern is Potato + Maize + HYV Aman. The winter maize has the practice of Maize + China Irri + Fallow at Jessore and Maize + Fallow + Local T. Aman at Syedpur. With the introduction of maize it substituted several crops of which HYV Boro and vegetables are more prominent at Birganj; while mustard, sugarcane, vegetables and wheat at Savar. In two other areas, maize substituted wheat. Such substitutions cover about half of the

current maize land in the study villages. Some fallow land has also been brought under maize.

Average household production of maize is only two tons, the highest being at Savar (three tons). The consumption of maize at household level is less than three per cent. Eighty per cent is sold to traders and the remainder goes directly to poultry farm and the feed mills. In the traditional village fresh maize cobs are sold to traders from fields, mainly for local consumption as roasted or boiled cobs. Some consumption of maize as flour for chapatis, is reported at Birganj.

Maize growers are little interested in keeping stock for off-season sales because of price risk and possible fungal attack. Only 18% of maize growers kept stock amounting to 16% of their total production. Stocking is higher in Savar (28% of their production). All producers emphasized the need for proper drying before stocking. This is, however, difficult in earthen floor specially in the monsoon season. The poultry farms and the feed mills generally do not stock maize beyond one month's requirement as they have a regular schedule of procurement. Small poultry farm owners buy broken grains instead of finished feeds usually once a week from the local market.

The demand for maize as feed ingredient is growing fast in the country with the establishment of new poultry, dairy and fish farms. Annual increase in the number of poultry and dairy farms over the last six years ending 1997/98 is estimated to be 6850 and 3706 respectively. The present annual consumption of maize and wheat by poultry farms is observed to be 14 kgs by a bird at the ratio of 5:2 which however, varies depending on their relative prices. Poultry farms with an average capacity of below 5000 birds consume imported maize to the extent of only one-fourth of their requirements. The feed mills, on the other hand, use imported maize amounting to two-thirds of their grain consumption. Very rough estimates show that there is an annual requirement of 450 thousand tons of maize by poultry farms in the country against the present domestic

supplies of only 65,000 tons. Poultry and dairy industries are thus, import-dependent despite having high potentials of domestic production (three million hectares). Provision of adequate price incentives to growers appears to be a major step towards increased production of maize in the country.

The procurement programme of maize in 1997/98 by the Ministry of Food was quite satisfactory. Their existing rice godowns are adequate but the procurement officers are required to be extra-cautious about moisture content in maize which should by no means exceed 13.5%.

The economics of production of maize and its competitive crops like wheat, potato, China-Irri paddy, mustard etc. suggest that the minimum price to growers should be above Tk. 6.00 per kg. under the existing cost-price configurations and the crop production technologies used.

To encourage maize production, government institution through its procurement programme is essential at least in the initial stage. Along with the procurement programme, special credit supports may be extended to commercial farmers, traders, and the NGOs interested in maize stock for year-round supplies to the poultry farms and the feed mills. In this regard, the Department of Agricultural Marketing or the present Integrated Maize Promotion Project of the Ministry of Agriculture may act as a facilitator between the potential buyers and the sellers as many of the farms are not well aware of local supplies, their quality and prices.

For increased commercial production, market supplies of hybrid seeds should be kept under constant quality inspection by some state agency like BADC and their sales prices should be kept lower as far as possible. Block farming by local maize growers like country's existing sugarcane cultivation in the mill zone may be organized through timely supplies of seeds, fertilizer and credit.

It is also considered important to carefully study the economics of production of maize at a broader perspective of agricultural development as its expansion is going to substitute some of the major crops like jute, wheat, mustard and pulses whose growth in production is also essential to meet their growing demand in the country.

1. INTRODUCTION

BACKGROUND OF THE STUDY

Area and production of maize in Bangladesh have been rising fast in the last six years. Until 1990-91 area under maize remained stagnant at around 3,000 hectares. Since then this number started rising and reached the level of 15,000 hectares in the year 1997/98, about a five fold increase. Production also rose from 3,000 tons in 1990/91 to 65,000 tons (Figures 1 and 2). Maize has still an insignificant coverage of only about three percent of wheat area and only about 0.2 percent of rice area. In the last few years there has been a substantial increase in maize yield as well, to 4370 kgs/ha in 1997/98 from only 1000 kgs/ha in 1993/94. In the last seven years ending 1997/98 the annual rate of growth in production was estimated to be 47 percent and almost the same rate of increase (23.5%) has been recorded in acreage and yield. Increases in area and yield are claimed to be due to the introduction of a high yielding composite variety of maize and, very recently, hybrid seeds. Intensive agricultural extension efforts through the Integrated Maize Promotion Project of the Ministry of Agriculture have made a significant contribution to such a rapid rate of increase. Introduction of the new seeds has resulted in higher rates of return to farmers and thus there have been some changes in cropping patterns.

In the last five years, demand for maize also increased in the country mainly due to the establishment of new poultry and dairy farms. Available information indicates that in the last six years there has been an annual increase of 3-4 thousand farms in each sub-sector of poultry and dairy. Do these farms consume maize or wheat or both? Are they local or

Figure 1 — Area under Maize in Bangladesh, 1980/81 - 1997/98

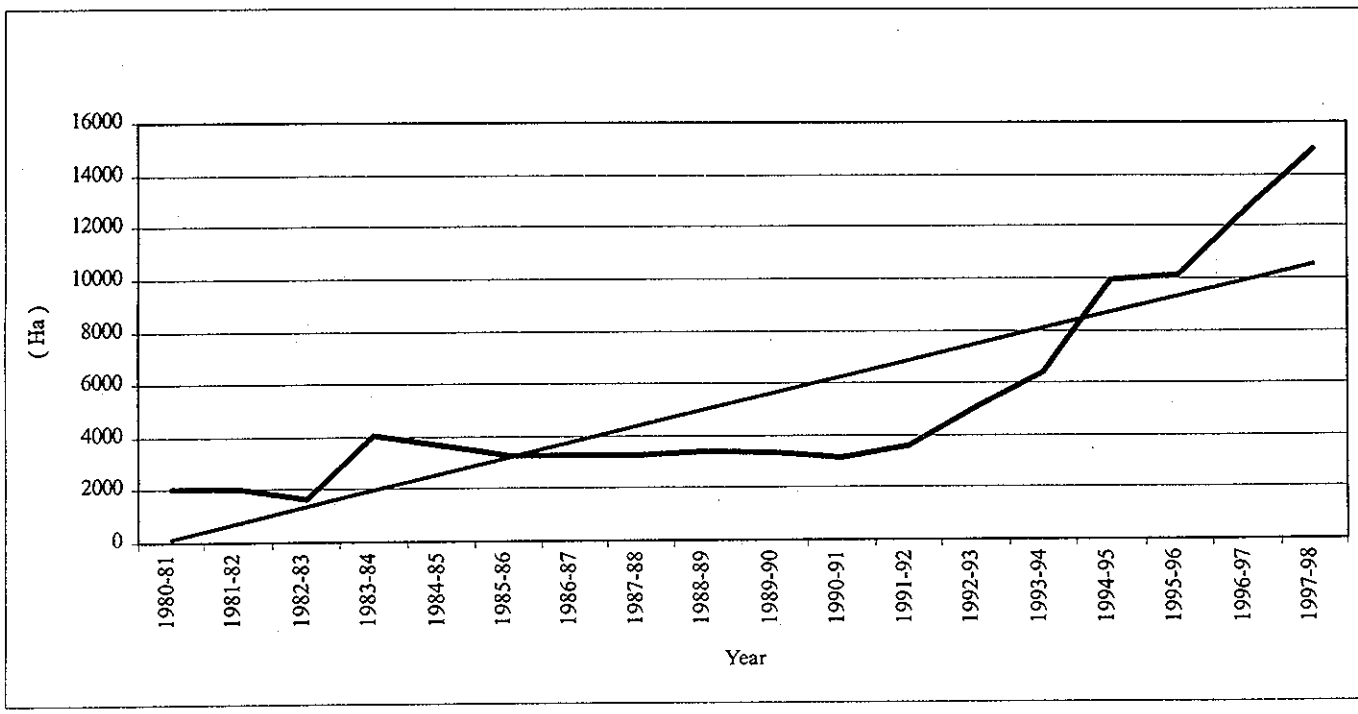
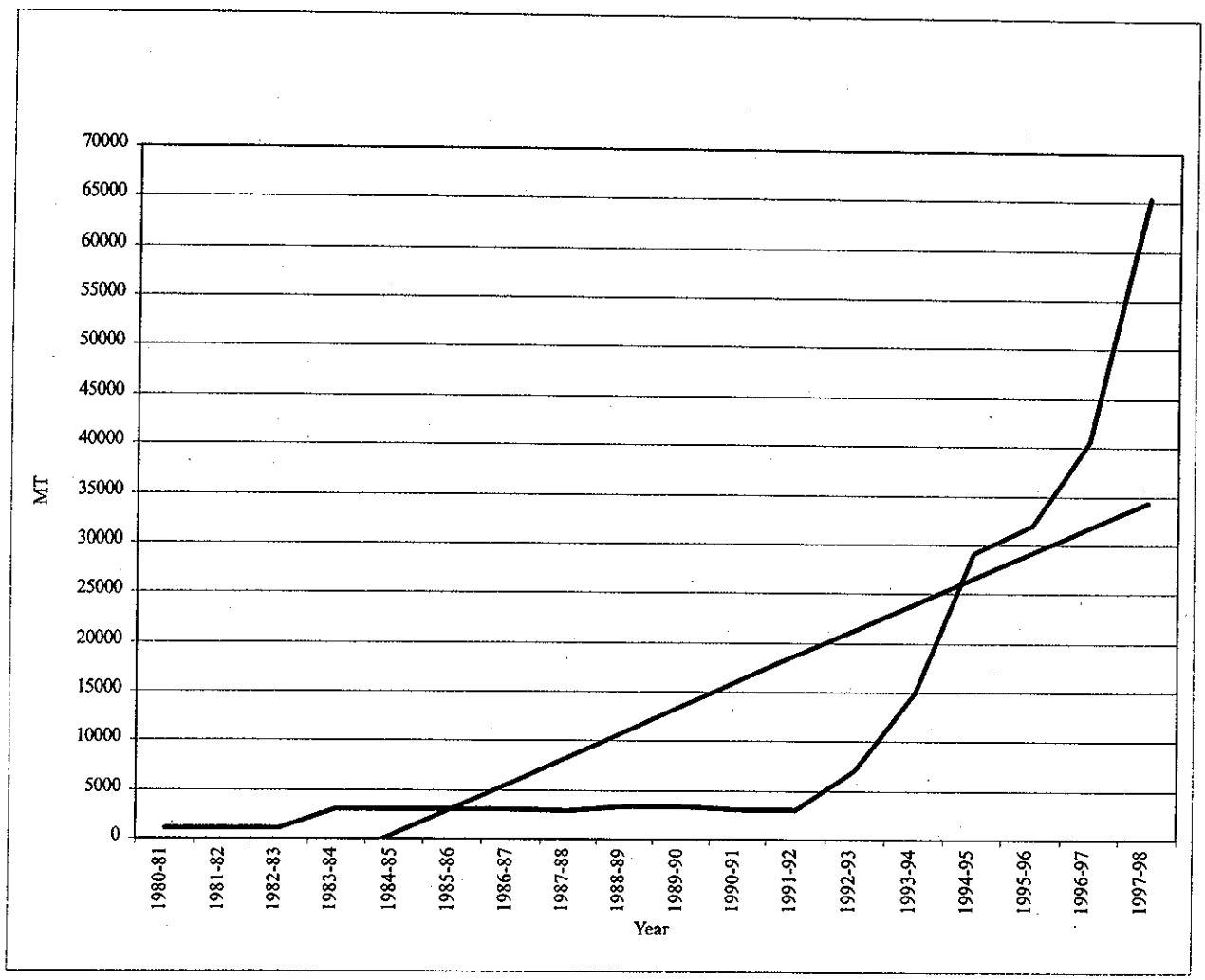


Figure 2 — Trend of Maize Production in Bangladesh, 1980/81 - 1997/98



imported? Is the price of local maize competitive with the international price? Is there adequate domestic incentive to produce maize as compared to other crops? These areas need careful study.

Extension people working in agriculture report that rural people in Rajshahi Division are slowly getting used to consuming maize flour by mixing it with wheat in different proportions. There are also reports that several flour mills in the Dinajpur region are mixing maize flour with wheat. Is such mixing accepted by consumers or is there any market for such mixed flour? The present consumption statistics suggest that about three-fourths of the country's maize production is used as animal feed especially by poultry farms (Iqbal, Javed, 1997). Human consumption does not exceed five percent of total production. This means future demand for maize will largely be an outcome of the growth of livestock farms. Maize as an ingredient for starch, used in textiles and other industries, does not seem to be an important factor in immediate future increase in the demand for local maize.

Furthermore, it has been observed that maize production is highly concentrated in Rajshahi Division especially in Dinajpur, Rangpur and Bogra districts covering about half of the country's hectareage. These districts, along with Kushtia and Chuadanga of Khulna Division, have records of faster rates of increase. In Dhaka division, Dhaka district recorded a five-fold increase in hectareage in 1998. Such differential rates of growth in different districts need careful examination. As far as agronomic potential of maize is concerned, large opportunities exist in Rajshahi Division followed by Dhaka. Mallick, et al. (1995) in their paper report of potential hectareage to the extent of about three million hectares against the existing area of only 16.2 thousand hectares in the country. The principal cause for such poor achievement so far is the lack of demand as apparent from the last year's poor harvest price. The feed mills and the livestock farm owners on the other hand are reporting of the non-availability of local maize and the use of imported maize. Reportedly over two-thirds of the country's maize requirement is met from imports. In the future, import needs will

increase further with the increase in the establishment of poultry and dairy farms. An in-depth study is therefore necessary to understand the gap between potential and existing area, production and imports.

MAIN OBJECTIVES OF THE STUDY

The broad objective of the study is to assess the present situation of maize production and marketing in the country and to suggest suitable policy measures towards increased production as well as use of maize. To be more specific the study estimates the recent growth of maize production and examines the differential levels of production in different districts. It also examines the economics of the production of maize and its competitive crops. Another objective is to understand the different forms of use of maize. The study also tries to identify constraints to the rapid growth of production and marketing with special reference to government procurement programs, initiated last year. Attempts will also be made to put forward some policy suggestions.

SURVEY METHODOLOGY AND THE VILLAGES SELECTED

The present study is an indicative exercise spreading over a period of only three months. It thus depends mainly on secondary sources of information and, due to time constraints, only four villages for the field survey were selected in the maize producing areas of the country. The villages selected for the study are Pranagar at Birganj in Dinajpur, Botlagari at Sayedpur in Nilphamari, Hamidpur at Jessore Sadar in Jessore and Gorat at Savar in Dhaka districts which henceforth are expressed in their respective thana names (Table 1). All the villages are well connected to metalled road and have easy access to all physical and institutional infrastructural facilities. They can be considered developed villages. Farmers in these villages are commercially motivated and many villagers are employed in non-agricultural occupations. Actually non-agricultural occupations consist of about half of the labor force against 38% in Bangladesh[1] (Labor Force Survey, 1995-96).

[1]Adults aged 15 years and above.

Table 1 — Villages Selected for the Study and Their Locations

S.L. No.	Study Village	Unions	Thana	District
1	Pran Nagar	Sator	Birganj	Dinajpur
2	Botlagari	Botlagari	Sayedpur	Nilphamari
3	Hamidpur	Fatepur	Jessore Sadar	Jessore
4	Gorat	Yearpur	Savar	Dhaka

SELECTION OF MAIZE PRODUCING HOUSEHOLDS

To understand the present land use and production economics of maize and its competing crops, 19 maize growers (small* - 9, medium* - 6 and large* - 3) in each of the selected villages were interviewed using a short questionnaire. The selection of maize growers does not follow any systematic statistical technique, as we did not have a population census frame. The selection was done in consultation with local knowledgeable farm households who could report approximate farm size of maize producers. In total 72 maize producers were selected for household level information.

Besides the maize producers, some case studies have been conducted in poultry and dairy farms in the selected districts and discussions were held with two feed mills at Sreepur thana of Gazipur district using the open-ended questionnaires. Such interviews enabled us to estimate the extent of use of maize as feed and storage practices of feed mills.

PHYSICAL CHARACTERISTICS OF THE SAMPLE VILLAGES

All four sample villages are flood free. An insignificant proportion of farmland is low which sometimes is submerged in the monsoon due to poor drainage. The average farm size in the sample is higher (1.30 hectare) than the country's average of less than one hectare. The largest farm size is noticed at Birganj (1.46 hectare) while the lowest is at Savar (1.17 hectare), as shown in Table 2. Soils in the village are largely loam and sandy loam, very

* Small - cultivating holding below1.01 hectare; medium – 1.02 to 2.02 hectare; and Large –2.02 hectare & above.

much suitable for maize production. Almost all crops including maize are grown in the sample villages. Tubewell irrigation is available in all the villages. The villages, other than Savar, are well endowed with shallow tube wells. Savar has a deep tubewell as well.

Of the selected villages, Jessore and Sayedpur have a long tradition of maize cultivation of over 10 years. The two other villages, namely Birganj and Savar, have experience with maize of only three years. More than four-fifths of the farm households at Savar grow maize. In aggregate, half of the farmers are growing maize in our study villages. Furthermore, there has been a three-fold increase in maize hectareage, in the last three years and the number of producers has also increased substantially (Table 3). Maize hectareage in the two commercial villages (Birganj and Savar) has expanded more than five-fold, over the last few years.

Table 2 — Average Size of Farm of the Selected Maize Producing Households by Size of Farm in the Study Villages

Study Village	Farm Size (Ha)			
	Small	Medium	Large	All Farms (Ha)
Birganj	0.97	1.82	2.27	1.46
	(9)	(6)	(3)	(18)
Sayedpur	0.93	1.05	3.08	1.34
	(9)	(6)	(3)	(18)
Savar	0.69	1.50	1.98	1.17
	(9)	(6)	(3)	(18)
Jessore	0.57	1.30	3.04	1.21
	(9)	(6)	(3)	(18)
All villages	**0.77**	**1.42**	**2.59**	**1.30**
	(36)	(24)	(12)	(72)

Notes: (a) Number of observations in parenthesis
(b) It includes Maize Producing Owner Households excluding Owner - cum - Tenant and Tenant Households

Source: Field Survey, 1998

Table 3 — Year of Start of Maize Cultivation in the Village and the Changes in Maize Coverage and Maize Production

Study Village	Year of start	Present area (Ha)	Area increase over three years (%)	Present maize producers (No.)	Increase in number of growers in last three years (%)
Birganj	1995	105	500	200	666
Sayedpur	1988	9	140	75	187
Savar	1994	28	700	150	600
Jessore	1968	19	106	50	142
All villages	**1968 - 1995**	**161**	**320**	**475**	**365**

Note: Based on Village Survey, 1998
Source: Field Survey, 1998

LIMITATIONS OF THE STUDY

As reported earlier the villages are purposively selected in maize producing areas and the farm households interviewed are all maize producers. Tenant operators were excluded. The findings of the study are thus not representative of the country. They can however, indicate the present situation with respect to maize production, consumption, and marketing problems faced by maize producers in developed villages. The conclusions of the study are, therefore, limited to progressive producers in areas with more developed infrastructures. Maize producers scattered across other regions, as well as those in remote villages might be facing completely different problems that we have not studied. It is likely that areas where production, and especially marketing environments, are less favorable have not been examined in this paper.

2. MAIZE CULTIVATION AND ITS CROPPING PATTERNS

Maize is a photo-insensitive crop. It can therefore be grown throughout the year in the sub-tropical climate of Bangladesh. The three cropping seasons of the country are commonly known as (a) *Rabi* or Winter (November-February), (b) *Aus* or Pre-monsoon (March-June) and (c) *Aman* or Monsoon (July-October). Winter maize is predominant in Bangladesh covering 84% of the country's acreage in maize and the season is considered to be more appropriate for its cultivation if irrigation is available. The irrigation requirement for maize is lower than that of rice and wheat (38% of rice and 70% of wheat). The production period is around 150 days (Islam, 1995). Different varieties of maize are grown in the country. Besides the traditional varieties, grown mostly in Chittagong Hill Tracts, composite varieties are Barnali, Shuvro and Mohar. In recent years hybrids such as Pacific-11, Pacific-60 and Pacific-600 are also being grown in different districts especially in Rajshahi Division. The Integrated Maize Promotion Project of the Ministry of Agriculture has been promoting maize production in the country through the dissemination of production knowledge and seed supplies.

MAIZE ACREAGE BY DISTRICTS

At present maize is grown on only about 16.2 thousand hectares in the country. Of the existing coverage Rajshahi Division has the largest share (60%); followed by Dhaka Division (20%). In these two divisions all the districts are again not equally advanced. Prominent districts among them are Dinajpur, Dhaka, Bogra, Rangpur, Mymensingh and Kushtia that have experienced faster rates of growth in maize cultivation. In three of these districts, Dinajpur, Bogra and Rangpur, wheat cultivation has increased along with maize. Increased hectareage is mainly an outcome of larger cropped areas in the *Rabi* (winter) season and also to some extent due to a decline in area under oilseeds and pulses (Annex 1-

12). These three districts have declining trends in potato coverage.

Regarding the potential area for maize there is one estimate that mentions three million hectares, a figure very much higher than the present coverage of only 16.2 thousand hectares. The potential area is again highly concentrated in Rajshahi Division. Outside this division, the prominent districts are Mymensingh, Tangail, Comilla and Jamalpur having a potential area of over thirty thousand hectares together. The existing acreage and future growth potential suggest that the maize promotion program should be accelerated in these two divisions, namely Rajshahi and Dhaka.

MAIZE AREA IN THE STUDY VILLAGE

The present village survey finds that maize is grown mainly in two seasons - winter and pre-monsoon. Monsoon has the least coverage of only four percent (Table 4). Pre-monsoon has the highest coverage (55%), followed by winter maize (41%), when Sayedpur and Savar have over 60% of their maize acreage. The observed seasonal distribution is different from the country's maize coverage. The national statistics appear to have included pre-monsoon within the winter season and thus, they have a larger share of 84% in the winter season.

Regarding seasonal cropped acreage, it has been observed that over two-fifths of pre-monsoon crop area on maize producing farms is cultivated with maize; compared to one-fifth in the winter season. In aggregate, only one-fifth of the annual cropped acreage in the study area is under maize at present (Table 5). Savar has the largest coverage of maize (31%). A wide variety of non-maize crops is grown in these areas. China-IRRI paddy is the main non-maize crop in the pre-monsoon or *Aus* season. Vegetables are the second crop in that season. In the winter, the main non-maize crop is potato at Birganj and Savar, China-IRRI at Jessore, and vegetables (Carrot, Radish and Lal-shak) at Sayedpur.

Table 4 — Area Planted to Maize by Season of the Year in the Study Villages

(Area in Ha)

Study Village	Winter (Rabi)	Pre–monsoon (Kharif)	Monsoon (Kharif)	Total Area Planted to Maize
Birganj	0.38	7.25	0.74	8.37
	(4.5)	(86.6)	(8.8)	
Sayedpur	2.99	1.19	0.45	4.64
	(64.5)	(25.6)	(9.8)	
Savar	6.87	4.47	---	11.34
	(60.6)	(39.4)	---	
Jessore	2.74	4.46	---	7.20
	(38)	(62)	---	
All villages	**12.94**	**17.36**	**1.20**	**31.56**
	(41)	(55)	(3.8)	

Note: Percentage of total area planted to maize is in parenthesis
Source: Field Survey, 1998

Table 5 — Area Planted to Maize by Season by Surveyed Farmers (Percentage Share in Each Cropping Season)

Study Village	Winter Season (Ha)	Pre - Monsoon (Ha)	Monsoon (Ha)	Annual (% of total cropping acreage)
Birganj	0.38	7.25	0.74	8.37
	(2.4)	(44.1)	(5.2)	(18)
Sayedpur	2.99	1.19	0.45	4.64
	(20.0)	(12.8)	(3.1)	(12)
Savar	6.87	4.47	---	11.34
	(45.2)	(67.5)		(31)
Jessore	2.74	4.46	---	7.2
	(18.3)	(50.4)		(18)
All Areas	**12.98**	**17.36**	**1.2**	**31.56**
	(21.2)	(42.2)	(2.0)	(20)

Source: Field Survey, 1998

Vegetables, wheat and mustard are the second most important winter crops. Crops that compete with maize are, therefore, China-IRRI, potato, vegetables, mustard and wheat.

It may be of interest to report that Jessore and Sayedpur produce fresh maize mainly for local consumers, and thus, they have little incentive for increased production. In Jessore, there is a community program of maize cultivation that follows a weekly schedule of plantation of maize by farmers from November to February. This is necessary to cater to the regular needs of fresh maize cob consumers and also to avoid a glut condition in the market.

CROPPING PATTERNS WITH MAIZE

As earlier reported, maize is grown in both the winter and the pre-monsoon seasons. Cropping patterns practiced with maize thus, vary widely. The common patterns followed in the two principal growing seasons are shown in Table 6. It has been observed that varieties of crops are grown both before and after maize. For example, at Birganj pre-monsoon maize is preceeded by potato/wheat in the Winter and followed by local T. *Aman*/vegetables or sometimes fallow. The major pattern there is Potato + Maize + Local T. *Aman*. At Jessore, the main pattern is China-IRRI + Maize + Local T. *Aman*. Similarly in the two other areas, e.g. Sayedpur the common pattern with winter maize is Maize + Jute + Local T. *Aman*, while at Savar it is Maize + Fallow + HYV-*Aman*. Actual cropping patterns vary from farmer to farmer, depending on the type of plot and their crop choices, usually determined by price and land productivity. Two specific plot-wise patterns are shown in Table 7.

About the exact timing of the maize plantation in a cropping season, it may be noted that maize planting starts from October at Sayedpur, Mid-November at Jessore, Mid-February at Birganj and End-February at Savar. Thus, maize is planted at any time during October to February covering five months of the year depending on the land suitability and the cropping

practice. It needs 3-4 irrigations. Approximate plantation and harvesting time of maize followed in an annual cropping pattern may be seen in Figure 3.

Table 6 — Major Cropping Patterns with Maize by Sample Farmers

Study Village	Winter Season (Ha)	Pre-Monsoon Season (Ha)	Monsoon Season (Acres)
1. Birganj	i) Potato (6.72) ii) Wheat (0.41) iii) Tomato (0.12)	Maize (7.25)	i) Local T. Aman (3.60) ii) Fallow (1.78) iii) Vegetables (0.90) iv) China IRRI (0.85) v) Cauli flower (0.12)
2. Sayedpur	Maize (3.0)	i) Jute (0.77) ii) China IRRI (0.77) iii) Fallow (0.73) iv) Vegetables (0.69)	i) Local Aman (2.19) ii) Vegetables (0.57) iii) HYV - Aman (0.24)
3. Savar	i) Potato (3.94) ii) Groundnut (0.53)	Maize (4.47)	i) Local T. Aman (1.66) ii) BR - 11 (0.94) iii) Brinjal (1.60) iv) Fallow (0.27)
	Maize (6.87)	i) Fallow (6.41) ii) Groundnut (0.33) iii) Brinjal (0.13)	i) HYV - Aman (5.80) ii) Local T. Aman (0.69) iii) Fallow (0.27) iv) Groundnut (0.13)
4. Jessore	i) China IRRI (1.7) ii) Mustard (0.97) iii) Fallow (0.69) iv) Pulses (0.61) v) Maize (0.53)	Maize (4.49)	i) Local T.Aman (3.40) ii) BR - 11 (0.49) iii) Fallow (0.49) iv) Potato (0.12)

Source: Field Survey, 1998

Table 7 — Principal Plot-wise Maize Cropping Patterns

Study Area	Winter	Pre-monsoon	Monsoon
Birganj	i) Potato	Maize	Local T. Aman
	ii) Potato	Maize	Fallow
Sayedpur	i) Maize	Fallow	Local T. Aman
	ii) Maize	Jute	Local T. Aman
Savar	i) Potato	Maize	HYV - Aman
	ii) Groundnut	Maize	Fallow
Jessore	i) China IRRI	Maize	Local T. Aman
	ii) Maize	ii) China IRRI	Fallow

Source: Field Survey, 1998

Figure 3 — Crop Calender for Maize Cropping Patterns

Study Village	Maize Season	Winter Season				Pre-monsoon Season				Monsoon Season			
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Birganj	Pre-Monsoon	Potato				Maize				HYV - Aman (BR -II)			
Sayedpur	Pre-monsoon	Maize				Jute				Local T. Aman			
	Pre-monsoon	Potato				Maize				HYV - Aman (BR - II)			
Savar	Winter	Maize				Fallow				HYV - Aman (BR - II)			
	Winter	Maize				China - IRRI				Fallow			
Jessore	Pre-monsoon	China - IRRI				Maize				Local T. Aman			

SUBSTITUTION OF CROPS BY MAIZE

With the expansion of maize, or its introduction into an area, some crops are expected to be substituted by it or it may be cultivated in fallow land where available. To understand the extent of substitution over time the maize growers were asked about the crops grown by them three years back in the currently cultivated maize plots. Growers' response reveal that only one-third of the maize land was earlier under maize cultivation. This is especially so at Jessore and Birgonj. Maize was grown there as a pre- monsoon crop. Again fallow land brought under maize amounts to 13% of the currently covered by maize particularly observed at Savar. So, substitution by maize occurs in only half of the cropland. Crops substituted are mainly HYV-*Boro*, wheat, sugarcane and potato and also some vegetables as shown in Table 8.

Substitutions of crops are predominant in the winter season in three villages (Sayedpur, Savar and Jessore); and in the pre-monsoon season at Birgonj and also in Savar. In Savar, sugarcane and mustard have been replaced by winter maize, while the pre-monsoon maize replaced vegetables. In Jessore substitution is limited to wheat and potato. In Sayedpur, wheat is also substituted by maize (Table 8). These crop substitutions may not always be due to a higher rate of return. Shortage of labor, cash constraint and risks involved might be other factors inducing such substitution.

Table 8 — Farmer's Use of Maize Land (Three Years Ago)

Study Village	Season	Originally Maize Land	Land Remained Fallow	Crops Substituted by Maize							Total Area
				HYV-Boro	Sugarcane	Vegetables	Wheat	Potato	Mustard	Jute	
Birganj	i)Winter	0.38	-	-	-	-	-	-	-	-	-
	ii)Pre-Monsoon	2.06	0.26	2.6	0.8	0.83	0.40	0.20	-	-	4.92
Sayedpur	i)Winter	1.03	0.36	0.2	0.24	0.43	0.69	-	-	-	1.60
	ii)Pre-Monsoon	0.43	-	0.2		0.12	0.39	-	-	-	0.76
Savar	i)Winter	0.67	1.20	0.2	1.60	0.25	0.74	0.53	1.60	-	5.00
	ii)Pre-Monsoon	0.94	1.60		-	1.93	-	-	-	-	1.93
Jessore	i)Winter	1.68	-		-	0.12	0.53	0.4	-	-	1.06
	ii)Pre-Monsoon	3.31	0.45		-	-	-	-	-	0.4	0.40
All Villages (Percentage)	**Both Seasons**	**10.50**	**3.87**	**3.4**	**2.66**	**3.68**	**2.76**	**1.14**	**1.60**	**0.40**	**15.68**
		35	**13**	**1**	**9**	**12**	**9**	**4**	**5**	**1.1**	**51.10**

Source: Field Survey, 1998

3. PRODUCTION AND DISPOSAL OF MAIZE BY PRODUCER HOUSEHOLDS

VARIETIES OF MAIZE GROWN AND THEIR YIELDS

The study villages grow different varieties of maize. Jessore grows exclusively composite maize while Savar only hybrids. In Birganj both hybrids and composite maize are grown. In Sayedpur on the other hand, maize production is dominated by a hybrid variety. Farmers reportedly take lesser care in composite maize. The yield difference between these two types of maize is quite significant, with lower yields in composite (about two-thirds of hybrid maize) as shown in Table 9. The average yield of hybrid maize is estimated to be 5.2 metric ton per hectare or 2.1 ton per acre. Despite lower yield farmers grow composite maize due to lower costs on seeds and easy availability. Hybrid seeds are costly and their prices are observed to be between Tk.120 to Tk.135 per Kg compared to only Tk.50.00 for composite. Farmers are suspicious of the quality of hybrid seeds available in the market. Some farmers, both at Birganj and Savar, complained of poor germination and lower yields.

Table 9 — Per Hectare Yield of Maize (M.tons)

Study Area	Composite	Hybrid
Birganj	3.5	5.4
Sayedpur*	3.1	6.2
Savar		4.7
Jessore*	3.4	
All Areas	**3.4**	**5.2**

Note: *Estimated from sales value of Maize Fields @ Tk. 6.00 per Kg
Source: Field Survey, 1998

SOURCES OF MAIZE SEEDS

Maize seeds are available from different sources. The principal source is the market, followed by NGOs. The share of home supplied seeds is less than one-fifth (Table 10). Farmers at Savar procure their seeds from Kushtia Seeds Store, located at Mirpur of Dhaka. NGOs are predominant at Birganj and Sayedpur supplying half of farmer's requirements. The NGOs in operation are BRAC and GKF. BADC's support is almost absent, though they maintain substantial stocks of maize seeds at Madhupur, Tangail. Recently they established a dehumidified seed store with a capacity of 150 tons at a cost of Tk. 2.8 million under the Integrated Maize Promotion Project of the Ministry of Agriculture.

Seed rates for maize production are low. Hybrid needs 15 Kg and composite 25 Kgs per hectare. Farmers' use in the field varies somewhat depending on the land fertility and time of planting. Late planting requires more seeds.

Table 10 — Sources of Maize Seeds

(Percentage)

Study Area	Home Supplied	Markets	NGOs	BADC/DAE	Total Seeds (Kgs)
Birganj	41.5	8.4	50.2	-	149.5
Sayedpur	22.1	19.0	56.4	2.5	99.5
Savar	-	100.0	-	-	182.0
Jessore	10.5	58.8	30.7	-	133.5
All Areas	17.4	51.8	30.4	0.4	564.5

Source: Field Survey, 1998

VARIOUS USES OF MAIZE

Maize has multifarious uses. Actually every part of the maize plant is useful. Green cobs of maize are cooked by roasting or boiling in water. The top green portion of the plant after harvest of the cob is fed to cattle as fodder, and the dry portion of the stem along with fibrous roots are used as fuel. The greatest advantage of maize over rice and wheat is its high bio-mass potential. Its grain contains more calories on an quivalent dry-weight basis (Kaul and Rahman, 1987). It is also of interest to report that calorie yield in maize is two and half times higher than local and HYV paddy (Karim, 1992). Maize grain, full or broken, is used in *Khichuri*, gruel often mixed with pulses. Popcorn is consumed as snacks. Grains are the principal ingredients for poultry and cattle feed. Industries make use of maize for corn oil, starch, adhesives, medicines and in the manufacture of various food products like corn flakes, chips etc. In Bangladesh, human consumption of maize is observed mainly as boiled cob by tribal people living in Chittagong Hill Tracts, Madhupur tract of Tangail and also in Mymensingh. The Urdu speaking non-Bengalis known as *Biharis* also take maize as roasted cobs. Recently some use of maize flour is reported in Dinajpur and Rangpur region. They mix maize flour with wheat flour in proportion of 1:4 for making *chapatis*. These *chapatis*, according to consumers are a bit sweet and look somewhat red and they consider them tasty. They are also soft and old people prefer them. Refined milling of maize flour in the country may attract more consumers as observed in Zimbabwe (Jayne and Rubay, 1993).

People in Bangladesh consider maize as animal feed or at best a poor people's food. In other countries, however, (e.g. Mexico, Chile, Kenya, Central America and Zimbabwe) maize is a staple food. Even in Indonesia, more than 18 million people consume corn as their staple food. Its income elasticity is however, negative (-0.6), estimated by Monteverde and Mink, 1987. Maize is more nutritious than rice in terms of protein, phosphorus and carotene content (Table 11). Fats and mineral contents are also higher. It is rich in Vitamin B and trace elements. Also, its price is much lower than rice. The main constraints to its

consumption expansion are poor orientation and somewhat different tastes of which people are not accustomed. Low and uncertain rates of return of traditional varieties also discourage its production. However, with the introduction of high yielding seeds and the increased demand by poultry and dairy farms, the production environment is undergoing changes significantly in recent years.

Table 11 — Comparative Nutritive Value of Maize, Wheat and Rice Food Composition per 100gm of Edible Portion

Composition	Maize Dry	Tender	Wheat Flour Whole	Rice (Milled)
Energy (kcl)	342.00	125.00	341.00	346.00
Protein (g)	11.00	4.70	12.10	6.40
Fat (g)	3.60	0.90	1.70	0.40
Minerals (g)	1.50	0.80	2.70	0.70
Fibre (g)	2.70	1.90	1.90	2.00
Carbohydrates (g)	66.20	24.60	69.40	79.00
Calcium (mg)	10.00	9.00	48.00	9.00
Phosphorus (mg)	348.00	121.00	355.00	143.00
Iron (mg)	2.00	1.10	11.50	4.00
Coratine (mg)	90.00	32.00	29.00	-
Thiamine (mg)	0.40	0.10	0.50	0.20
Riboflavin (mg)	0.10	0.20	0.20	0.10
Niacin (mg)	1.80	0.60	4.30	3.80
Vitamin C (mg)	-	6.00	-	-
Moisture (g)	14.90	67.10	12.20	13.30

Source: Islam and Kaul, 1986

USE OF MAIZE AS FEEDS

In recent years several feed mills in the private sector have been established in the country. Some of them are quite sophisticated. They include among others, Paragon Poultry Ltd., Quality Feeds Ltd., Phoenix Ltd., Aftab Ltd. and Saudi-Bangla. Some of the feed mills have an annual production capacity of more than five thousand tons. The public sector has also a few feed mills having a total capacity of 17,000 tons. All poultry feeds use maize to the extent of 45-55% of carbo-hydrate feeds. Some of the common poultry feeds manufactured by the mills are:

i) Layer Starter (Mesh)
ii) Layer Grower (Mesh)
iii) Layer-Layer (Mesh)
iv) Broiler Starter (Pellet)
v) Broiler Finisher (Pellet) etc.

Some of the mills also manufacture fish and cattle feeds where maize is also used but with a reduced share. These mills use both maize and wheat in varying proportions depending on their availability and market price. They, however, prefer maize because poultry fed with maize produce eggs with yellow yolks and harder shells. Mills use both local and imported maize, but are largely dependent on imported maize. Only 30 percent of their maize requirement is met from local supplies. Over time, the demand for maize will be rising fast as every year new poultry and dairy farms are being established in the country.

Information available from the Department of Livestock indicates that in the last eight years the annual increase of dairy and poultry farms number 3706 and 6850 respectively. Annual rate of growth in dairy farms is, however, negative (-0.32%) but

Figure 4 — Growth of Dairy Farms in Bangladesh, 1990-91 to 1997-98

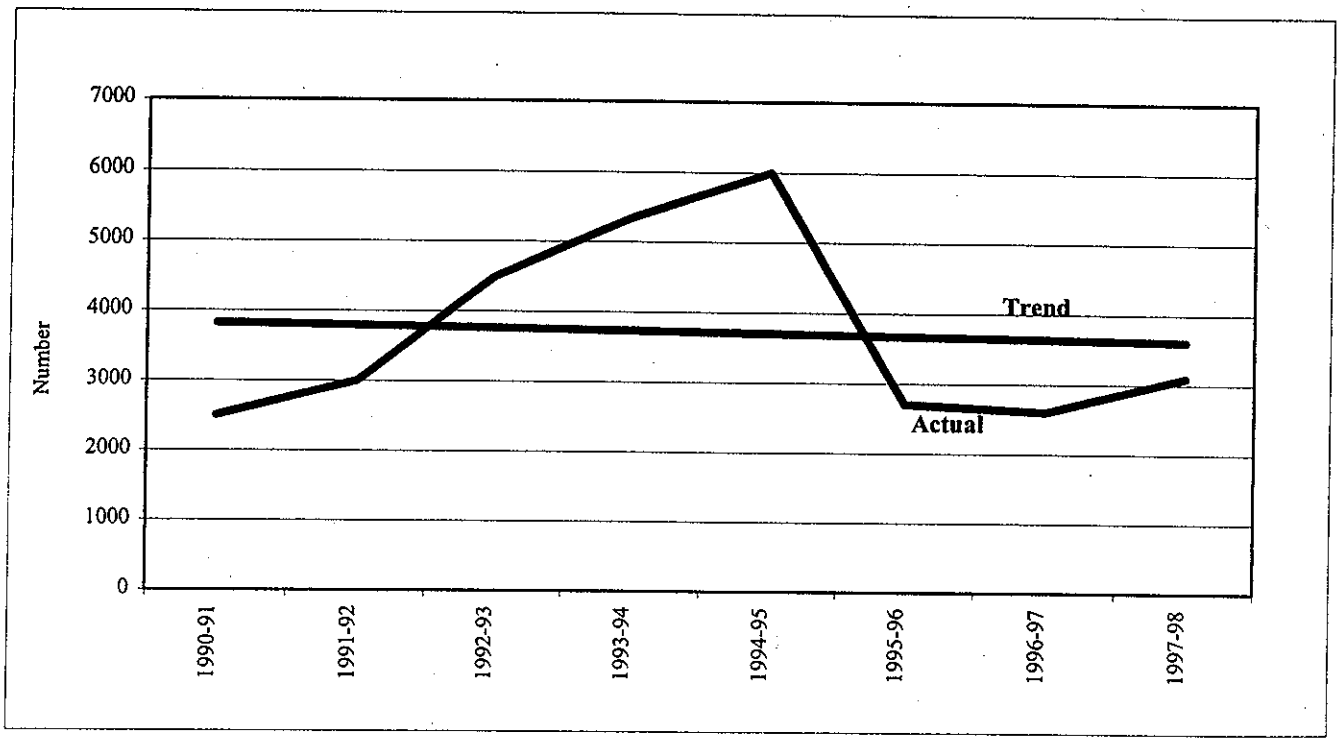
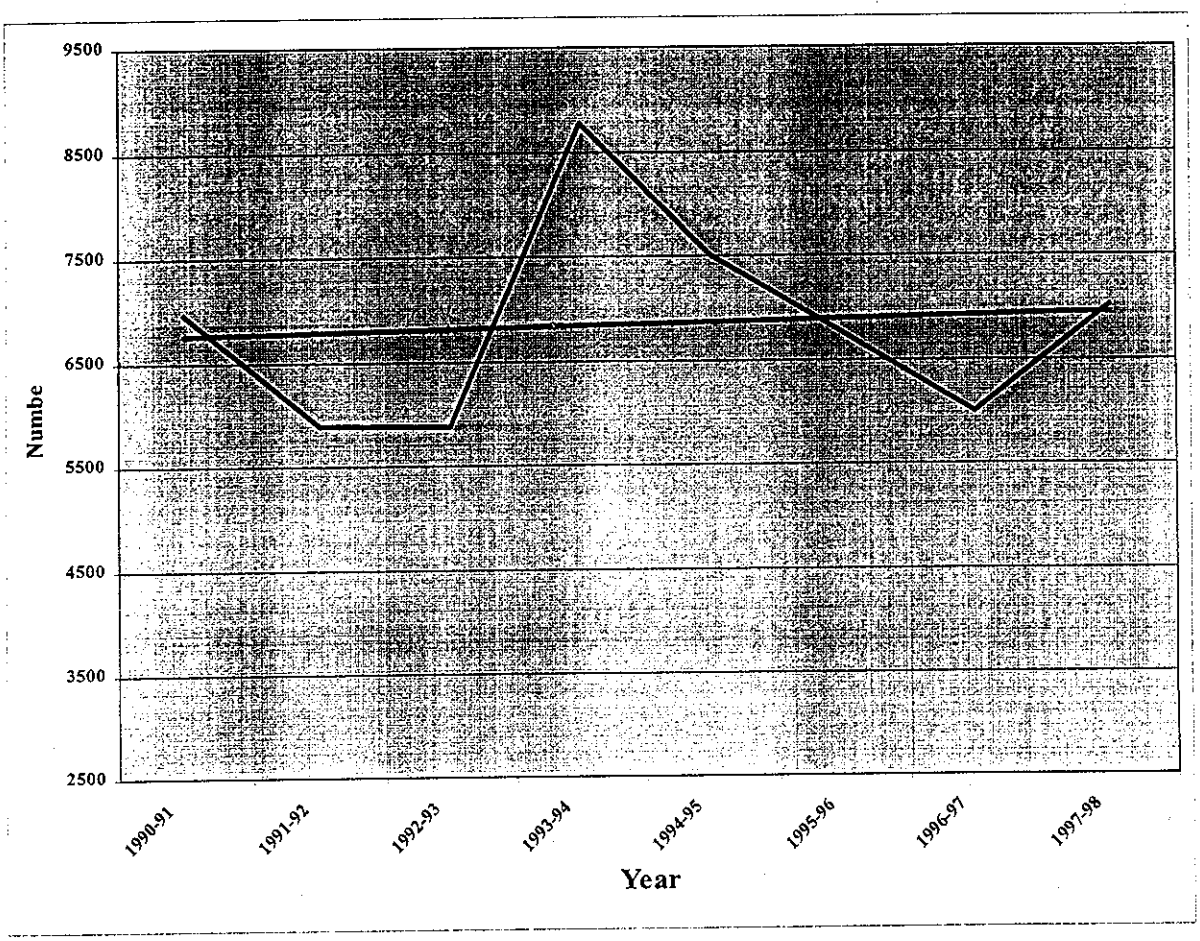


Figure 5 — Growth of Poultry Farms in Bangladesh 1990-91 to 1997-98



positive in poultry[2] (Figure 4 and 5). All these livestock farms require concentrate feeds. As of now, there are about 60 thousand poultry, 25 thousand duck and 25 thousand dairy farms in the country. To feed all these farms there is a huge demand for maize.[3] All these farms do not however, use finished feeds. Farmers procure broken corns, rice polish, oilcakes, oysters etc. from the local shops and make their own feeds. Reportedly their own prepared feeds are cheaper by Tk. 0.50 per kg. Maize consumption by dairy farms appears almost absent. In our study areas only one farm at Dinajpur uses maize grains, while another at Savar consumes maize plants as green fodder. Maize users report that its consumption helps increase milk yield as well as fat content. Zaher, (1995) suggests that maize can be used as a fish ingredient as well.

HOUSEHOLD PRODUCTION AND DISPOSAL OF MAIZE

The average production of maize per producing household is two tons with a range of 1.2 to 3.0 tons. Savar has the highest production per household. Most of their production has been sold (80%). About half of the maize produced at Savar is sold to poultry farms and the feed mills. Household consumption is negligible. Such consumption is reported at Birganj both as human food (in the form of fresh cobs and flour) and animal feed (about four percent each) as shown in Table 12. In Jessore and Sayedpur maize fields at harvest time are sold to the traders who instead harvest fresh cobs and sell to the consumers in the local markets. In two other areas traders come to the village and procure maize from the growers. In the post harvest season traders are hardly available for maize sales. At that time growers themselves have to contact the traders or buyers. It is, therefore, clear that the maize market is seasonal and very poorly developed.

[2] Dairy farms are those having five milch cows and poultry farms own more than 300 birds per farm.

[3] Fattah, 1995 reports that a broiler consumes 0.75 kg to 1.0 kg maize in a seven week life time and a layer about 17 to 20 kg per year.

Table 12 — Production and Disposal of Maize by Producer Households

Study Area	Total Production (ton)	Production per Household (ton)	Household Consumption as Food (%)	Household Consumption as Feed (%)	Sold to Traders (%)	Sold to Poultry farms & Millers (%)
Birganj	38.24	2.12	3.74	3.90	90.80	-
Sayedpur	27.95	1.55	-	-	100.00	-
Jessore	22.42	1.24	-	-	100.00	-
Savar	53.68	3.00	0.70	0.40	51.00	47.60
All Areas	**142.29**	**2.00**	**1.40**	**1.20**	**80.40**	**17.20**

Source: Field Survey, 1998

In Jessore and Sayedpur fresh maize cob is generally sold at about Tk. 1.00 each. Farmers did not experience any problem with marketing there as they had regular local markets. A serious problem was, however, reported in the last harvest season at both Birganj and Savar when price declined by 30% or Tk. 1.6 to Tk. 2.0 per kg over the previous year's price. Farmers at Birganj sold maize at Tk. 5.00 per kg, and at Savar the price was at Tk. 5.7 per kg. It was difficult for farmers to dispose of maize in the post-harvest season as there were no buyers in the market at that time. However, some of the maize growers themselves contacted the buyers for off-season sales. With this bitter experience the farmers are now hesitant to grow maize in these areas.

STORAGE OF MAIZE BY FARMERS

Storage of maize by farmers is difficult. It is more hygroscopic than paddy and wheat and thus, absorbs air moisture quickly. Consequently grain quality is deteriorated due to a fungus disease commonly called mycotoxin which is more harmful when used as food and feed. Sun-drying of maize grain, meant for storage is generally inadequate. Its moisture content should be below 13.5%. Such a high degree of drying on earthen yards is difficult with maize, but is easily possible with paddy. Sometimes maize absorbs moisture when left on earthen floor or kept stored in jute bags. Actually the optimum temperature for the

growth of storage fungi is between 29°C to 35°C. Maize harvested in the monsoon is especially difficult to store because the humidity rises to over 80 percent. Farmers interviewed did not show any interest in stocking maize mainly due to storage problems and uncertainty of maize prices.

The study reveals that less than one-fifth of maize producers stored maize. Those that stored maize were mainly from Savar and Birganj, and they generally stored maize for about two months. Average amount stored was only 15 tons at Savar and seven tons at Birganj, i.e. 28 and 19 percent of their respective area production of farmers who stored maize and only 16% of total productions in the area. Those who stored their maize did not face any problem within two months of their storage. They, however, emphasized that the grains must be well dried before storing and that sun-drying on a *Chatal* i.e. metal floor is more appropriate. For longer periods of storage, occasional drying (once a month) is useful. The drying difficulties, as well as storage problems, suggest that winter harvest of maize is better suited to our country. Farmers who stored maize also reported that the stored maize was attacked more by rats than other foodgrains, as they are sweet to taste.

STORAGE OF MAIZE BY POULTRY FARMS AND FEED MILLS

Sometimes poultry farms consuming maize keep some stock as part of their requirement for un-interrupted operations. The period of storage does not, however, exceed four months. During this period of storage, farm owners did not notice any problem in stored maize. Every farm owner, however, cautioned that maize must be well-dried reducing moisture content below 13.5% as they are susceptible to easy germination and fungal attack and/or aflatoxin contamination which has been linked to cancer in humans and causes decline in productivity in poultry farms. A very high degree of drying is a must for seeds (below 12%). For the purpose of human consumption moisture content should be below 13.5 percent (Karim, M.A. 1995) and maize may be stored in airtight containers.

Feed mills usually do not store maize for more than a month. They have a regular schedule of maize procurement from the local market or abroad. Actually, they do not import maize themselves, but procure the crop by floating tenders for maize purchased either from local markets or imported from abroad. The procurement officials reported that they are extra-cautious of procurement of maize because if the grain is of poor quality, the quality of their feeds suffers. They never accept poor quality maize and thus, they do not have any problem with their own stored maize.

4. GOVERNMENT PROCUREMENT AND IMPORT PRICE

LOCAL MARKETING AND PRICES OF MAIZE

The local maize market is poorly developed. It is a seasonal market operating only in the harvest months. Local traders in paddy and vegetables procure maize from the market or homesteads and sell them to outside traders. There are no special traders who trade only in maize. Traders do not take an active interest in the maize trade, but function only when there are abundant supplies in the area. In the off-season large producers contact the possible buyers and dispose of their stocks through negotiations. The Savar maize market is somewhat different. Local poultry farm owners and outside dealers visit the area and procure maize during the harvest season.

During the harvest season of 1998 maize producers in the Dinajpur region faced acute problems in selling maize, as there were few buyers. Growers' prices thus fell drastically even below Tk. 4.80 per kg. in Birganj. According to the country's maize production program both the Government and NGOs were supposed to procure maize from the growers at a predetermined price. NGOs, namely BRAC and GKF, in the year 1997, procured maize at Tk. 7.00/kg from their contract growers, some of whom at the time sold maize outside at a higher price. The maize farmers, thus, had higher price expectations in 1998. Unfortunately, with the unexpected excess supplies from India at lower prices (Tk. 5.00/kg) all buying agents/firms in the country refused to procure from the local markets at a higher price in spite of the earlier contract with the NGOs. This caused a serious setback in the marketing of maize in the last season. To overcome such abnormal market situations the Government planned to intervene and accordingly decided to procure maize at a floor price of Tk. 7.00/kg from the growers.

GOVERNMENT PROCUREMENT AND STORAGE AT DINAJPUR

To protect the interests of maize producers the government procured 2300 tons of maize in July, 1998 at Dinajpur. As already indicated, the Food Inspectors were not interested in procuring maize because they had little knowledge of quality standards for maize. They were even ignorant of the limit of 13.5% for moisture content and lacked maize moisture meters. Further, they lacked adequate knowledge on the treatment of maize when stored. They did not know the insecticides to be spread, or how to stack and provide aeration in the maize godowns. Above all, they were suspicious of the period of storage. In the case of long duration, rice procurement might be hampered. In the end, however, after much persuasion, Food Officers procured maize through eye examination and physical checking of maize grain.

The experience gained last year (1998) from maize procurement and its storage is quite interesting and positive. Discussions with the relevant officers reveal that the maize they procured and stored was of exceptionally good quality. There was no wastage and no deterioration in quality during the four-month storage. They recommended that winter maize is better for storage. The Department of Livestock was highly satisfied with the government stock of maize and they bought all 2300 tons of maize at Tk. 7.50/kg thereby paying a gross margin of about seven percent to the Food Ministry. Further, aeration in the godown was not at all difficult; rather easier than for rice, as the grains were not smooth like rice. Officials did not record any extra cost on pesticides, since maize requires almost the same treatment as wheat and rice. That means that maize can be kept stored in the existing godowns at the same cost as that of rice. It is, however, quite different with the maize seeds which need extra care. A de-humidified godown is necessary, like the BADC godown at Madhupur which costs Tk. 2.8 million for an 150 ton capacity seed store.

DEMAND FOR MAIZE BY POULTRY FARMS

The principal consumption of maize is in the form of feed for poultry although some dairy farms use maize as feed grains and its plants as green fodder. An accurate estimation of maize consumption by poultry farms is complex and very difficult without detailed statistics. Some rough estimates have, however, been made on the basis of our case studies and secondary information supplied by the Department of Livestock. The estimation is based on three alternative approaches. First, we take into account the supplies of chicks by the government and the private hatcheries and the feeds consumed by them. Total weekly supplies of chicks number 1.2-1.3 million of which about 0.6 million are distributed by the government farms. The maize consumption estimation has been done in the following manner.

Approach 1: Calculation Based on the Supply of Chicks

1. Total weekly supply of chicks is 1.2 million
2. Annual supply of chicks is (1.2 x 50) or 60 million
3. Chicks survived at a 90% rate, so the remaining population is 54 million
4. Existing consumption of maize is 10 kgs per bird[4]
5. Total consumption requirement is 54 x 10 million kgs or 540 thousand tons

Approach 2: Calculation Based on Number of Farms

1.	Total Poultry Farms:	60,000
1.1	Broilers	25,000
1.2	Layers	35,000
1.3	Breeding	48
2.	Number of Farms in Operation (Assumed)	
2.1	Broilers (75%)	18,750
2.2	Layers (85%)	29,750
2.3	Breeding (100%)	48
3.	Number of Birds Per Farm in a year	
3.1	Broilers	1600 in Four Batches
3.2	Layers	600 birds
3.3	Breeding	6000 birds

[4] Based on the case studies of poultry farms.

4. Total Birds in the Farms
   - 4.1 Broilers — 18750 x 1600 or 30 million
   - 4.2 Layers — 29750 x 600 or 18 million (Approximately)
   - 4.3 Breeding — 48 x 6000 or 0.3 million

5. Birds Survived (at the rate of)
   - 5.1 Broilers — (90%) or 27 million
   - 5.2 Layers — (90%) or 16 million (Approximately)
   - 5.3 Breeding — (85%) or 0.25 million (Approximately)

6. Carbo-hydrate Feeds Required (at the rate of)
   - 6.1 Broilers — (35 kg per year) or 27 x 35 = 945 million kgs
   - 6.2 Layers — (27 kg per year) or 16 x 27 = 432 million kgs
   - 6.3 Breeding — (50 kg per year) or 0.25 x 50 = 12.5 million kgs

7. Proportion of Maize actually used in the Carbohydrate Feeds (Assumed)
   - 7.1 Broilers — (30% of the feed weight)
   - 7.2 Layers — (35% of the feed weight)
   - 7.3 Breeding — (40% of the feed weight)

8. Quantity of Maize Required
   - 8.1 Broilers — 284 million kgs
   - 8.2 Layers — 151 million kgs
   - 8.3 Breeding — 5 million kgs

9. Total Maize thus, required is 440 million kgs or 440 thousand tons.

Approach 3: Calculation Based on Various Sizes of Poultry Farms

Type of Farms	**No. of Farms in Operation**	**Annual Capacity (ton)/Consumption of Maize (tons)**	**Amount of Maize Requirement (tons)**
1. Feed Mills	15	5000+	37,500 (half of the carbohydrate feeds)
2. Big Poultry Farms with 5000 birds and above	4800 (10% of total farms)	50 tons*	240,000
3. Small Farms (with 500 birds on average)	43200 (90% of total farms)	4.2 tons**	181,400
All Farms			458,900 or (460 thousand tons)

* Based on case studies

** Based on the Discussions with Feed Stores according to whom maize shares 60% of total grain consumption.

According to the first approach, the current demand for maize stands at 540 thousand tons, while for the second and third approaches, the demand is estimated to be 440 thousand and 460 thousands respectively. From these estimates we may consider that maize demand at present is about 460 thousand tons in the country of which 86% is imported (Table 13). Local supplies are available mainly in the harvest season of April to June. It may, however, be noted that not all poultry farms use only maize, rather many use wheat up to one-third (224 thousand tons) of the total foodgrain requirements due to its easy availability.

Table 13 — Uses of Maize and Its Sources of Supplies, 1998

Sources of Supply	Amount of Maize Available (Metric Tons)	Uses of Maize (Metric Tons) * Household Consumption as Food	Household Consumption as Livestock Feed	Poultry Feeds	Total %
Local	65,000	1000	800	63,200	100.0
(%)	(14)	(1.6)	(1.3)	(97.2)	
Imported	395700 +	-	-	395,700	100.0
(%)	(86)			(100.0)	
Total	460,700	1000	800	458900	100.0
(%)	(100.0)	(0. 22)	(0. 17)	(99.16)	

Notes: (1) * Estimates for use of Maize is Based on Household Survey, 1998.
(2) + Estimates by the Author

Over time, the maize requirement is likely to rise gradually due to the establishment of new poultry farms and higher rates of consumption of maize instead of wheat by the small farms. Furthermore, with the growth of national income and urbanization, demand for livestock products will grow at a faster rate and therefore, more maize will be needed. The income elasticity for meat and eggs was estimated to 1.35 (Hossain, 1989). Information collected from the poultry farms and the feed mills tend to indicate that there will be an annual increase in the demand for maize by at least over five percent. This however, depends on the relative prices of production inputs, mainly maize and wheat, as well as their

outputs, as feed to poultry and other uses.

LOCAL PRICE VS IMPORTED PRICE

With free trade in maize, the local prices are largely determined by the cost of imported grains shipped from India, Thailand, Mayanmar and also from the USA. Setting the local price of maize higher than the world price is inefficient and may have negative effects as noted in Mexico (Levy and Wijnbergen, 1992). Some price indications have been put forward here on the basis of scanty information collected from wholesalers and feed mill owners for ready reference. Lack of price statistics is a major constraint here. It seems that importers and wholesalers did not report their procurement price correctly.

Available price information indicates that the C&F price at Chittagong in the current year (1998) is around Tk. 6.0 per kg. Adding duties, surcharges and marketing margins it gives a wholesale price of Tk. 7.0 kg at Chittagong. Adding transport cost to Dhaka, the wholesale price amounts roughly to Tk. 8.0 at the Dhaka market (Table 14). Local transport

Table 14 — Average Wholesale Price at Chittagong and Dhaka Collected from Wholesalers Functioning in Three Market Centers

(Taka/kg)

Year	Wholesale Price at Chittagong				Wholesale Price at Dhaka				Gross Margin of Dhaka Price over Chittagong Price Taka (%)
	Savar	Gazipur	Fulbaria	All Areas	Savar	Gazipur	Fulbaria	All Areas	
1998	6.95	7.05	6.90	6.97	8.12	7.97	7.82	7.97	1.00 (14.3)
1997	6.74	6.90	6.65	6.77	7.83	7.90	7.68	7.80	1.03 (15.2)

Source: Field Survey, 1998

cost from Dinajpur (the principal source of supply) to Dhaka is reportedly also around Tk. 0.80 per kg. If this transport cost is deducted from the Dhaka import parity price of Tk. 8.00, then the corresponding farm gate price stands at Tk. 7.20, from where some traders' margin should also be deducted. That means growers' prices may be roughly around Tk. 7.00 per kg at which local maize should compete with imported maize.

Poultry farm owners from their own cost calculations and the income earned expressed that they could pay up to Tk. 7.00 at their gate; but beyond this it is difficult to compete with the Indian supplies of eggs. But as far as their procurement cost of maize in 1998 is concerned, it was estimated to be Tk. 7.6 per kg for local supplies while for imported maize such estimation could not be done due to a lack of reliable statistics. There are however some variations in import price depending on the sources and the form of supplies (bulk or bagged) and the timing of supplies. The available price statistics, however, lead us to conclude that a competitive farm gate price may be around Tk. 7.0 per kg. The next question is whether Tk. 7.0 can be an incentive price for maize production. This has been examined below.

5. ECONOMICS OF PRODUCTION OF MAIZE AND COMPETITIVE CROPS

NET RETURN AT FULL AND CASH COSTS

Maize is competitive with several winter and pre-monsoon crops. The major competitive crops are potato, wheat, China-IRRI, jute, sugarcane and oilseeds. Maize cannot, however, be a substitute for all these crops as all lands are not equally productive to all crops grown. Substitution generally takes place in marginal land depending on the relative rates of return. Costs and return data for the year 1998 show that maize is more profitable than only wheat and jute (Tables 15 and 16) at both full and cash costs. It is, however, less profitable compared to both China-IRRI paddy and potato. China-IRRI yields three times more return at full costs and 1.66 times at cash costs. Maize is also less profitable as compared to groundnut, grown at Savar, and mustard and lentil at Jessore and far less than vegetables like cauliflower at Birganj and brinjal at Savar. Potato yields an extraordinarily high return (about 10 times of maize return at full costs and three and half times at cash costs). The present price and productivity of maize therefore do not enable it to compete with several other crops in the country. With higher yields (seven tons in hybrid maize) or higher by two tons over the present survey findings, its profitability situation changes completely. It may be noted that such a high yield can be obtained in only closely supervised fields. Higher net return observed earlier in 1994 by Hussain, *et al.*, 1995 was due to both increased yield and higher sales prices. In the present study, maize and China-IRRI are found to be equally input-intensive, and a higher return from China-IRRI is thus mainly due to the higher price of paddy (higher by 36%). Potato also yields significantly higher (seven tons against two tons in maize). Higher net returns from maize at Sayedpur

Table 15 — Per Hectare Net Return from Maize and Its Competitive Crops at Full and Cash Costs in the Study Villages+

(Taka)

Study Village	At Full Costs					At Cash Costs				
	Composite Maize	Hybrid Maize	Potato	Wheat	China-IRRI Paddy	Composite Maize	Hybrid Maize	Potato	Wheat	China-IRRI Paddy
Birganj	(-) 3233.23	1385.67	35234.55	(-) 686.66	6063.85	4781.92	10771.67	43973.41	7054.32	15173.21
Savar	-	(-) 627.38	35723.61	(-) 5910.71	12211.68	-	6706.05	42814.98	3112.20	25418.77
Sayedpur	-	7260.36*	30689.75	(-) 1694.42	5542.68	-	25757.16*	39302.64	7711.34	13429.39
Jessore	3270.28*	-	16124.16	-	16788.59	11542.31*	-	25366.90	-	23672.48
All Areas	1133.73	3643.25	33898.28	(-) 1630.20	11414.4	9274.85	11725.09	42261.70	6836.96	19527.82

Notes: (i) '-' Not grown in the village.
(ii) '*' Maize gold in Fields as Fresh cobs.
(iii) '+' It does not include cost of working capital.

Source: Field Survey, 1998

Table 16 — Per Hectare Net Return from Other Competitive Crops at Full and Cash Costs in the Study Villages+

(Taka)

Study Village	At Full Costs				At Cash Costs			
	Jute	Groundnut	Mustard	Lentil	Jute	Groundnut	Mustard	Lentil
Birganj	-	-	-	-	-	-	-	-
Savar	-	8106.54	-	-	-	17060.29	-	-
Sayedpur	(-) 6204.64	-	-	-	2445.30	-	-	-
Jessore	-	-	5001.75	14624.87	-	-	10420.93	21459.36

Notes: (i) '–' Crops not grown in the area.
(ii) '+' It does not include cost of working capital.

Source: Field Survey, 1998

and Jessore become possible due to sales of fresh maize cobs from fields at harvest time.

The economics of the production of maize in two commercial villages (Savar and Birganj) furthermore, indicate that maize production at full costs is not profitable at Savar when maize is sold at below Tk. 6.0 per kg but is marginally profitable at Birganj in hybrid, but not in composite variety. This price thus, cannot act as an incentive price. To make this product more profitable, the farm gate price must be above Tk. 6.0 per kg. Survey evidence indicates that poultry farm owners and the feed mill owners are ready to pay Tk. 7.0 per kg at their gates. But, as indicated earlier, poultry farm owners at present are paying Tk. 7.6 for local maize and thus they can safely pay Tk. 7.00 at the farm gate. The opinion survey also indicates that for increased local production they are ready to pay more if necessary. They emphasized that local production must be encouraged at least for the sake of the country's bargaining purposes, otherwise complete dependence on imported maize will encourage importers to charge higher prices of maize. Financial and price analysis thus lead us to conclude that the floor price for maize at growers' level must be above Tk. 6.0 per kg for 1998/99. From efficiency consideration the procurement price should be fixed at the import parity level, equal to import parity at Dhaka, less transport and other marketing costs from farm gate to Dhaka. We may recommend Tk. 7.00 per kg. keeping in view its import parity price of about Tk. 8.0 per kg at Dhaka. It is very much relevant here to point out whether the country is going to be benefited in the long-run from maize where it is substituting jute, wheat, mustard and lentils which are also important in Bangladesh and since the country is already deficient in oilseeds and pulses.

FERTILIZER USE

Sometimes maize is claimed to be a more nutrient exhaustive crop and accordingly more intensive use of fertilizer is recommended. Our data on fertilizer use shows that there

Table 17 — Per Hectare Use of Fertilizer in Maize and Its Competitive Crops in the Study Villages

(kgs)

Study Village	Composite Maize				Hybrid Maize			
	Urea	TSP	MP	Others*	Urea	TSP	MP	Others*
Birganj	335.92	182.78	167.96	71.63	301.34	182.78	219.83	88.92
Savar	-	-	-	-	330.98	237.12	128.44	-
Sayedpur	-	-	-	-	195.13	133.38	71.63	14.82
Jessore	212.42	106.21	44.46	98.80	-	-	-	-
All Areas	251.94	130.91	83.98	88.92	293.93	202.54	138.32	54.34
	Potato				China-IRRI Paddy			
Birganj	308.75	3219.83	264.29	111.15	321.10	192.66	135.85	71.63
Savar	365.56	355.68	298.87	-	237.12	118.56	81.51	-
Sayedpur	227.24	163.02	160.55	4.94	209.95	160.5	76.57	41.99
Jessore	212.42	237.12	125.97	-	330.98	130.91	6.69	34.58
All Areas	266.76	212.42	219.83	93.86	291.46	150.67	86.45	44.46
	Wheat							
Birganj	259.35	182.78	133.38	81.51				
Savar	155.61	222.30	121.03	-				
Sayedpur	214.89	165.49	108.68	9.88				
Jessore	-	-	-	-				
All Areas	232.18	180.31	123.50	54.34				

Notes: (i) '-' Crops not grown.
(ii) '*' Other Fertilizers include Gypsum, Borax, Zinc-Sulphate etc.

Source: Field Survey, 1998

is a larger use of fertilizer by maize than China-IRRI paddy and wheat by 20 and 18 percent respectively (Table 17). But the intensity of fertilizer use is lower than potato (by 10 percent) and also compared to vegetables like cauliflower and brinjal where the rate of use is substantially higher (by over 60%). Per hectare use of three major chemical fertilizers (Urea, TSP and MP) in hybrid maize is 635 kgs, while in China-IRRI paddy, wheat and potato are 529, 536 and 699 kgs respectively.

It is, however, worth-mentioning here that fertilizer use is more balanced in hybrid maize with higher proportional use of TSP and MP. Its use is found to be higher in both the commercial areas of Birganj and Savar. Maize producers at Birgaj are more progressive in the use of sulphur, magnesium and zinc whose use per hectare is estimated to be 88.92 kg in hybrid maize. It may be concluded that maize is a fertilizer intensive crop but consumes a lesser amount than potato and vegetables. Farmers in those two areas are again careful about soil health and balanced use of all fertilizers including manures (cow dung and poultry litters). Per hectare use of cow dung at Birganj was estimated to be 6422 kgs. while poultry litters was 1522 kgs. in the use of maize at Savar.

LABOR USE

It may be of interest to report that maize is almost as equally labor intensive as potato, wheat and China-IRRI paddy. Per hectare use of labor in maize is 128 mandays against 114 in potato and wheat and 146 in China-IRRI. It may safely be concluded that any extension of maize cultivation is not going to replace any labor, rather it would absorb more labor particularly if women were involved in its shelling operation. Maize producers at Birganj are noted to be more vigilant with production as evidenced from higher mandays (Table 18), may be facilitated by low wage rates. Farmers at Savar, being more commercial, contract out various agronomic operations. Wage rate in any season at Savar is also much higher (Tk. 70.0 in pre-monsoon as against the lowest rate of Tk. 42.0 at Birganj).

Table 18 — Man-days Used Per Hectare in Maize and Some Selected Competitive Crops in the Study Villages

Study Village	Composite Maize	Hybrid Maize	Potato	Wheat	China-IRRI Paddy
Birganj	140.79	180.31	118.56	118.56	125.97
Savar	-	103.74	101.27	116.09	170.43
Sayedpur	-	88.92 (without harvest)	103.74	106.21	155.61
Jessore	66.69 (without harvest)	-	143.26	148.20	-
All Areas	140.79 (excluding Jessore)	128.44 (excluding Jessore)	113.62	113.62	145.73

Note: '-' Crops not grown
Source: Field Survey, 1998

COSTS OF PRODUCTION

The cost of production of maize is almost equal to China-IRRI but lower than potato by 35% as shown in Table 19 (in full costing). Hybrid maize costs Tk. 28454 per hectare or Tk. 5.74 per kg. while for composite it is Tk. 24206 per hectare or Tk. 6.82 at full costing (Table 20). Per hectare costs of production of wheat, potato and China-IRRI are estimated to be Tk. 24268, Tk. 44008 and Tk. 28025 respectively suggesting that maize production does not cost higher. Cost of production of potato per kg., however, is estimated to be much lower (Tk. 2.52), facilitated by increased per hectare yield (17.5 ton).

Detailed analysis of costs shows that material inputs share 48% of total costs in hybrid maize, which is almost equal to wheat and China-IRRI, but its proportional share rises to 69% in case of potato, caused by higher costs of seeds (about 33%). Rental value of land accounts for only 20% in all the three crops except potato with a share of only 12%,

although the absolute cost is almost the same (Tk. 4940 per hectare in a season). The study furthermore shows that home supplied inputs have almost the same level of contribution in all these crops including maize ranging between Tk. 7968 to Tk. 8467. The details of input use and the cost composition of maize and its competitive crops are shown in Tables 20 to 24.

Table 19 — Per Hectare Costs of Production of Maize and Its Competitive Crops in the Study Areas+

(Taka)

Study Village	At Full Costs					At Cash Costs				
	Composite Maize	Hybrid Maize	Potato	Wheat	China-IRRI Paddy	Composite Maize	Hybrid Maize	Potato	Wheat	China-IRRI Paddy
Birganj	24206.00	27449.11	44129.02	22415.25	28602.60	16198.26	18063.11	35387.69	14706.38	19517.94
Savar	-	2908.88	46339.67	31776.55	28503.80	-	21575.45	39248.30	22753.64	15296.71
Sayedpur	-	22062.04 (without Harvest)	38880.27	24783.90	27227.96	-	13565.24 (without harvest)	30267.38	15220.14	19448.78
Jessore	8475.60 (without harvest)	-	43966.00	-	28279.03	-	-	34725.73	-	21395.14
All Areas	24206.00 (without Jessore)	28454.40	44007.99	24267.75	28024.62	16198.26	20486.18	35644.57	15800.59	19987.24

Notes: (i) "-" Crops not grown
(ii) "+" It does not include cost of working capital

Source: Field Survey, 1998

Table 20 — Composition of Costs in the Production of Maize (%)

Production Inputs	Hybrid Maize			Composite Maize	
	Birganj	Savar	All areas	Jessore	Birganj
A) Total Labor					
1) Family Labor	9.14	8.16	8.45	7.93	4.58
2) Hired Labor	7.79	8.43	8.24	12.60	5.77
Sub-Total (A)	16.93	16.59	16.69	20.53	10.35
B) Contract Activities					
1) Weeding	2.92	3.16	3.08	-	2.40
2) Harvesting	3.57	2.81	3.04	-	4.36
3) Threshing	3.79	2.53	2.91	-	6.66
4) Ploughing	0.29	9.12	6.47	5.64	0.00
Sub-Total (B)	10.57	17.62	15.50	5.64	13.42
C) Ploughing (Family)	5.71	0.12	1.79	9.71	6.80
D) Cost of Material Inputs	6.51	7.08	6.91	4.55	4.64
1) Seeds	25.50	20.58	22.06	18.15	26.12
2) Fertilizer	5.11	5.61	5.47	3.12	4.16
3) Manure	8.14	13.65	12.00	11.52	0.58
4) Irrigation	2.20	0.80	1.22	0.04	2.25
5) Pesticides	0.00	0.87	0.60	0.00	0.00
6) Others	47.46	48.59	48.26	37.38	47.75
Sub-Total (D)					
E) Cost of Land	19.35	17.08	17.76	26.74	21.69
All Costs	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
(Cost Per Hectare) Tk.	27449.11	28908.88	28454.40	18475.60	24206.00
Cost Per kg (Tk.)	5.10	6.10	5.74	-	6.82
Sales Price per kg	4.8	5.7	5.4	-	5.4
(No. of Observations)	(10)	(9)	(19)	(9)	(8)

Source: Field Survey, 1998

Table 21 — Mandays and Use of Inputs Per Hectare in the Production of Maize

Production Inputs	Hybrid Maize			Composite Maize		
	Birganj	Savar	All areas	Jessore	Birganj	All areas
A) Total Labor (A+B)						
1) Family (Mandays)	59.28	34.58	41.99	24.70	24.70	24.70
2) Hired (Mandays)	51.87	34.58	39.52	39.52	34.38	37.05
B) Contract Activities						
1) Weeding (Mandays)	19.76	12.35	14.82	-	14.82	4.94
2) Harvesting (Mandays)	24.70	12.35	17.2	-	2470	9.88
3) Threshing (Mandays)	24.70	19.88	14.82	-	37.05	12.35
4) Ploughing (Tk)	79.04	2633.02	1842.62	1042.34	-	699.01
C) Ploughing (Tk) (Family)	1568.45	34.587	511.29	1793.22	1645.02	1746.29
D) Cost of Material Inputs						
1) Seeds (kg)	14.42	16.08	15.56	24.01	23.24	23.71
2) Fertilizer (kg)	787.93	696.54	726.18	459.42	755.82	555.75
3) Manure (kg)	6473.56	1521.50	3057.86	5337.67	6706.05	5787.24
4) Irrigation (Tk)	2235.35	3942.12	3413.54	2129.14	2558.92	2269.93
5) Pesticides (Tk)	602.68	232.18	345.80	7.46	543.40	182.78
6) Others (Tk)	-	249.47	172.90	-	-	-
E) Cost of Land (Tk)	5310.50	4940.00	5056.09	4940.00	5248.75	5041.27
F) Wage Rate (Tk/Manday)	41.5	70.00	55.75	56.00	41.25	120.09
G) Yield (ton/hectare)	5.43	4.73	4.95	-	3.55	-
H) Sales Price (Tk/kg)	4.80	5.68	5.38	-	5.40	-
I) Value of Produce (Tk)	26058.50	26801.01	26631.54	-	19152.38	-
J) Value of by Product (Tk)	2793.57	1393.08	1827.8	1561.04	1810.51	1642.55
K) Net Return at Full Cost (Tk/hectare)	1385.67	-627.38	-2.74	3270.28	-3233.23	1133.73
(No. of Observations)	(10)	(9)	(19)	(9)	(8)	(17)

Source: Field Survey, 1998

Table 22 — Composition of Costs in the Production of Potato (%)

Inputs	All areas	Birganj	Sayedpur	Savar	Jessore
A) Total Labor					
1) Family Labor	3.97	2.99	5.60	4.64	9.22
2) Hired Labor	5.13	2.46	6.87	10.59	6.95
Sub-Total (A)	9.10	5.45	12.47	15.23	16.17
B) Contract Activities					
1) Weeding	1.82	2.84	1.03	-	-
2) Harvesting	1.62	2.69	-	-	-
3) Threshing	0.22	0.36	-	-	-
4) Ploughing	3.41	0.72	4.86	7.39	13.62
Sub-Total (B)	7.07	6.61	5.89	7.39	13.62
C) Ploughing (Family)	3.48	5.06	4.13	-	-
D) Cost of Material Inputs	33.12	34.38	39.85	25.11	41.42
1) Seeds	17.55	18.00	13.24	19.44	11.91
2) Fertilizer	2.40	2.65	3.04	1.64	1.44
3) Manure	6.22	4.38	3.66	12.59	2.36
4) Irrigation	8.45	9.74	5.55	7.94	1.28
5) Pesticides	1.18	1.98	-	-	-
6) Others	68.92	71.13	65.34	66.72	58.41
Sub-Total (D)					
E) Cost of Land	11.55	11.75	12.41	10.66	11.80
All Costs	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
(Cost Per Hectare) (Tk)	44007.99	44126.55	38880.27	46339.67	43966.00
(No. of Observations)	(38)	(18)	(11)	(6)	(3)

Source: Field Survey, 1998

Table 23 — Composition of Costs in the Production of China-IRRI Paddy (%)

Inputs	All areas	Birganj	Sayedpur	Savar	Jessore
A) Total Labor					
1) Family Labor	6.71	4.42	5.11	21.11	6.00
2) Hired Labor	14.55	3.76	12.62	17.58	20.19
Sub-Total (A)	21.26	8.18	17.73	38.69	26.19
B) Contract Activities					
1) Weeding	0.64	2.87	-	-	-
2) Harvesting	4.43	6.67	12.15	-	-
3) Threshing	0.23	1.02	-	-	-
4) Ploughing	5.54	0.68	4.29	5.73	8.49
Sub-Total (B)	10.84	11.24	16.44	5.73	8.49
C) Ploughing (Family)	3.12	9.27	3.64	2.58	-
D) Cost of Material Inputs					
1) Seeds	3.54	3.75	3.46	4.40	3.32
2) Fertilizer	16.80	22.29	15.01	12.39	15.90
3) Manure	1.57	2.52	1.00	1.22	1.47
4) Irrigation	21.14	18.72	18.96	12.50	25.00
5) Pesticides	2.01	3.00	2.43	2.16	1.29
6) Others	0.95	2.91	1.29	-	-
Sub-Total (D)	46.01	53.19	42.15	32.67	46.98
E) Cost of Land	18.87	18.13	20.10	20.33	18.34
All Costs	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
(Cost Per Hectare) (Tk)	27992.51	28627.30	27335.49	26722.93	28279.03
(No. of Observations)	(40)	(11)	(7)	(7)	(15)

Source: Field Survey, 1998

Table 24 — Composition of Costs in the Production of Wheat (%)

Inputs	Birganj	Sayedpur	Savar	All areas
A) Total Labor				
1) Family Labor	5.85	12.60	12.85	9.29
2) Hired Labor	4.16	4.21	12.85	5.47
Sub-Total (A)	10.01	16.81	25.70	14.76
B) Contract Activities				
1) Weeding	-	-	-	-
2) Harvesting	12.04	5.89	-	8.07
3) Threshing	0.49	-	-	0.25
4) Ploughing	-	8.95	11.88	4.95
Sub-Total (B)	12.51	14.84	11.88	13.27
C) Ploughing (Family)	8.81	1.92	-	5.04
D) Cost of Material Inputs				
1) Seeds	8.38	10.85	5.13	8.77
2) Fertilizer	24.30	18.94	30.28	23.29
3) Manure	2.36	2.57	2.83	2.50
4) Irrigation	13.64	9.06	7.55	11.10
5) Pesticides	0.16	1.36	1.08	0.72
6) Others	-	-	-	-
Sub-Total (D)	48.84	42.78	46.87	46.38
E) Cost of Land	19.83	23.65	15.55	20.55
All Costs	**100.00**	**100.00**	**100.00**	**100.00**
(Cost Per Hectare) (Tk)	22447.36	24616.02	31774.00	24267.75
(No. of Observations)	(9)	(7)	(2)	(18)

Source: Field Survey, 1998

6. SUMMARY AND POLICY RECOMMENDATIONS

SUMMARY OF THE FINDINGS

Maize is the third grain crop in Bangladesh, but has an insignificant coverage of only 0.2 percent of rice and three percent of wheat acreage. It can be grown in all the three seasons of the year. Winter maize is, however, found to be predominant with a share of 84% of the country's total maize area. Among different districts, Dinajpur, Rangpur, Bogra, Dhaka, Kushtia and Chuadanga are noted to be more progressive in maize production with higher rates of growth. Both composite and hybrid maize are grown well in the loam and sandy-loam soils of the country (with three to four irrigations). Hybrid maize has a greater yield with 2.2 tons/acre (5.4 tons per ha), which is higher by one-third over composite maize (1.47 tons/acre or 3.63 tons/hectare). Farmers, however, prefer the composite variety because of the easy availability of seeds, lower price and known quality. Farmers are somewhat uncertain about the quality of hybrid maize seeds available in the market. Their prices are also higher by about three times (Tk. 135 to Tk. 150 per kg) as compared to the composite variety.

In the last six years ending 1997/98 the production of maize expanded rapidly to the level of 65,000 tons at an annual average growth of 47% due to equal rate of growth of acreage (23%) as well as yield (24%), facilitated by the Accelerated Maize Promotion Project of the Ministry of Agriculture. The project supports include assessing the quality of maize land, the dissemination of technical knowledge and the supply of seeds. NGOs like BRAC and GKF also provided assistance with the supplies of hybrid seeds as well as credit, and through buy-back arrangement from their contract growers.

The recent introduction of high yielding seeds of maize has changed the existing

cropping patterns specially in the winter season from November to February (*Rabi*) and also to some extent in pre-monsoon from March to June (*Aus*). Such changes are more noticeable in two commercial areas of Savar in Dhaka district and Birganj in Dinajpur district. The two other villages (Sayedpur and Jessore) are traditionally maize growing village. Of the total maize acreage in the four study villages, over 50% was cultivated in the pre-monsoon season while 40% in the winter season. Winter maize is predominant in both Sayedpur and Savar; while maize cultivated in the pre-monsoon is predominant at Birganj. With respect to specific seasonal cropping, maize covers an area of 40% in the pre-monsoon and only 20% in the winter. That implies that non-maize crops are still important in those two seasons even in the maize producing areas. Major non-maize crops include potato in the winter and China-IRRI paddy in the pre-monsoon, presumably because of their higher rates of return. In Sayedpur vegetables are overwhelmingly grown in both these seasons. The major cropping patterns emerged with pre-monsoon maize at Birganj are: (i) Potato + Maize + Local T. *Aman*/Fallow; while at Jessore it is (i) China-IRRI + Maize +Local T. *Aman*. In Savar such pattern is (i) Potato + Maize + HYV-*Aman*. Winter maize has the practice of (i) Maize + China-IRRI + Fallow at Jessore and (ii) Maize + Fallow + Local T *Aman* at Sayedpur.

In the last three years, maize substituted several crops of which HYV-*Boro* and vegetables are more prominent at Birganj; while mustard, sugarcane, vegetables and wheat are prominent at Savar. In two other areas wheat is substituted by maize. Such substitution covers about half of the current maize areas in the study villages. Another one-third had maize earlier especially at Jessore and Sayedpur. Some fallow land has also been brought under maize during the period.

Average household production of maize is estimated to be only two tons, the highest being at Savar (3.0 tons). The overall consumption of maize at the household level is negligible (less than 3.00 percent) and 80% is sold to traders. The remaining goes directly to

poultry farms and feed mills. In the traditional villages, fresh maize cobs are sold to the traders from fields, mainly for local consumption, used predominantly as roasted cobs. Some consumption as human food as well as animal feed is reported at Birganj (totaling to only 8.0 percent). Maize is also used as flour for *chapatis* there. In Savar over half of the production is sold to the traders and the rest is sold directly to the feed mills and local poultry farms. Almost all sales transactions take place in the harvest seasons of two months. Maize growers are little interested in keeping stock for off-season sales because of price risk and possible fungal infection on grains.

Only 18% of maize producers in the study villages kept stock for a short period of two months. They are concentrated at Savar and Birganj and the amount stored was 28 and 19 percent of their production respectively. In aggregate, it accounts for only 16% of the total maize production. The producers did not face any serious problem with their short-period stock although no pesticide was used. Some producers at Savar, however, complained of attack by rats as maize tastes sweet. All producers emphasized the need for proper drying, which is, however, difficult in earthen floor especially in the monsoon season.

The owners of poultry farms and the feed mills generally do not keep stock of maize beyond one months' requirement as they have a regular schedule of procurement. For such a short-period stock, they rarely use any pesticides. Small poultry farm owners regularly buy broken grains instead of finished feeds from the local market and maintain a stock of only about one month due to cash constraint.

Demand for maize in the country is growing and is expected to increase further with the establishment of new poultry, dairy and fish farms. Annual increase of such farms seems to be over three thousand. Also, some increase in demand for maize is observed with higher rates of consumption of grains over-time by commercial poultry and duck rearers, usually supported by NGOs. The present annual consumption of maize and wheat by poultry farms is noted to be 14 kgs. by a bird at the ratio of 5:2, but consumption of wheat is expected to be

falling depending on their relative prices. Dairy farms, on the other hand, use little maize. Maize consumption accounts for only seven percent of total consumption of grains. Information collected in this study indicate that large size poultry farms having an average capacity of 4580 layers use imported maize to the extent of 26% and the remaining 74% is home-supplied. The position is almost opposite with the feed mills which use mostly imported maize amounting to two-thirds of their grain requirements.

Interviews with the relevant farm operators suggest that there will be an annual increase of demand for maize by more than five percent due to new poultry farms and higher rates of consumption by the existing farms. Maize imports will increase if domestic production growth cannot be accelerated. A very rough estimate indicates that there is a current requirement of about 450 thousand tons of maize by poultry farms in the country. The country's production at present meets less than one-fifth of its requirement. This means, poultry and dairy industries in Bangladesh are import-dependent for maize despite having high potentials for its production (Three million hectares against present coverage of only sixteen thousand hectares as reported by Mallick et al., 1995). To frame suitable policies towards increased production of maize, the provision of an adequate price incentive to growers appears to be a major step.

The poorly developed maize market and its seasonal operations caused an unusual price fall in the last harvest season of 1998 which prompted the Ministry of Food to procure maize from growers at an administered price of Tk. 7.00 per kg. in Dinajpur region. The Food Department is satisfied with their procurement program and is confident of future procurement. The existing godown facilities are adequate. The immediate requirement is the moisture meter in the procurement centers. Further, they need to be extra-cautious about moisture content, as it should by no means exceed 13.5%.

The determination of procurement price of maize is a tricky question as it should be favorable to growers as well as to poultry farm owners and must also be competitive to the

international price. The economics of production of maize and its competitive crops like wheat, potato, China-IRRI paddy, mustard etc. suggests that the minimum price to growers should be above Tk. 6.0 per kg. As far as wholesale price for imported maize at Dhaka or import parity price is concerned, farm gate price can be fixed at Tk. 7.0 per kg at which the existing price environment and the crop production technology can promote maize production in the country and the government can hopefully dispose of their stock to the Department of Livestock and the poultry farms later at a reasonable rate of margin as experienced in 1998.

POLICY RECOMMENDATIONS

Maize is a versatile crop due to its multifarious uses as feeds, food and industrial raw material. Land is quite suitable for its cultivation and seeds can be sown at any time during November to February and harvested from April and onwards. It has a large production potential but it remains highly unexploited due to poorly developed market where only a few traders function in the harvest season. Maize growers are thus, deprived of a fair price. State participation through its procurement program is thus, essential at least in the initial years as practiced in the case of rice and wheat.

Along with the state procurement program special credit supports may be extended to commercial farmers, traders, and the NGOs interested in maize stock. Selected poultry farms and the feed mills may also receive institutional credit for maize stock of three to four months. Here we must ensure the timely distribution of credit. To facilitate private procurement in the major producing areas, government godowns, if available, may also be rented-out to them. In this regard, the Integrated Maize Promotion Project or the Department of Agricultural Marketing may act as facilitator by communicating between the potential buyers and the sellers as many of the potential buyers are not aware of the local supplies and their prices.

To encourage maize production, market supplies of seeds should be under constant quality inspection by some state agency like BADC and their prices may be kept lower than the prevailing price of Tk. 135.0 per kg for hybrid seeds. Block farming by local producers like sugarcane cultivation in mill zone may be facilitated through timely supplies of seeds and credit.

Further, to make local maize production competitive with international price, emphasis may be given towards higher crop yields, for which areas with potential yields of over 7 tons/ha may be given priority. Also HYV *Boro* areas requiring irrigation of more than 15 times in the season may be substituted by maize cultivation. Low lying land from where floodwater recedes late may also be used for maize cultivation.

Existing flour mills in the country may also be oriented to the production of mixed flour with wheat and maize at the ratio of 4:1, declaring its proportional contents in the packet. Retail prices may be reduced accordingly.

In order to encourage increased human consumption of maize flour, a special motivational program may be initiated in the state media like television and radio indicating that maize is a nutritious food and very rich in protein, phosphorus and fat. It is richer than rice in terms of trace elements (magnesium, potassium and sulphur etc.). Once people are used to such consumption, maize flour may be introduced in the existing rural development programs like FFW, FFE and the VGD. Maize price being considerably lower than wheat its production may be encouraged as a first measure towards food security for at least mal-nourished people. It is expected that the supply of highly refined flour can easily attract them.

For sustainable supplies of quality seeds in the country agricultural research institutes need to be further strengthened in maize research with modern equipment and trained specialists. However, they need to be remunerated properly. Contract research

program in this regard appears to be more appropriate and an all-out emphasis may be given to develop suitable technology for production and drying of monsoon maize for year-round production and supplies of maize.

Lastly, it is considered important to carefully study the economics of the production of maize at a broader perspective as it is going to substitute some the country's major crops like jute, wheat, mustard and pulse in which production increase is essential to meet their growing demand in the country.

ANNEX TABLES AND FIGURES

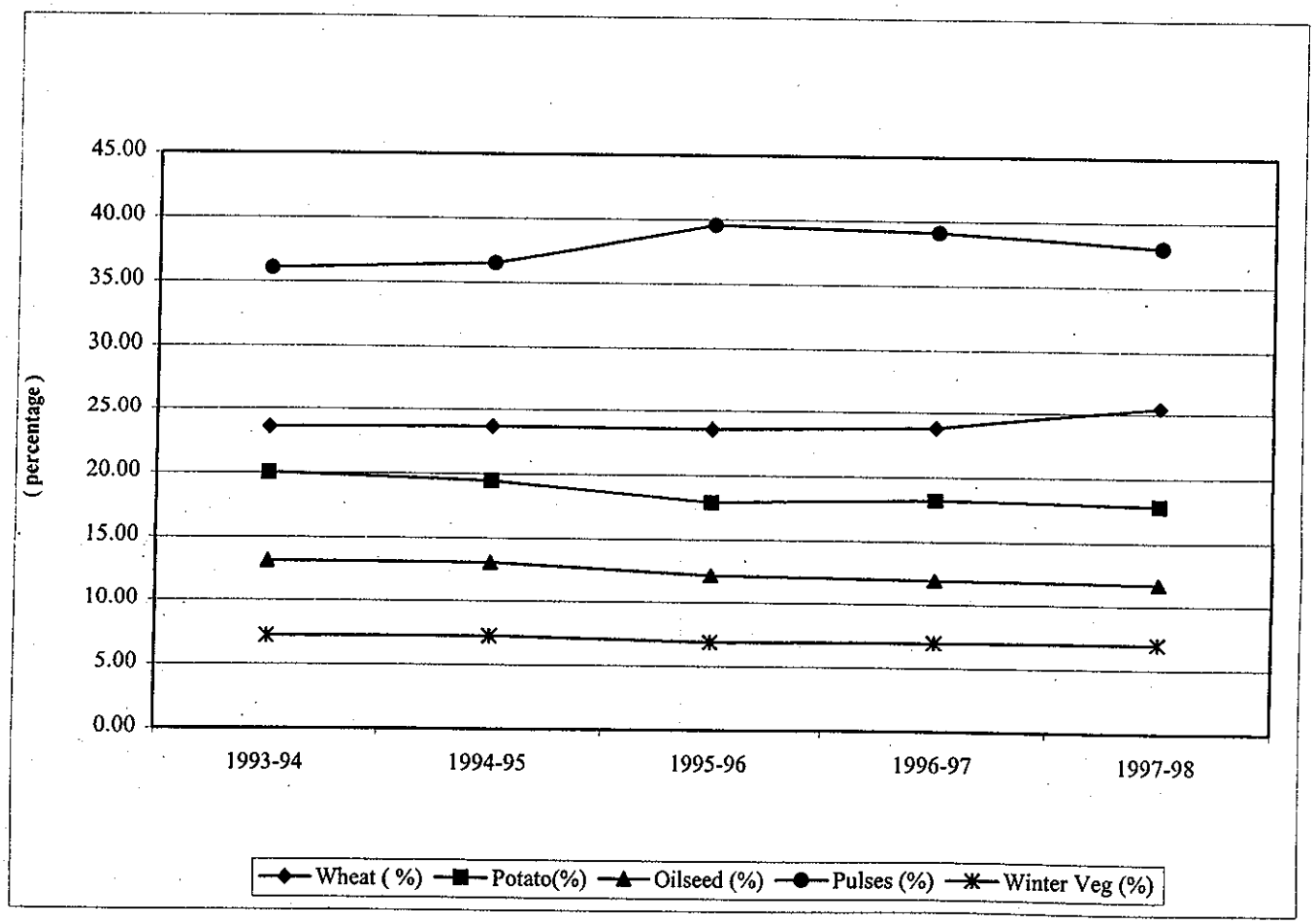
Annex 1 — Percent Area of Different Crops in the Rabi Season in Dhaka District 1993/94 to 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	133028	23.53	20.04	13.14	36.05	7.24
1994-95	137789	23.63	19.47	13.07	36.53	7.30
1995-96	150443	23.53	17.85	12.15	39.55	6.92
1996-97	152504	23.80	18.15	11.92	39.13	7.00
1997-98	155617	25.45	17.78	11.71	38.03	7.03

Source: BBS

Annex 2 — Percent Area of Different Crops in the Rabi Season in Dhaka District, 1993/94 - 1997/98



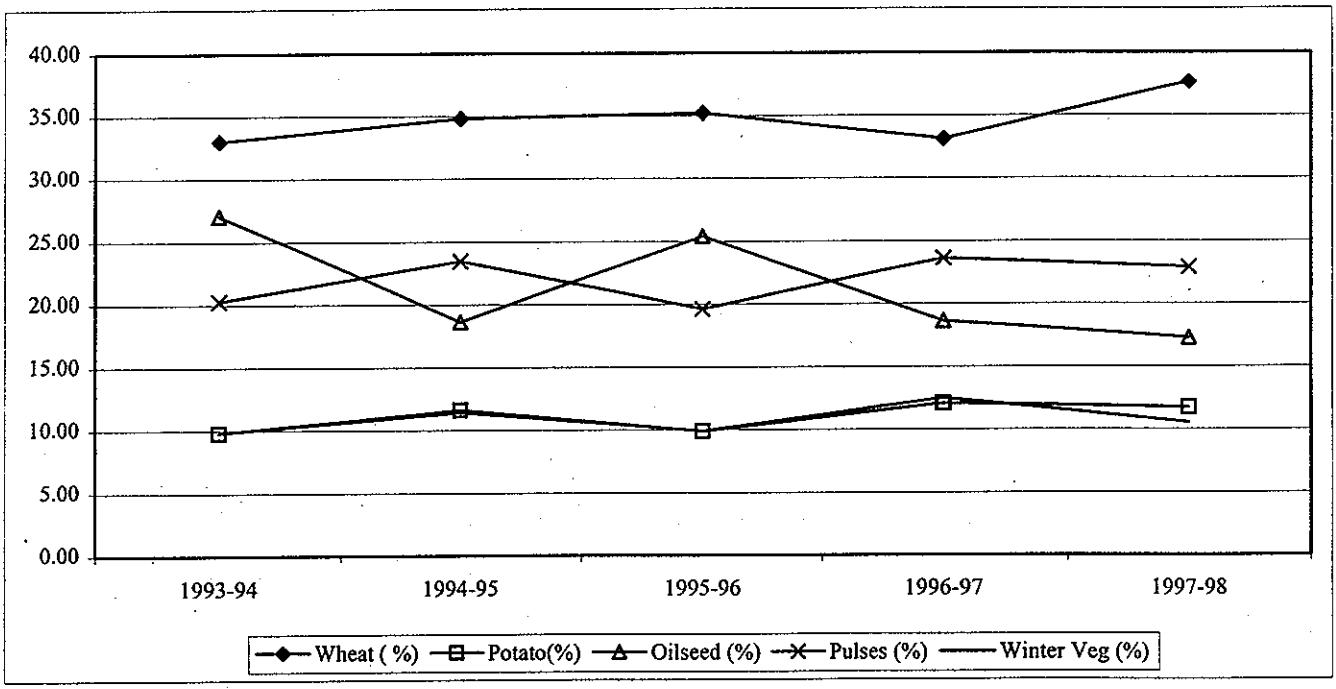
Annex 3 — Percent Area of Different Crops in the Rabi Season in Mymensingh District, 1993/94 to 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	38970	33.04	9.81	27.08	20.27	9.80
1994-95	34095	34.84	11.64	18.60	23.46	11.46
1995-96	41105	35.20	9.88	25.42	19.61	9.89
1996-97	33796	33.17	12.11	18.60	23.61	12.51
1997-98	35996	37.62	11.73	17.24	22.88	10.53

Source: BBS

Annex 4 — Percent Area of Different Crops in the Rabi Season in Mymensingh District, 1993/94 - 1997/98



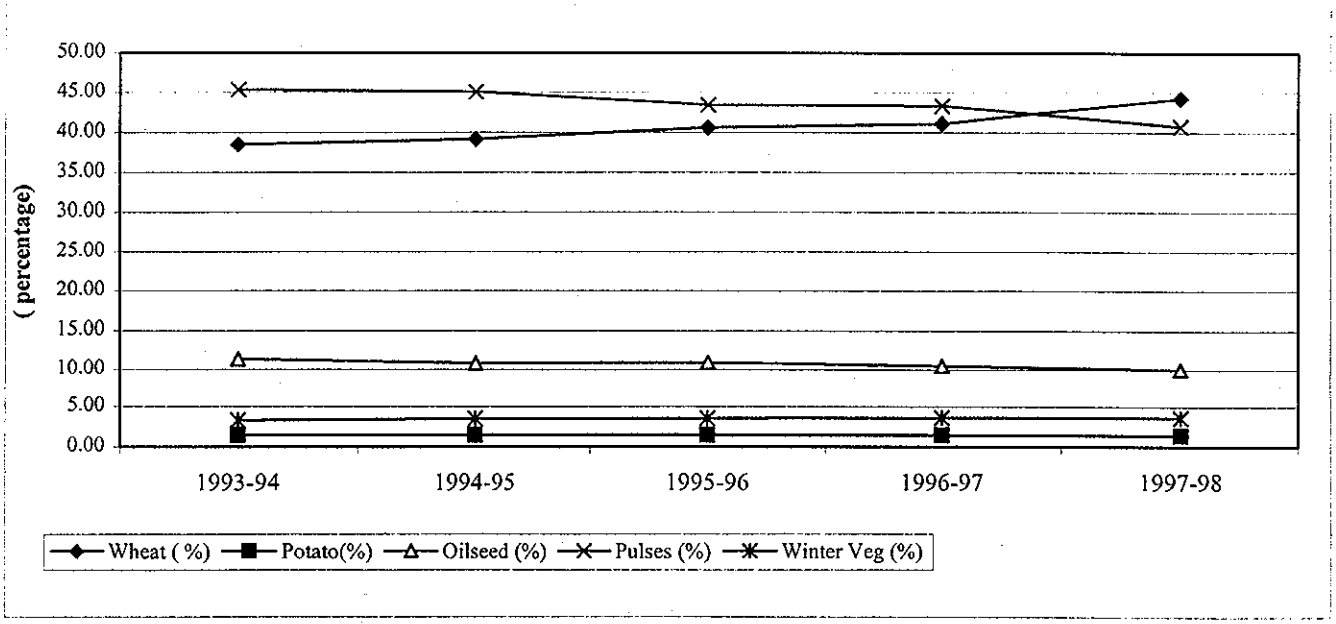
Annex 5 — Percent Area of Different Crops in the Rabi Season in Kushtia District, 1993/94 to 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	119111	38.50	1.46	11.39	45.37	3.28
1994-95	121411	39.15	1.48	10.83	45.04	3.50
1995-96	124443	40.59	1.48	10.96	43.42	3.55
1996-97	125356	41.10	1.47	10.50	43.30	3.64
1997-98	130980	44.21	1.44	10.00	40.73	3.62

Source: BBS

Annex 6 — Percent Area of Different Crops in the Rabi Season in Kushtia District, 1993/94 - 1997/98



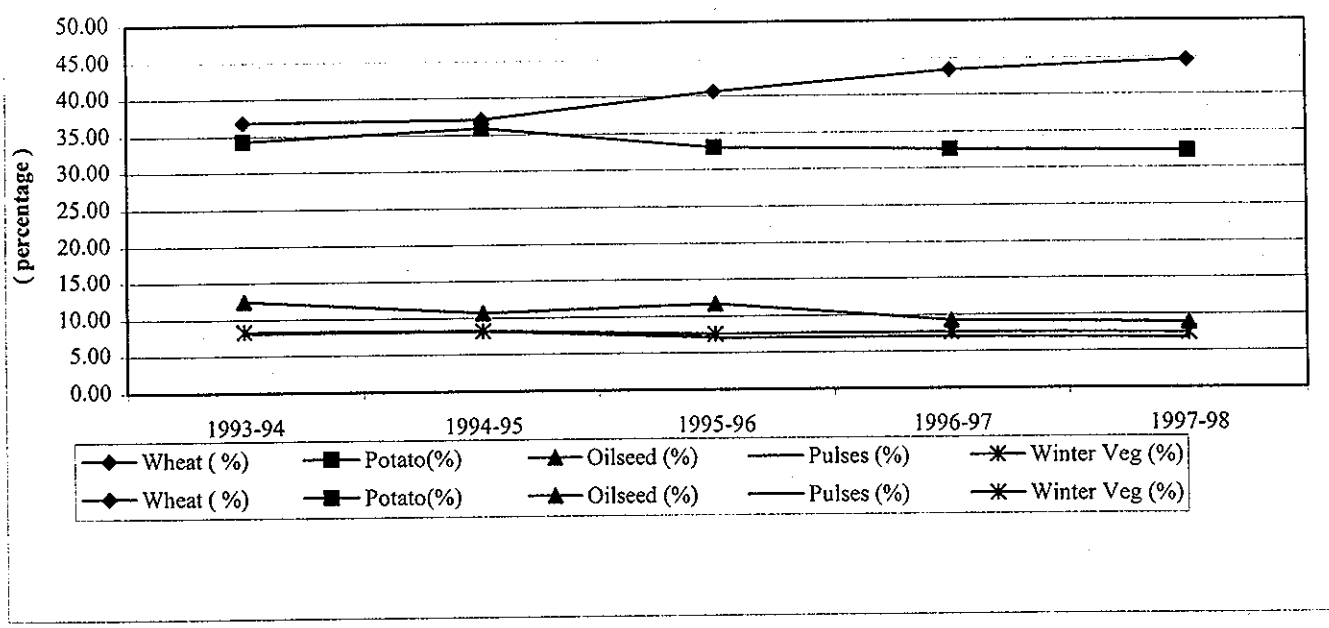
Annex 7 — Percent Area of Different Crops in the Rabi Season in Bogra District, 1993/94 - 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	45239	36.83	34.31	12.44	8.12	8.31
1994-95	44755	37.08	35.88	10.66	8.17	8.21
1995-96	48538	40.62	33.05	11.67	7.08	7.59
1996-97	49219	43.46	32.61	9.24	7.04	7.65
1997-98	51468	44.66	32.30	8.84	6.76	7.44

Source: BBS

Annex 8 — Percent Area of Different Crops in the Rabi Season in Bogra District, 1993/94 - 1997/98



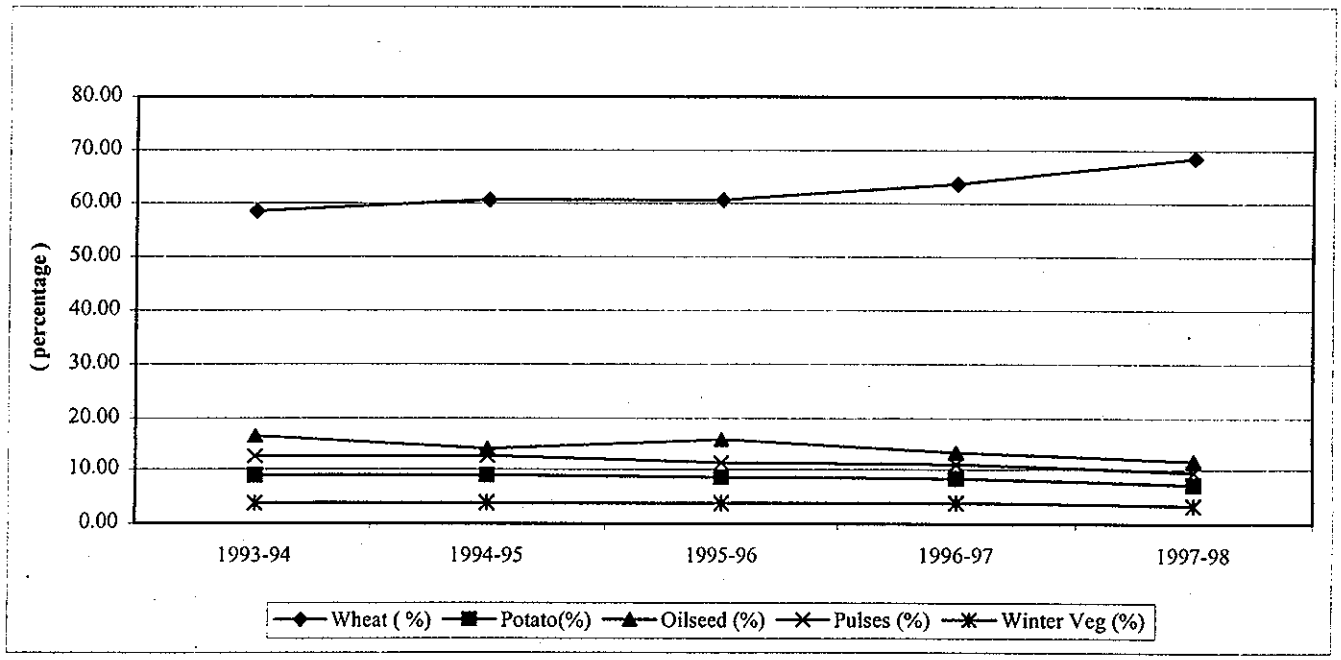
Annex 9 — Percent Area of Different Crops in the Rabi Season in Dinajpur District, 1993/94 to 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	148024	58.45	8.82	16.57	12.50	3.67
1994-95	147802	60.62	8.90	14.03	12.63	3.83
1995-96	154053	60.62	8.49	15.91	11.23	3.75
1996-97	157502	63.73	8.25	13.27	10.93	3.82
1997-98	183536	68.51	7.14	11.56	9.44	3.35

Source: BBS

Annex 10 — Percent Area of Different Crops in the Rabi Season in Dinajpur District, 1993/94 - 1997/98



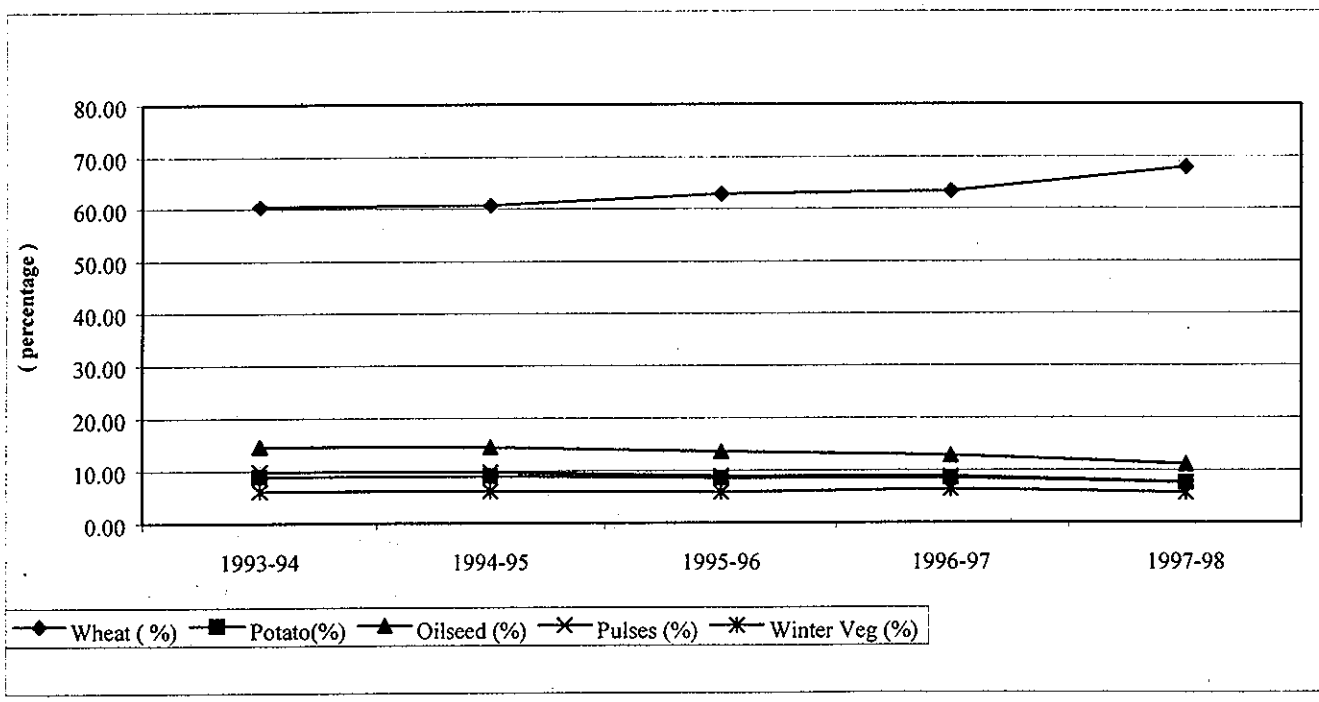
Annex 11 — Percent Area of Different Crops in the Rabi Season in Rangpur District, 1993/94 to 1997/98

(Areas in Ha)

Year	Total Area	Wheat (%)	Potato (%)	Oilseed (%)	Pulses (%)	Winter Veg (%)
1993-94	109557	60.39	8.91	14.67	9.89	6.14
1994-95	111156	60.69	9.00	14.47	9.74	6.10
1995-96	116219	62.90	8.59	13.61	9.01	5.90
1996-97	116591	63.36	8.56	12.83	8.85	6.39
1997-98	136040	67.95	7.56	11.15	7.63	5.70

Source: BBS

Annex 12 — Percent Area of Different Crops in the Rabi Season in Rangpur District, 1993/94 - 1997/98



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International Food Policy Research Institute

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