

Global Adoption of Bt Maize, 1996-2003

Bt maize is second only to herbicide tolerant soybean in terms of global GM crop adoption and represented 18% of the global GM area in 2003. Between 1996 and 2003, a total of 55.6 million hectares of Bt maize was grown worldwide in eleven countries. To put this area into context, this is equivalent to almost twice the area planted to maize in the US annually, which is around 30 million hectares.

The adoption of Bt maize on a global basis is captured in Figure 1 based on data detailed in Table 1. Notable features are that the number of countries adopting Bt maize increased from one industrial country in 1996 to nine countries in 2003, four industrial – US, Canada, Spain, and Germany, and five developing countries, Argentina, Honduras, South Africa, Uruguay, and the Philippines.

Whereas the US was the only country to adopt Bt maize in 1996, it was joined in 1997 by Canada (Table 2). 1998 was a watershed year for Bt maize with four new countries adopting Bt maize for the first time – Argentina, South Africa, from the developing countries, and two countries from the European Union, Spain and France growing token areas of Bt maize. Portugal joined the group of Bt maize adopters in 1999 but withdrew the registration a year later. In 2000, Germany started to grow a small area of Bt maize and has continued to grow a few hundred hectares of Bt maize for the last four years. Although there was a slight consolidation from 8.2 million hectares to 7.7 million hectares globally in 2001, growth revived in 2003 to reach 12.3 million hectares, equivalent to 8.8% of the global maize area of 140 million hectares.

France grew a small amount of Bt maize only in 2000 and 2001. Honduras extended its Bt maize plantings in 2003, after becoming the first country in Central America to grow a GM crop with a pre-commercial introductory area of approximately 500 hectares of Bt maize in 2002. In another strategic development, the Philippines grew approximately 20,000 hectares of Bt maize for the first time in 2003. This was the first major food/feed crop to be approved for commercial production in Asia - which has 40% of the world area of maize, and with China being the dominant maize player with 24.5 million hectares. The Asiatic corn borer is known to be a significant biotic constraint in the temperate maize area of China, the most important production region in the country, thus prompting China to field test Bt maize. India, with 6.2 million hectares, also has significant potential for Bt maize where spotted stem borer, Asian pink stem borer, and armyworm are important

pests. Indonesia, with 3.3 million hectares, and Thailand, both suffering economic losses from Asiatic corn borer, could probably benefit significantly from Bt maize technologies.

The US continues to be the major adopter of Bt maize, growing more than three-quarters of the global total. The USA is the world's largest producer of maize, which occupies 32 million hectares, about one quarter of the area of all US crops. The US maize crop is valued at close to \$20 billion annually, which is approximately 20% of the value of all crops in the US. In 2003, the US grew 83% of global Bt maize, followed by Argentina at 9%, Canada at 5% and South Africa at 3% with the balance grown in Spain, Honduras, Philippines, Uruguay, and Germany. However, steady growth continued in countries other than the US. For example, Argentina increased its area from over 750,000 hectares in 2002 to around 1.1 million hectares in 2003, representing 40% of the national maize area.

Similarly, South Africa, which first grew Bt maize in 1998, increased its plantings to 340,000 hectares in 2003. Notably, Bt white maize, used for food, first introduced in 2001 on 6,000 hectares, equivalent to 0.3 % of the total white maize area, increased 14 fold to 84,000 hectares in 2003, equivalent to 4 % of the total white maize area of 2.1 million hectares.

Significant increases in productivity have been reported from Bt maize field trials in the Philippines, 25% in the dry season and 40% in the wet season, and 2003 should have provided the first assessment of the performance of Bt maize in commercial production. Unfortunately, the July 2003 typhoon destroyed several thousand hectares of Bt maize in the Philippines; preliminary indications are that the Bt maize that survived the typhoon performed very well. Early field trials in China indicate that Bt maize can increase yields by over 15%, which is significant because China has 25 million hectares of maize.

It is very important to acknowledge the progress made in Spain with Bt maize and to recognize that it is the only country within the EU that grows a substantial commercial area of a GM crop. Spain increased its area of Bt maize by one third in 2003 to 32,000 hectares, from just under 25,000 hectares in 2002. This increase was coincidental with Spain approving five new Bt maize varieties in 2003. It is estimated that approximately 40% of the maize area

Table 1. Global Adoption of Bt Maize (Bt and Bt/Herbicide Tolerance) 1996 to 2003 (Millions of Hectares)

	1996	1997	1998	1999	2000	2001	2002	2003	Total
Bt	0.3	3.0	6.7	7.5	6.8	5.9	7.7	9.1	47
Bt and HT	0.0	0.0	0.0	0.0	1.4	1.8	2.2	3.2	8.6
Total	0.3	3.0	6.7	7.5	8.2	7.7	9.9	12.3	55.6

Source: Clive James, 2002, 2003. HT is Herbicide Tolerance



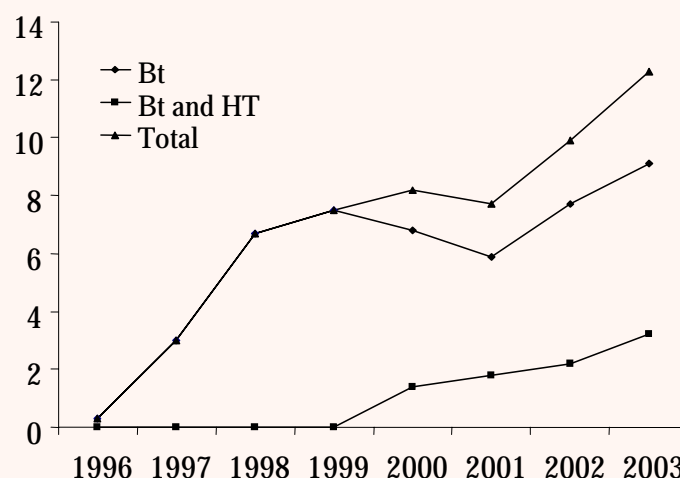
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Table 2. Adoption of Bt Maize, by Country, by Year 1996-2003

Country	1996	1997	1998	1999	2000	2001	2002	2003
USA	X	X	X	X	X	X	X	X
Canada		X	X	X	X	X	X	X
Argentina			X	X	X	X	X	X
South Africa			X	X	X	X	X	X
Spain			X	X	X	X	X	X
France			X	X	X			
Portugal				X				
Germany					X	X	X	X
Honduras							X	X
Philippines								X
Uruguay								X
Total	1	2	6	7	7	6	6	9

Source: Clive James, 2003.

Figure 1: Global Adoption of Bt Maize (Bt and Bt/Herbicide Tolerance) 1996 to 2003 (Millions of Hectares)



in Spain could benefit from the *cry1Ab* gene to control both European corn borer and Mediterranean corn borer (Brookes 2002). According to a recent study by Gianessi et al (2003), France, Italy and Germany, the other major maize producers in Europe, could collectively increase production by 1.9 million MT, valued at \$ 250 million, by deploying *cry1Ab* expressing maize varieties.

Despite the on-going debate in the European Union, there is cause for cautious optimism that the global area of Bt maize will continue to grow in 2004 and beyond. New GM crop-growing countries from the South, like India and Brazil, are likely to approve GM maize already deployed in other countries. New input products from industry will contribute to sustained growth. Those already commercially available in North America in 2003 include two new traits introduced in maize conferred by the *cry3Bb1* gene for corn rootworm control, and the *cry1Fa2* gene in Bt maize with broader control of lepidopteran pests. Furthermore, five new Bt and novel gene products for maize insect resistance are anticipated for launch in the next three years. Thus, the global Bt maize area is likely to increase significantly in the near to mid-term.

References:

- Brookes, G. 2002. The farm level impact of using Bt maize in Spain. http://www.europabio.org/pages/ne_gbgmcrops.asp
- Gianessi, L., S Sankula and N Reigner. 2003. Plant biotechnology: Potential impact for improving pest management in European agriculture – Maize case study. National Center for Food and Agriculture Policy (NCFAP), Washington, DC, USA <http://www.ncfap.org/europe.htm>
- James, C. 2003. Global Status of Commercialized Transgenic Crops: 2003. ISAAA Briefs No. 30. ISAAA Ithaca, NY.
- James, C. 2003. Global Review of Commercialized Transgenic Crops: 2002 Feature: Bt Maize. ISAAA Briefs No. 29. ISAAA: Ithaca, NY.