K Sheet

GLOBAL DEMAND FOR MAIZE IN 2020 TO INCREASE BY 45%: POTENTIAL ROLE OF BT MAIZE

Global cereal demand in 2020 is estimated at 2.1 billion MT and will, for the first time, show a major shift in favor of maize with demand estimated at 852 million MT compared with 760 million MT for wheat and 503 million MT for rice. Thus, global demand for maize in 2020 will increase by 45% (compared with 30% for wheat and 32% for rice). This reflects a substantial growth of 72% for maize in developing countries, and 18% growth in industrial countries. This 72% increase in demand for maize in developing countries compares with only 44% for wheat and 33% for rice (Table 1).

Table 1. Maize, wheat and rice demand projections, 1997 and 2020, (million metric tonnes [MT])

	MAIZE			WHEAT			RICE*		
	1997 Demand	2020 Demand	Change (%)	1997 Demand	2020 Demand	Change (%)	1997 Demand	2020 Demand	Change (%)
Global	586	852	266 (45)	585	760	175 (30)	381	503	122 (32)
Industrial Countries	291	344	53 (18)	245	268	23 (9)	17	19	2 (9)
Developing Countries	295	508	213 (72)	341	492	152 (44)	364	484	120 (33)

Source: IFPRI, 2003. *Milled rice.

This increase in demand translates to 213 million MT of maize between 1997 and 2020 in developing countries compared with only 152 million MT of wheat and 120 million MT of rice. Within developing countries, the highest increase in demand for maize by 2020 will be for the countries of East Asia, dominated by China which would require 252 million MT. This is equivalent to an 85% increase (Table 2).

The next highest increase is in Sub Saharan Africa at 79% with a demand of 52 million MT, followed by South East Asia at 70% requiring 39 million MT, Latin America at 57% with a demand of 118 million MT, the WANA region at 56% requiring 28 million MT, and finally

K Sheets are Knowledge Sheets, packaged information on crop biotechnology products and related issues available at your finger tips. They are produced by the Global Knowledge Center on Crop Biotechnology and additional copies can be obtained from our website (http://www.isaaa.org/kc). For more information, please contact the International Service for the Acquisition of Agri-biotech Applications (ISAAA) SE*Asia*Center, c/o IRRI DAPO Box 7777, Metro Manila, Philippines. Tel: +63-2-8450563; Fax: +63-2-8450606; E-mail: knowledge.center@isaaa.org

Table 2. Maize demand for developing countries in 1997 and 2020 (million metric tonnes [MT])

Region	1997 Demand	2020 Demand	Change (%)
East Asia	136	252	116 (85%)
Latin America	75	118	43 (57%)
Sub Saharan Africa	29	52	23 (79%)
South East Asia	23	39	16 (70%)
WANA*	18	28	28 (56%)
South Asia	14	19	5 (36%)

Source: IFPRI, 2003. *WANA - West Asia and North Africa.

South Asia at 36% at 19 million MT. (Table 2). Japan is the major importer (imports over 15 million MT) for the industrial countries. This percentage is expected to remain at approximately the same level.

In 2020, of the 852 million MT of maize required globally, 69% will be used for feed, 15% for food, and 16% for non -food/feed industrial uses (Table 3). While only 5% of maize will be used for food purposes in industrial countries, and 22% will be used for food in developing countries (Table 3).

Table 3. Demand and use of maize in 2020

Region	Area[1]	Demand[2]	% Food	% Feed	% Other	Net Trade[3]
Global	158	852	15%	69%	16%	
Industrial	50	344	5%	76%	19%	+67
Developing	108	508	22%	64%	14%	-67
East Asia	30	252	4%	82%	14%	-43
Latin America	32	118	25%	60%	15%	+5
Sub Saharan Africa	26	52	76%	10%	14%	-6
South East Asia	9	39	32%	58%	10%	-8
WANA	2	28	28%	63%	9%	-14
South Asia	9	19	70%	13%	17%	-<1

Source: IFPRI, 2003. [1] Million of hectares; [2] Millions of metric tonnes (MT); [3] Millions of MT, exports (+), imports (-)

Within developing countries, the highest proportion of maize used for food will be in the countries of Sub Saharan Africa (76%) and South Asia (70%) which includes India, Pakistan and Bangladesh. In contrast, the developing countries of East Asia, principally China, will use only 4% of maize for food, with 82% used for feed and 14% for other uses.

In terms of overall demand for maize in 2020, East Asia is estimated to have the highest demand at 252 million MT This compares with 227 million MT for the USA, 118 million MT for Latin America, 52 million MT for Sub Saharan Africa and 40 million MT for the 15 countries of the European Union. There are currently only two major exporters of maize, the USA and Argentina. The USA currently exports about 45 million MT, and this is expected to increase

to about 70 million MT by 2020. Argentina, on the other hand, exports 10 million MT and, by 2020, this is expected to increase to about 20 million MT. The only significant new exporters in 2020 are the countries of Eastern Europe which could export up to 8 million MT (IFPRI 2003).

The challenge of producing an additional 266 million MT to meet an unprecedented global demand (totaling 852 million MT) of maize in 2020 is formidable. The challenge is even more daunting considering that over 80% of the increased demand of 266 million MT, equivalent to 213 million MT, will be required by the developing countries. Furthermore, only around 10% is likely to be supplied through increased exports from industrial to developing countries leaving developing countries to produce most of their own additional maize requirements.

Major importers will include East Asia (43 million MT), WANA (14 million MT), South East Asia (8 million MT), and Sub Saharan Africa (6 million MT). Thus, of the 213 million extra MT required by developing countries, most will have to be produced in developing countries on almost the same area of land. The global area of maize is expected to increase by only 12%, from 140 million hectares in 2000 to 158 million hectares in 2020. Thus, 88% of the necessary increase in maize production will need to be generated through increased productivity resulting in higher yields per unit area of land. This is a daunting challenge for developing world farmers, who have small scale farms, and are resource-poor. Most of these farmers grow two-thirds (approximately 100 million hectares) of the global maize area, with a current average yield of 2.8 MT/hectare. Their current productivity compares with 6.8 MT/hectare in all industrial countries with the highest yields of over 8 MT per hectare restricted to the USA and the countries of the European Union.

THE POTENTIAL ROLE OF BT MAIZE

Biotic stresses due to pests are severely constraining production in developing countries. Similarly, abiotic stresses due to drought, salinity, acid soils and deficiency or toxicity of micronutrients constrain productivity of large areas in developing countries. Overcoming these biotic and abiotic constraints, through conventional and biotechnology applications, would allow the potential of the current maize germplasm deployed in developing and industrial countries to be realized, resulting in significant yield increases.

The global cereal demand shift in favor of maize reflects rising incomes in many developing countries with consequent growth in meat consumption, which drives demand for maize as feed for poultry and swine. The demand for more maize is particularly strong in East Asia where demand is projected to rise from 136 million MT in 1997 to 252 million MT in 2020. Coincidentally, in Sub Saharan Africa, high population growth and pervasive poverty continue to drive a high demand for maize as a food source. The same is true for Central America and South Asia. Compared to its 1997 level, maize demand in Sub Saharan Africa is projected to almost double from 29 million MT to 52 million MT in 2020. Food maize demand in countries, such as Mexico, in Latin America is expected to remain high as income increases.

The substantial increased demand for maize in the next 20 years is a challenge to developing countries, because imports, which have typically supplied about 10% of developing country needs, are not expected to change significantly (CIMMYT 2000). The quantity of maize traded is projected to increase to 67 million MT by 2020 - a 150% increase compared with the 1997 volume of maize traded. Thus, the only way that developing countries can meet their maize needs is to increase maize productivity per unit of land, where improved technology has traditionally been an important element.

In developing countries, particularly the more advanced larger countries, commercial maize production has a feed focus and the use of improved conventional technology, such as hybrids, as well as biotechnology applications, is expected to substantially increase. For example, three developing countries, Argentina, South Africa, and the

Philippines already deploy Bt maize for the control of various stem borers. In Honduras, the major pest is the fall armyworm. The increased participation of the private seed industry could help meet increasing grain demand by increasing the efficiency of seed distribution. This could also provide access to improved technologies. Increasing the productivity of food maize, a sector dominated by subsistence farmers supported by technology coming from the public sector, presents more challenges for introducing improvements delivered by biotechnology applications. However, progress is being made in countries such as South Africa where Bt white maize for food, introduced in 2001, was well accepted. Areas planted to Bt white maize have, since then, increased ten-fold to almost 60,000 hectares in 2002.

MEETING INCREASED DEMANDS – THE ROLE OF BT MAIZE

As noted above, increased demand for maize will require significant increases in production in both industrial countries and developing countries. Whereas the industrial countries have the capability to increase production significantly, the challenge will be in the developing countries, particularly in Africa, which has limited access to improved technologies and a weak infrastructure to deploy them.

Technology is an essential core element in any national strategy that aims to increase maize productivity. Some developing countries experience significant constraints in accessing improved conventional technology, and new technologies represent even greater challenges. However, the fact that GM technology is incorporated into the seed makes GM crops a very appropriate technology for small farmers. And this can be attested to by the 5 million small farmers in Asia, Latin America and Africa who have already adopted Bt cotton. These resource-poor farmers are willing to pay a premium for Bt cotton, because of its high benefits.

Bt maize offers small farmers in Asia, Latin America and Africa similar advantages to Bt cotton because of the productivity gains it offers, as well as the lower input costs it requires. Bt maize also offers advantages for maize farmers and consumers in industrial countries where pests, that can be controlled by Bt such as the stem borers and corn rootworm, are prevalent and economically important. Bt maize offers advantages in productivity and profitability for farmers, but it also offers important advantages such as lower levels of harmful mycotoxins, elimination of insecticides for the targeted pests, and lower exposure to insecticides for farmers and the environment. These three cardinal attributes of Bt maize offer important advantages for farmers, the environment, consumers and society at large.

Source: James, C. 2003. Global Review of Commercialized Transgenic Crops: 2002 Feature: Bt Maize. ISAAA Briefs No. 29. ISAAA: Ithaca, NY. http://www.isaaa.org.