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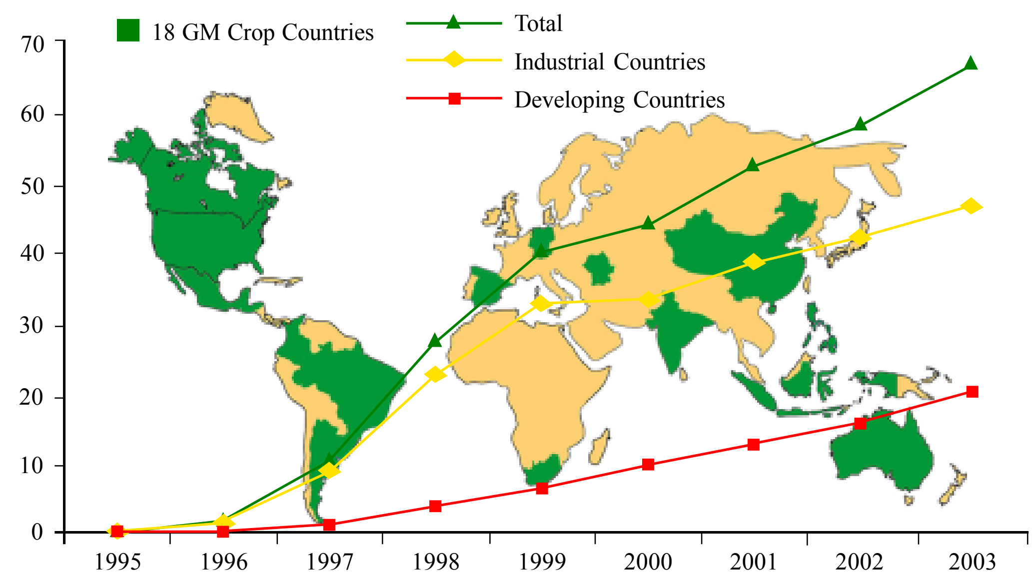
PREVIEW

Global Status of Commercialized Transgenic Crops: 2003

by

Clive James
Chair, ISAAA Board of Directors

Global Area of Transgenic Crops
Million Hectares (1996 to 2003)



Increase of 15%, 9M hectares or 22.2M acres between 2002 and 2003

Source: Clive James, 2003

No. 30 - 2003

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ISAAA

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GLOBAL STATUS OF COMMERCIALIZED TRANSGENIC CROPS: 2003

Global Status of GM Crops in 2003

- **In 2003, the global area of transgenic crops continued to grow for the seventh consecutive year at a sustained double-digit growth rate of 15% compared with 12% in 2002. The estimated global area of GM crops for 2003 was 67.7 million hectares; this includes a provisional conservative estimate of 3 million hectares of GM soybean in Brazil (the final hectarage could be significantly higher), officially approved for planting for the first time in 2003. It is noteworthy that a double-digit rate of 10% growth in GM crops was sustained in 2003, even excluding the Brazilian hectarage. The 67.7 million hectares of GM crops in 2003, equivalent to 167 million acres was grown by 7 million farmers in 18 countries, an increase from 6 million farmers in 16 countries in 2002. The increase in area between 2002 and 2003 of 15% is equivalent to 9 million hectares or 22 million acres.**

- During the eight-year period 1996 to 2003, global area of transgenic crops increased 40 fold, from 1.7 million hectares in 1996 to 67.7 million hectares in 2003, with an increasing proportion grown by developing countries. Almost one-third (30%) of the global transgenic crop area of 67.7 million hectares in 2003, equivalent to over 20 million hectares, was grown in developing countries where growth continued to be strong. It is noteworthy that the absolute growth in GM crop area between 2002 and 2003 was almost the same in developing countries (4.4 million hectares) and industrial countries (4.6 million hectares), with the percentage growth more than twice as high (28%) in the developing countries of the South compared with the industrial countries of the North (11%).

GM Crop Area, by Country, Crop and Trait

- In 2003, six principal countries, compared with four in 2002, grew 99% of the global transgenic crop area; this reflects the broadening participation of the lead GM countries with ten countries now growing 50,000 hectares or more, of GM crops. The USA grew 42.8 million hectares (63% of global total), followed by Argentina with 13.9 million hectares (21%), Canada 4.4 million hectares (6%), Brazil 3 million hectares (4%), China 2.8 million hectares (4%) and South Africa 0.4 million hectares (1%). Of the six leading GM crop countries, China and South Africa had the highest year-on-year increase with a 33% growth rate. China increased its Bt cotton area for the fifth consecutive year from 2.1 million hectares in 2002 to 2.8 million hectares in 2003, equivalent to 58% of the total cotton area of 4.8 million hectares in 2003. South Africa increased its combined area of GM maize, soybean and cotton to 0.4 million hectares in 2003 with particularly strong growth in white maize used for food, which has increased rapidly from 6,000 hectares in 2001 to 84,000 hectares in 2003. Canada's GM crop area grew at a significant 26% between 2002 and 2003 to reach 4.4 million hectares with increases totaling almost 1 million hectares in the three crops, canola, maize and soybean. Despite the continuing economic constraints in Argentina, and soybean adoption rates already close to 100% in 2002, its GM crop area grew at 3% with strong growth in Bt maize. A growth rate of 10% was achieved in the USA (3.8 million hectares) reflecting strong growth in both Bt and herbicide tolerant maize, and continued growth in herbicide tolerant soybean. GM crop hectarage in Australia decreased slightly because of the continued severe drought, which is the worst in centuries, with total area planted to cotton at approximately one third of normal plantings. India increased its Bt cotton area by 100%; Spain also increased its Bt maize area by one third to reach over 6% of the national maize crop in 2003. Uruguay and Romania also reported significant growth, exceeding 50,000 hectares of GM crops for the first time, whilst countries that introduced GM crops for the first time in 2002, such as Colombia and Honduras reported modest growth.

- Two countries, Brazil and the Philippines approved planting of GM crops for the first time in 2003. Brazil officially approved herbicide tolerant soybean in late September 2003, immediately before the start of the planting season. This late approval has exacerbated the difficulties in projecting provisional estimates of GM soybean hectarage in Brazil for the 2003/2004 season. At the time when this publication went to press, in late 2003, only 50% of soybeans had been planted in Brazil. A provisional conservative estimate of 3 million hectares of GM soybean has been projected for Brazil in 2003, in the knowledge that the final planted hectarage of GM soybean in Brazil in 2003 could be significantly higher. The Philippines grew approximately 20,000 hectares of Bt maize for the first time in 2003. Brazil and the Philippines joined 16 countries that already grew GM crops in 2002 for a total of 18 GM crop countries in 2003; notably, 11 are developing countries compared with 7 industrial countries. Thus, the number of countries growing GM crops has increased steadily from 6 in 1996, to 9 in 1998, to 13 in 2001, and 18 in 2003.

- Globally, in 2003, growth continued in all four commercialized GM crops: GM soybean occupied 41.4 million hectares (61% of global GM area), up from 36.5 million hectares in 2002; GM maize was planted on 15.5 million hectares (23% of global GM area), up substantially from 12.4 million hectares in 2002, with the highest growth rate for all crops at 25% - this follows a 27% growth rate in GM maize in 2002; transgenic cotton was grown on 7.2 million hectares (11% of global GM area) compared with 6.8 million hectares in 2002; and GM canola occupied 3.6 million hectares (5% of global GM area), up from 3.0 million hectares in 2002.

- During the eight-year period 1996 to 2003, herbicide tolerance has consistently been the dominant trait followed by insect resistance. In 2003, herbicide tolerance, deployed in soybean, maize, canola and cotton occupied 73% or 49.7 million hectares of the global GM 67.7 million hectares, with 12.2 million hectares (18%) planted to Bt crops. Stacked genes for herbicide tolerance and insect resistance deployed in both cotton and maize continued to grow and occupied 8% or 5.8 million hectares, up from 4.4 million hectares in 2002. The two dominant GM crop/trait combinations in 2003 were: herbicide tolerant soybean occupying 41.4 million hectares or 61% of the global total and grown in seven countries; and Bt maize, occupying 9.1 million hectares, equivalent to 13% of global transgenic area and grown in nine countries. Whereas the largest increase in Bt maize was in the US, growth was witnessed in all seven countries growing Bt maize. Notably, South Africa grew 84,000 hectares of Bt white maize for food in 2003, a substantial 14 fold increase from when it was first introduced in 2001. Bt/herbicide tolerant maize and cotton both increased substantially, reflecting a continuing trend for stacked genes to occupy an increasing percentage of the area planted to GM crops on a global basis.

- A useful way to provide a global perspective of the adoption of GM crops is to express the global adoption rates for the four principal GM crops as a percentage of their respective global areas. In 2003, 55% of the 76 million hectares of soybean planted globally were transgenic - up from 51% in 2002. Twenty-one percent of the 34 million hectares of cotton were GM, up from 20% last year. The area planted to transgenic canola in 2003 was 16%, up from 12% in 2002. Finally, of the 140 million hectares of maize grown globally, 11% was GM in 2003 equivalent to 15.5 million hectares, up substantially from 9% or 12.4 million hectares in 2002. If the global areas (conventional and transgenic) of these four principal GM crops are aggregated, the total area is 272 million hectares of which 25%, up from 22% in 2002, was transgenic in 2003. Thus, for the first time one quarter of the aggregate area of the four crops, totaling over one quarter billion hectares is GM. The biggest increase in 2003 was a 4.9 million hectares increase in GM soybean equivalent to a 13% year-on-year growth, followed by a 3.1 million hectare increase in GM maize equivalent to a substantial 25% year-on-year growth, which follows a 27% year-on-year growth in 2002.

The Potential Contribution of GM Crops

- The World Food Program recently reported that the number of people suffering from malnutrition increased by 25 million from 815 to 840 million. The most compelling case for biotechnology, and more specifically GM crops, is their capability to contribute to:

  - increasing crop productivity, and thus contribute to global food, feed and fiber security;
  - conserving biodiversity, as a land-saving technology capable of higher productivity;
  - more efficient use of external inputs, for a more sustainable agriculture and environment;
  - increasing stability of production to lessen suffering during famines due to abiotic and biotic stresses;
  - and, to the improvement of economic and social benefits and the alleviation of abject poverty in developing countries.

- The experience of the first eight years, 1996 to 2003, during which a cumulative total of over 300 million hectares (approximately 750 million acres, equivalent to almost one-third of the total land area of the US or China) of GM crops were planted globally in 21 countries, has met the expectations of millions of large and small farmers in both industrial and developing countries. In 2003, coincidental with evidential confirmation that commercialized GM crops continue to deliver significant economic, environmental, and social benefits to both small and large farmers in developing and industrial countries, the global area of transgenic crops continued to grow at an annual sustained double-digit growth rate of more than 10%. The number of farmers that benefited from GM crops continued to grow and reached 7 million in 2003, up from 6 million in 2002. Notably, more than 85% of these 7 million farmers benefiting from GM crops in 2003, were resource-poor farmers planting Bt cotton, mainly in nine provinces in China and also in the Makhathini Flats in KwaZulu Natal province in South Africa.

The Global Value of GM Crops

- In 2003, the global market value of GM crops is estimated to be $4.50 to $4.75 billion, having increased from $4.0 billion in 2002 when it represented 15% of the $31 billion global crop protection market and 13% of the $30 billion global commercial seed market. The market value of the global transgenic crop market is based on the sale price of transgenic seed plus any technology fees that apply. The global value of the GM crop market is projected at $5 billion or more, for 2005.

Concluding Comments and Future Prospectives

- Despite the on-going debate in the European Union, there is cause for cautious optimism that the global area and the number of farmers planting GM crops will continue to grow in 2004 and beyond. Taking all factors into account, the outlook for the next five years points to continued growth in the global hectarage of GM crops to approximately 100 million hectares, with up to 10 million farmers growing GM crops in 25, or more, countries. The global number and proportion of small farmers from developing countries growing GM crops is expected to increase significantly. Established GM country markets are continuing to grow in GM area, with a more diversified portfolio of GM crop products available. New GM countries from the South, like India and Brazil, have increased their hectarage of Bt cotton and herbicide tolerant soybean respectively, and some like Uruguay have also approved new products such as GM maize, already deployed in other countries. New input trait products from industry that will contribute to sustained growth include the dual Bt gene (*cry1Ac and cry1Ab*) in cotton and two new traits introduced into maize in North America. The *cry3Bb1* for corn rootworm control, and the *cry1Fa2* gene in Bt maize, with broader control of lepidopteran pests were both introduced in the US in 2003. Furthermore, five new Bt and novel gene products for maize insect resistance are expected to be launched in the next three years. Thus, the global GM maize area with insect resistance and herbicide tolerance traits, as well as the stacked traits, is likely to increase significantly in the near to mid-term. With the approval of GM soybean in Brazil for 2003/04, global GM soybean area is likely to experience renewed high growth rates in the near to mid-term.

- In 2003, the three most populous countries in Asia – China, India, and Indonesia (total population 2.5 billion and a combined GDP of over $1.5 trillion), the three major economies of Latin America – Argentina, Brazil and Mexico (population 300 million and a GDP of $1.5 trillion) and the largest economy on the continent of Africa - South Africa (population 45 million and GDP of $130 billion) are all officially growing GM crops. Their combined populations of 2.85 billion with a total GDP of over $3 trillion are recipients of the significant benefits that GM crops offer. The top ten GM crop countries, each of which grew 50,000 hectares or more of GM crops in 2003, had a combined population of approximately 3 billion, close to half the world's population, with a combined GDP of $13 trillion, almost half of the global GDP of $30 trillion. In 2003, GM crops were grown in 18 countries with a combined population of 3.4 billion, living on six continents in the North and the South: Asia, Africa and Latin America, and North America, Europe and Oceania. Thus, despite the continuing controversy about GM crops, the hectarage and number of farmers growing GM crops have continued to grow at a double digit rate or more, every year since their introduction in 1996, with 7 million farmers benefiting from the technology in 2003.

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Introduction

The experience of the first seven years, 1996 to 2002, during which a cumulative total of over 235 million hectares (over 580 million acres) of transgenic crops were planted globally in 19 countries, has confirmed that the early promise of biotechnology has been fulfilled. GM crops deliver substantial agronomic, environmental, economic and social benefits to farmers and, increasingly, to society at large. GM crops have met the expectations of large and small farmers planting transgenic crops in both industrial and developing countries. The rapid adoption of transgenic crops, often referred to as genetically modified crops (GM crops) or biotech crops, during the initial seven year period, 1996 to 2002, reflects the substantial multiple benefits realized by both large and small farmers in industrial and developing countries that have grown transgenic crops commercially. Between 1996 and 2002, a total of nineteen countries, 10 industrial and 9 developing, contributed to a thirty-five fold increase in the global area of GM crops from 1.7 million hectares in 1996 to 58.7 million hectares in 2002. Adoption rates for transgenic crops during the period 1996 to 2002 are unprecedented and are the highest for any new technologies by agricultural industry standards. High adoption rates reflect farmer satisfaction with the products that offer substantial benefits ranging from more convenient and flexible crop management, higher productivity and/or net returns per hectare, social benefits, and a cleaner environment through decreased use of conventional pesticides, which collectively contribute to a more sustainable agriculture. There is a growing body of compelling evidence that clearly demonstrates the improved weed and insect pest control attainable with transgenic herbicide tolerant and insect resistant Bt crops, that also benefit from lower input and production costs; GM crops offer substantial economic advantages to farmers compared with corresponding conventional crops. The severity of weed and insect pests varies from year to year and hence will directly impact pest control costs and the economic advantages of GM crops in any given time or place.

Despite the on-going debate on GM crops, particularly in countries of the European Union, millions of large and small farmers in both industrial and developing countries continue to increase their plantings of GM crops in consecutive years because of the significant multiple benefits they offer. This high rate of adoption is a strong vote of confidence in GM crops, reflecting farmer satisfaction in both industrial and developing countries. About 6 million farmers grew transgenic crops in 2002 and derived multiple benefits that included significant agronomic, environmental, social and economic advantages. ISAAA's 2002 Global Review predicted that the number of farmers planting GM crops, as well as the global area of GM crops, would continue to grow in 2003. Global population exceeded 6 billion in 2000 and is expected to reach over 9 billion by 2050, when approximately 90% of the global population will reside in Asia, Africa and Latin America. Today, 840 million people in the developing countries suffer from malnutrition and 1.3 billion are afflicted by poverty. Transgenic crops, represent promising technologies that can make a vital contribution to global food, feed and fiber security and also make a contribution to the alleviation of poverty.

The most compelling case for biotechnology, and more specifically GM crops, are their capability to contribute to:

- increasing crop productivity and thus contribute to global food, feed and fiber security;
- conserving biodiversity, as a land-saving technology capable of higher productivity;
- more efficient use of external inputs and thus a more sustainable agriculture and environment;
- increasing stability of production to lessen the suffering during famines due to abiotic and biotic stresses;
- the improvement of economic and social benefits and the alleviation of abject poverty in developing countries.

It is proposed that a combination of conventional and biotechnology applications be adopted as the technology component of a global food, feed and fiber security strategy that also addresses other critical issues including population control and improved food, feed and fiber distribution. Adoption of such a strategy will allow society to continue to benefit from the vital contribution that plant breeding offers the global population.

The author has published global reviews of transgenic crops annually since 1996 as ISAAA Briefs. This publication, a Preview of the 2003 Annual Review to be published later, provides the latest information on the global status of commercialized transgenic crops in 2003. A detailed global data set on the adoption of commercialized GM crops is presented for the year 2003 and the changes that have occurred between 2002 and 2003 are highlighted. The global adoption trends during the last eight years from 1996 to 2003 are also illustrated. The continuing debate on transgenic crops in Europe, the division of global powers over the war in Iraq and the status of the global economy, have not provided an environment conducive for global growth in transgenic crops in 2003. This Preview documents the global database on the adoption and distribution of GM crops in 2003.

Note that the words, rapeseed and canola, as well as transgenic, biotech crops, and genetically modified crops or GM crops, are used synonymously in the text, reflecting the usage of these words in different regions of the world. In this text the words corn, used in North America, and maize, used more commonly elsewhere in the world, are synonymous, with maize being used consistently in this Brief, except for common names like corn rootworm where global usage dictates the use of the word corn. Global figures and hectares planted commercially with transgenic crops have been rounded off to the nearest 100,000 hectares and in some cases this leads to insignificant approximations, and there may be slight variances in some figures, totals, and percentage estimates. It is also important to note that countries in the Southern Hemisphere plant their crops in the last quarter of the calendar year. The transgenic crop areas reported in this publication are planted, not necessarily harvested, hectarage in the year stated. Thus, the 2003 information for Argentina, Brazil, Australia, South Africa, Indonesia and Uruguay is hectares usually planted in the last quarter of 2003 and harvested in the first quarter of 2004.

Global Area of Transgenic Crops in 2003

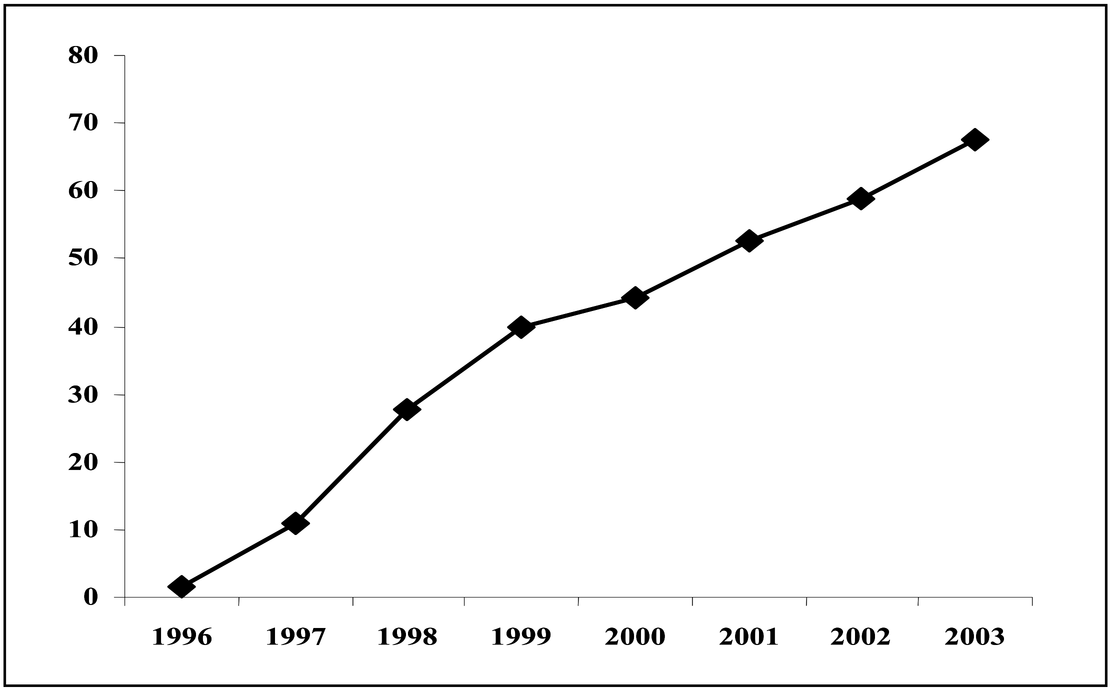
In 2003, the global area of transgenic crops continued to grow for the seventh consecutive year at a sustained double-digit growth rate of 15%, compared with 12% in 2002. The estimated global area of GM crops for 2003 was 67.7 million hectares; this includes a provisional conservative estimate of 3 million hectares of GM soybean in Brazil, officially approved for planting for the first time in 2003. Brazil officially approved herbicide tolerant soybean in late September 2003, immediately before the start of the planting season. This late approval has exacerbated the difficulties in projecting provisional estimates of GM soybean hectarage in Brazil for the 2003/2004 season. At the time when this publication went to press, in late 2003, only 50% of soybeans had been planted in Brazil. A provisional conservative estimate of 3 million hectares of GM soybean has been projected for Brazil in 2003, in the knowledge that the final planted hectarage of GM soybean in Brazil in 2003 could be significantly higher. It is noteworthy that a double-digit rate of 10% growth in GM crops was sustained in 2003 even excluding the Brazil herbicide tolerant soybean hectarage. The 67.7 million hectares of GM crops in 2003, equivalent to 167 million acres was grown by 7.0 million farmers in 18 countries, an increase from 6 million farmers in 16 countries in 2002. To put this global area of transgenic crops into context, 67.7 million hectares is equivalent to 7% of the total land area of China (956 million hectares) or the US (981 million hectares) and almost three times the land area of the United Kingdom (24.4 million hectares). The increase in area between 2002 and 2003 of 15% is equivalent to 9.0 million hectares or 22 million acres.

Table 1. Global Area of Transgenic Crops, 1996 to 2003

	Hectares (million)	**Acres** (million)
1996	1.7	4.3
1997	11.0	27.5
1998	27.8	69.5
1999	39.9	98.6
2000	44.2	109.2
2001	52.6	130.0
2002	58.7	145.0
2003	**67.7**	**167.2**

Increase of 15%, 9 Million Hectares or 22.2 Million Acres between 2002 and 2003.
Source: Clive James, 2003.

Figure 1. Global Area of Transgenic Crops, 1996 to 2003 (Million Hectares)



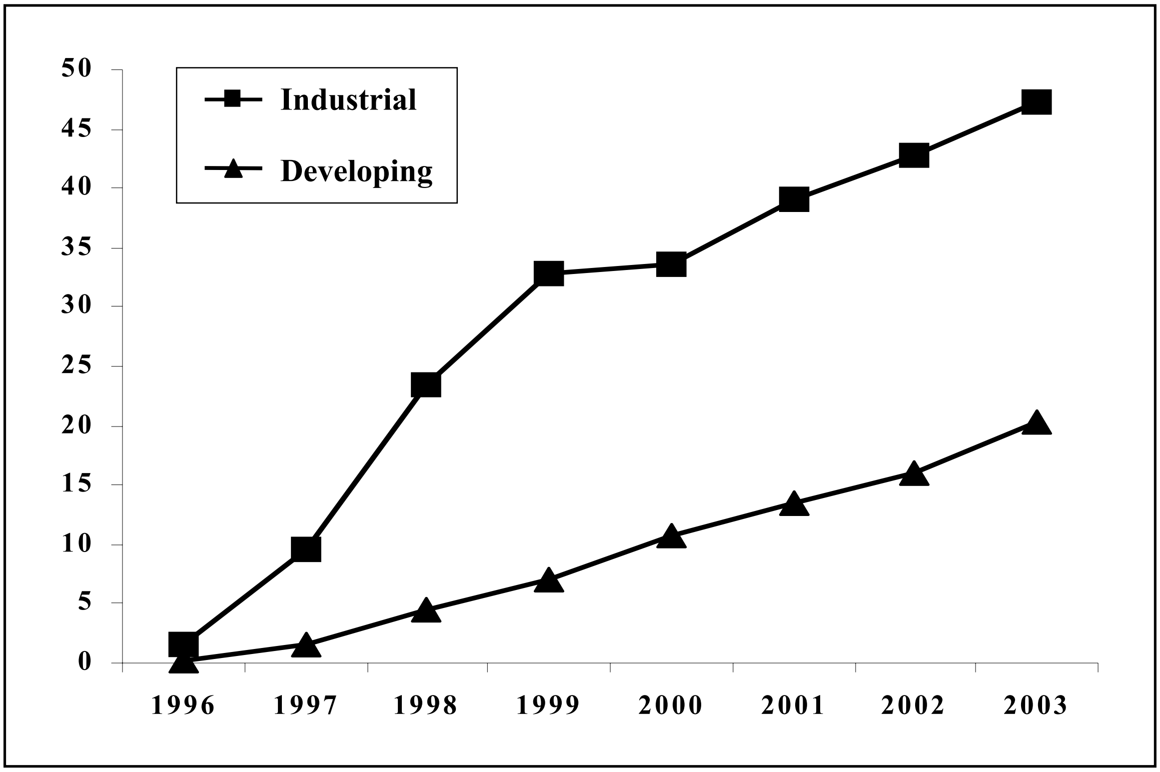
Source: Clive James, 2003.

During the eight-year period 1996 to 2003, the global area of transgenic crops increased 40 fold, from 1.7 million hectares in 1996 to 67.7 million hectares in 2003 (Figure 1). This rate of adoption is one of the highest rates of technology adoption in agriculture and reflects the growing acceptance of transgenic crops by farmers using GM crops in both industrial and developing countries. During the eight-year period 1996 to 2003, the number of countries growing transgenic crops more than doubled, increasing from 6 in 1996 to 9 in 1998, to 12 countries in 1999, to 18 in 2003.

Distribution of Transgenic Crops in Industrial and Developing Countries

Figure 2 shows the relative hectarage of transgenic crops in industrial and developing countries during the period 1996 to 2003. It clearly illustrates that whereas the substantial share of GM crops has been grown in industrial countries, the proportion of transgenic crops grown in developing countries has increased consistently from

Figure 2. Global Area of Transgenic Crops, 1996 to 2003: Industrial and Developing Countries (Million Hectares)



Source: Clive James, 2003.

Table 2. Global Area of Transgenic Crops in 2002 and 2003: Industrial and Developing Countries (Million Hectares)

	2002	%	2003	%	+/-	%
Industrial Countries	42.7	73	47.3	70	4.6	+ 11
Developing Countries	16.0	27	20.4	30	4.4	+ 28
Total	**58.7**	**100**	**67.7**	**100**	**9.0**	**+ 15**

Source: Clive James, 2003.

14% in 1997, to 16% in 1998, to 18% in 1999, 24% in 2000, 26% in 2001, 27% in 2002 and 30% in 2003. Thus, in 2003, more than one quarter, 30%, (Table 2) of the global transgenic crop area of 67.7 million hectares, equivalent to 20.4 million hectares, was grown in developing countries where growth continued to be strong between 2002 and 2003. Developing country GM crop area grew in 2003 in part because of the inclusion of Brazil's GM crop area for the first time. However, equally important is the continued strong growth in China, Argentina, South Africa, and India, which planted almost 100,000 hectares of Bt cotton for the second year in 2003. Almost one-third (30%) of the global transgenic crop area of 67.7 million hectares in 2003, equivalent to over 20 million hectares, was grown in developing countries where growth continued to be strong. It is noteworthy that the absolute growth in GM crop area between 2002 and 2003 was almost the same in the developing countries (4.4 million hectares) as in industrial countries (4.6 million hectares). The percentage growth was more than twice as high (28%) in the developing countries of the South, compared to the industrial countries of the North (11%).

Distribution of Transgenic Crops, by Country

In 2003, six principal countries, compared with four in 2002, grew 99% of the global transgenic crop area; this reflects the broadening participation of the lead GM crop countries with ten countries now growing 50,000 hectares or more of GM crops. The USA grew 42.8 million hectares (63% of global total), followed by Argentina with 13.9 million hectares (21%), Canada 4.4 million hectares (6%), Brazil 3 million hectares (4%), China 2.8 million hectares (4%) and South Africa 0.4 million hectares (1%) (Table 3 and Figure 3). It is noteworthy that the top six countries for the first time include more (four) developing countries, Argentina, Brazil, China and South Africa, than industrial countries (two), USA and Canada. Of the top six GM countries Brazil allowed the growing of GM crops officially for the first time in 2003 whilst the other five countries all reported continued growth of GM crops between 2002 and 2003 (Table 3 and Figure 3). The estimated 3 million hectares of herbicide tolerant soybean in Brazil is conservative and the final hectarage of herbicide tolerant soybean in 2003/04 could be significantly higher. Most of the hectarage is in the southern state of Rio Grande do Sul where herbicide tolerant soybean has been planted unofficially for several years.

Of the six leading GM crop countries, China and South Africa had the highest year-on-year increase with a 33% growth rate. China increased its Bt cotton area for the fifth consecutive year, from 2.1 million hectares in 2002 to 2.8 million hectares in 2003, equivalent to 58% of the total cotton area of 4.8 million hectares in 2003. South Africa increased its combined area of GM maize, soybean and cotton to 0.4 million hectares in 2003 with particularly strong growth in white maize used for food, which has increased rapidly from 6,000 hectares in 2001 to 84,000 hectares in 2003. Canada's GM crop area grew at a significant 26% between 2002 and 2003 to reach 4.4 million hectares with increases totaling almost 1 million hectares in all three crops, canola, maize and soybean.

Despite the continuing economic constraints in Argentina, and the very high rate of adoption for herbicide tolerant soybeans, which was close to 100% in 2002, growth rate of GM crops continued to climb in 2003, with a total of approximately 13.9 million hectares. There is continued growth in Bt maize, which now represents 40 % of the national maize hectarage. Year-on-year growth was 10% for the US. India, which grew Bt cotton for the first time in 2002 increased its Bt cotton area by 100% in 2003 to 100,000 hectares. Growth is expected to continue in India in 2004. GM crop hectarage in Australia decreased slightly because of the continued severe drought, which is the worst in centuries. The drought situation reduced total area planted to cotton to approximately one third of normal plantings. It is noteworthy that Spain, the only EU country to grow a significant hectarage of a commercial GM crop, increased its Bt maize area by one third from just under 25,000 hectares in 2002 to 32,000 hectares in 2003, over 6% of the national maize crop. Uruguay and Romania also reported significant growth, exceeding 50,000 hectares of GM crops for the first time, whilst countries that introduced GM crops for the first time in 2002, such as Colombia and Honduras reported modest growth.

The 18 countries that grew transgenic crops in 2003 are illustrated in Figure 3 and listed in descending order of their transgenic crop areas (Table 3). There are 11 developing countries, 5 industrial countries, and two from Eastern Europe. In 2003, transgenic crops were grown commercially in all six continents of the world – North America, Latin America, Asia, Oceania, Europe (Eastern and Western), and Africa. The top six countries grew 99% of the global transgenic crop area, with the balance of 1% grown in the remaining 12 countries. Australia and India each grew approximately 100,000 hectares, and Romania, and Uruguay grew over 50,000 hectares. See Table 3 for the listing of the 10 countries that grew 50,000 or more

Table 3. Global Area of Transgenic Crops in 2002 and 2003: by Country (Million Hectares)

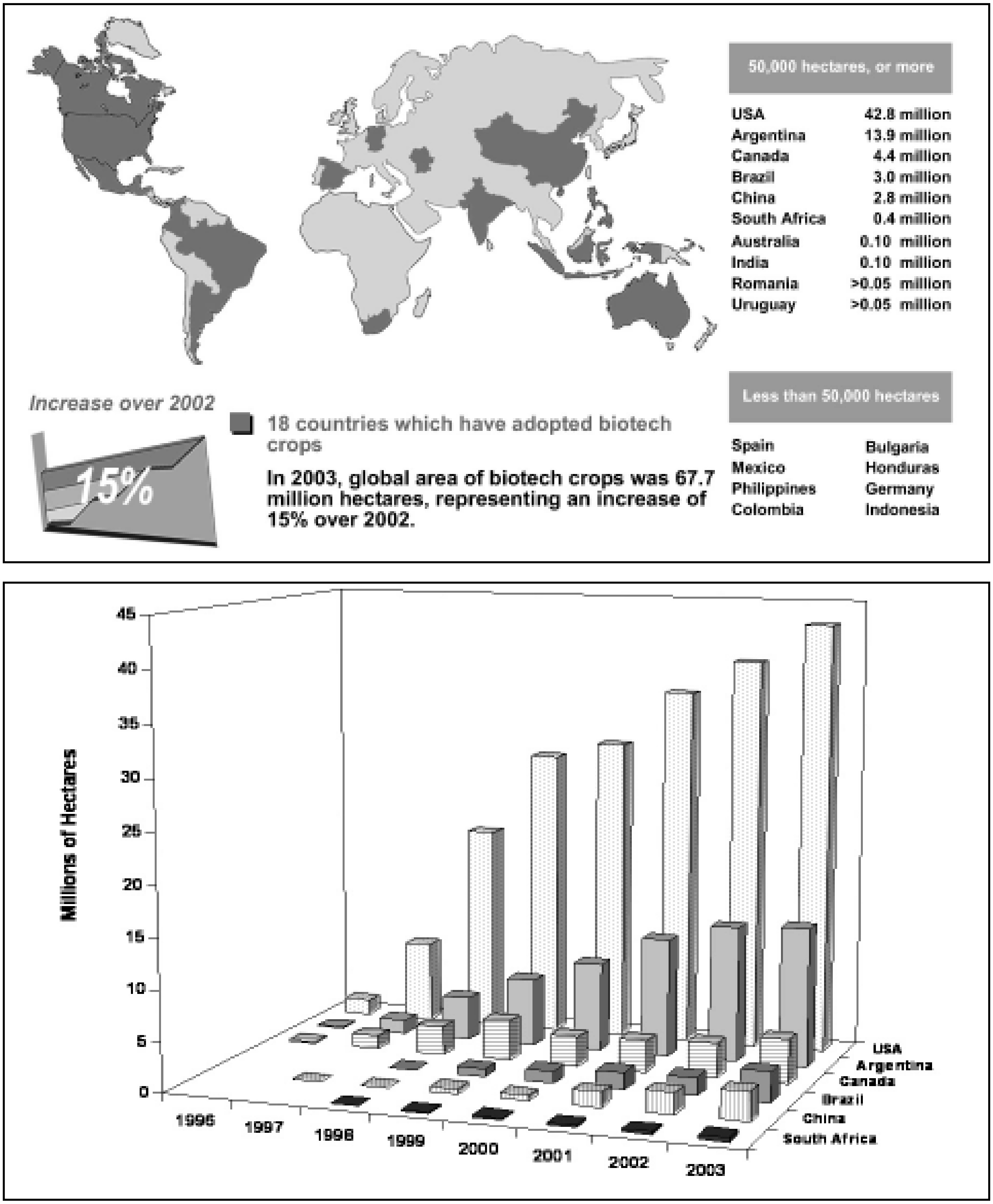
	2002	%	2003	%	+/-	%
USA*	39.0	66	42.8	63	+3.8	+10
Argentina*	13.5	23	13.9	21	+0.4	+3
Canada*	3.5	6	4.4	6	+0.9	+26
Brazil*	----	--	3.0	4	+3.0	----
China*	2.1	4	2.8	4	+0.7	+33
South Africa*	0.3	1	0.4	1	+0.1	+33
Australia*	0.1	<1	0.1	<1	----	----
India*	<0.1	<1	0.1	<1	+0.05	+100
Romania*	<0.1	<1	<0.1	<1	<0.1	----
Uruguay*	<0.1	<1	<0.1	<1	<0.1	----
Spain	<0.1	<1	<0.1	<1	<0.1	----
Mexico	<0.1	<1	<0.1	<1	<0.1	----
Philippines	----	--	<0.1	<1	<0.1	----
Colombia	<0.1	<1	<0.1	<1	<0.1	----
Bulgaria	<0.1	<1	<0.1	<1	<0.1	----
Honduras	<0.1	<1	<0.1	<1	<0.1	----
Germany	<0.1	<1	<0.1	<1	<0.1	----
Indonesia	<0.1	<1	<0.1	<1	<0.1	----
Total	**58.7**	**100**	**67.7**	**100**	**+9.0**	**+ 15%**

Source: Clive James, 2003. *Countries that grew more than 50,000 hectares of GM crops in 2003.

hectares of GM crops in 2003. The following paragraphs provide a more detailed analysis of the GM situation in selected countries.

In the USA, there was an estimated net gain of 3.8 million hectares of transgenic crops in 2003, which arose as a result of significant increases in the area of transgenic maize and soybean. There was a slight decrease in herbicide tolerant canola and GM cotton. The decrease in cotton plantings in the US was attributed to continuing low international prices of cotton, making the crop less profitable than soybean and maize, both of which increased in total plantings at the expense of cotton.

Figure 3. Global Area (Million Hectares) of Transgenic Crops, 1996 to 2003, by Country and for the Top Six Countries



Source: Clive James, 2003.

In Argentina, despite the continuing economic constraints, a gain of 400,000 hectares was reported for 2003 due to a 40% increase in Bt maize and a continuing increase in herbicide tolerant soybean, despite the fact that the adoption has been close to 100% (98 to 99%) for the last two years.

For Canada, a net gain of 26 % in total GM crop area was reported, equivalent to an increase of 0.9 million from 3.5 million hectares in 2002 to 4.4 million hectares in 2003. This high growth rate reflects higher total plantings of canola in 2003 after the drought of 2002, and significant growth in both GM maize and GM soybean.

For China, the area planted to Bt cotton increased by a significant 0.7 million hectares, equivalent to 33% growth from 2.1 million hectares in 2002 to 2.8 million hectares in 2003. An estimated 6 million small farmers grew Bt cotton in China in 2003, up from 5 million in 2002. This brings the total number of GM crop farmers globally in 2003 to 7 million or more, over 85% of whom are resource-poor farmers from developing countries.

A significant increase in GM crop area was reported for South Africa, where the combined area of transgenic maize, cotton and soybean is expected to be approximately 400,000 hectares in 2003. The continuing severe drought in Australia makes it unlikely that the total area planted to cotton in 2003-2004 will be more than 170,000 hectares (approximately one-third of the normal crop of 450,000 hectares). This has resulted in a defacto reduction in the hectarage planted to GM cotton to approximately 100,000 hectares in 2003, equivalent to 59% of the total cotton area. In 2003, the GM cotton area in Australia is likely to comprise about 25,000 hectares of the single or dual Bt gene cotton, an equal hectarage of the stacked gene (Bt/HT) and approximately 50,000 hectares of herbicide tolerant cotton, for a total of approximately 100,000 hectares of GM cotton in 2003-2004. There is a limitation in place on the percentage of Bt cotton allowed to be planted in Australia in 2003-2004. The single Bt gene product is restricted to 15% on any farm, and the combined area of the single and dual gene Bt products is restricted to a maximum of 40% on any farm. Continuing low international prices for cotton have not provided the incentive for cotton growers generally. The total plantings of GM cotton in the US in 2003 is slightly lower by about 5% or 200,000 hectares, but the decline is more than offset by a significant increase of 33%, equivalent to 700,000 hectares, in China. India which grew approximately 50,000 hectares of Bt cotton for the first time in 2002, doubled its Bt cotton area to approximately 100,000 hectares in 2003, a significant increase, although below the expectations of some market observers.

Romania increased its area of GM soybean by 50% to 70,000 hectares in 2003. Spain increased its area of Bt maize by one third in 2003 to 32,000 hectares, from just under 25,000 hectares in 2002. In 2003 elsewhere in Europe, Germany continued to grow a token area of Bt maize and similarly Bulgaria continued to grow a few thousand hectares of herbicide tolerant maize under a permit from its government. Mexico continued to grow a small area of GM soybean and Bt cotton. Uruguay tripled its GM crop area from 20,000 hectares of herbicide tolerant soybean to around 60,000 and introduced Bt maize, approved for the first time in 2003. In Indonesia unconfirmed reports indicate that farmers planted a small area of Bt cotton in Sulawesi prior to the closing of the cotton processing facility that served the needs of Bt cotton farmers in the region.

Colombia, in Latin America, expanded its area of Bt cotton to approximately 5,000 hectares from the initial plantings in 2002. Similarly, 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 2003, there was another increase in the total number of countries growing GM crops. Two new countries, Brazil and the Philippines, joined the expanding global group of countries that are growing GM crops. Notably, Brazil the second largest producer of soybeans in the world, approved planting of herbicide tolerant soybean in September 2003. In another strategic development, the Philippines grew approximately 20,000 hectares of Bt corn for the first time. This is the first major feed/food crop to be commercialized in Asia, which grows 30% of the global 140 million maize hectares, with China itself growing 25 million hectares plus significant production in India, Indonesia, Thailand and Vietnam.

The country portfolios of deployed GM crops continued to diversify in 2003. Of particular interest was the introduction of the Bt *cry3Bb1* gene (event MON 863) for the control of corn rootworm in the US. The rootworm is a major economic pest that costs US farmers about $1 billion dollars per year in losses and control costs. The *cry3Bb1* gene was deployed in event MON 863 and will soon be offered as a dual gene product with *cry1Ab*. Event MON 863 has also been approved for planting in Canada. The Bt gene *cry1Fa2* (event TC 1507) was also commercialized for the first time in the US in 2003. The *cry1Fa2* gene was deployed in event TC 1507 and provides a broader spectrum of activity that includes excellent protection against first and second generation European corn borer, southwestern corn borer, fall armyworm, black cutworm, western bean cutworm and intermediate suppression of corn earworm. TC 1507 has also been approved for growing in Canada.

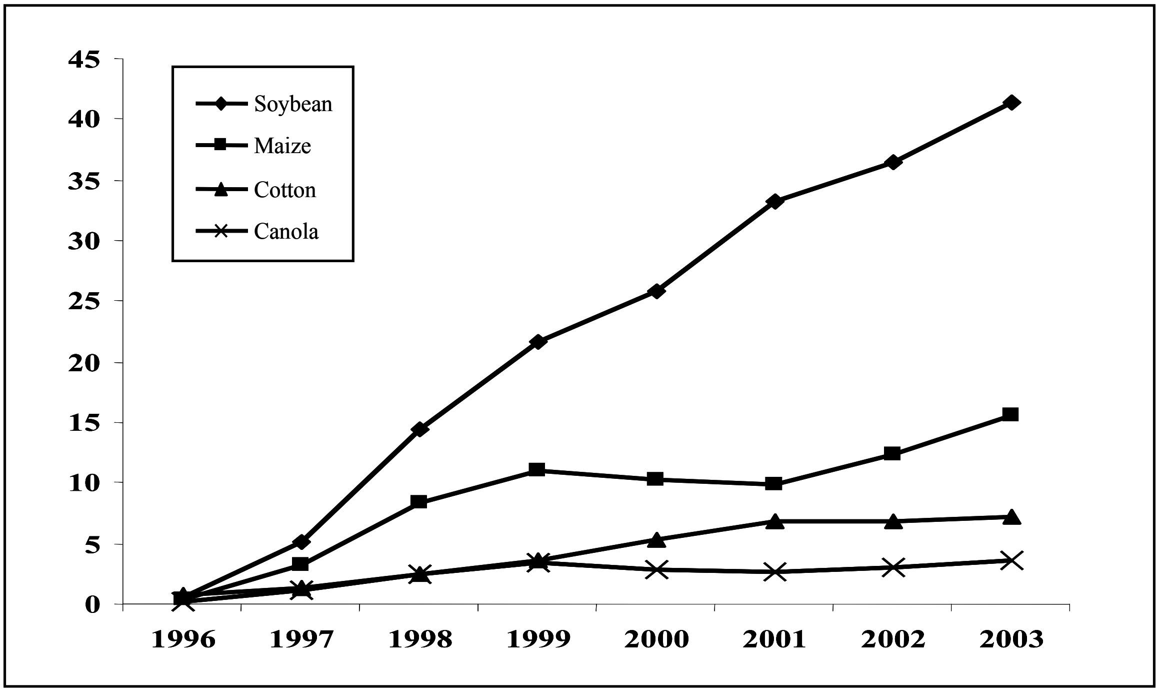
The MON 810 event (*cryAb1*) in Bt maize was approved for commercialization in Uruguay for the first time in 2003. The *cry1Ab* gene provides excellent control of the European corn borer, Southwestern corn borer, sugar cane borer, Southern corn stalk borer, Asian corn borer, the Chilo borers and corn earworm at the whorl stage, plus intermediate control for corn earworm at the ear stage.

Distribution of Transgenic Crops, by Crop

The distribution of the global transgenic crop area for the four major crops is illustrated in Figure 4 for the period 1996 to 2003. It clearly shows the continuing dominance of transgenic soybean occupying 61% of the global area of transgenic crops in 2003; the entire transgenic soybean hectarage is herbicide tolerant. Transgenic soybean retained its position in 2003 as the transgenic crop occupying the largest area. Globally, transgenic soybean occupied 41.4 million hectares in 2003, with transgenic maize growing fast in second place at 15.5 million hectares, transgenic cotton in third place at 7.2 million hectares, and finally canola at 3.6 million hectares (Table 4).

In 2003, the global hectarage of herbicide tolerant soybean is estimated to have increased by 4.9 million hectares, equivalent to a 13% increase. Significant gains of transgenic soybean were reported for the USA in 2003 with over 80% of the national soybean area of 30 million hectares planted to herbicide tolerant soybean. Brazil planted an estimated 3.0 million hectares with herbicide tolerant soybean for the first time in 2003, which is a conservative estimate and Argentina reported that 98% of its 13 million hectares of soybean were planted with herbicide tolerant soybean. Canada

Figure 4. Global Area of Transgenic Crops, 1996 to 2003: by Crop (Million Hectares)



Source: Clive James, 2003.

Table 4. Global Area of Transgenic Crops in 2002 and 2003: by Crop (Million Hectares)

Crop	2002	%	2003	%	+/-	%
Soybean	36.5	62	41.4	61	+ 4.9	+ 13
Maize	12.4	21	15.5	23	+ 3.1	+ 25
Cotton	6.8	12	7.2	11	+ 0.4	+ 6
Canola	3.0	5	3.6	5	+ 0.6	+ 20
Squash	<0.1	<1	<0.1	<1	- -	- -
Papaya	<0.1	<1	<0.1	<1	- -	- -
Total	**58.7**	**100**	**67.7**	**100**	**+ 9.0**	**+ 15**

Source: Clive James, 2003.

reached half a million hectares of herbicide tolerant soybean for the first time. Both Romania and Uruguay planted more than 50,000 hectares of herbicide tolerant soybean for the first time whilst South Africa and Mexico grew between 10,000 and 20,000 hectares of herbicide tolerant soybean.

Transgenic maize area increased by the highest percentage growth in 2003, 25% compared with 20% for canola and 13% for soybean and 6 % for cotton. The growth of 25% in GM maize in 2003 followed a 27% growth in 2002. Most of the increase occurred in the US, but there was also strong growth in Canada, Argentina, South Africa and Spain plus new countries, including Honduras, Philippines and Uruguay, allowing GM maize cultivation for the first time. In South Africa, Bt yellow maize used for feed increased from 175,000 hectares of the crop in 2002 to 200,000 hectares, equivalent to approximately 20% of the yellow maize crop 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 almost fifteen fold to 84,000 hectares, equivalent to 8% of the 2003 white maize crop of 1.8 million hectares.

The area planted to GM cotton globally was up 400,000 hectares, equivalent to a 6 % growth over 2002. In the USA in 2003, GM cotton was approximately 5% less than in 2002, and Australian GM cotton was constant, but China increased its area under GM cotton by 700,000 hectares, equivalent to a year-on-year growth of 33%.

The global area of transgenic canola in 2003 is estimated to have increased by 0.6 million hectares, from 3.0 million hectares in 2002 to an estimated 3.6 million hectares in 2003 with all the increase in Canada, with GM canola in the US slightly lower. In Canada 3.19 million hectares of the total of 4.7 million hectares of canola in 2003 were GM herbicide tolerant, with an additional 22% of mutagenic herbicide tolerant canola leaving only 10% of conventional canola.

Distribution of Transgenic Crops, by Trait

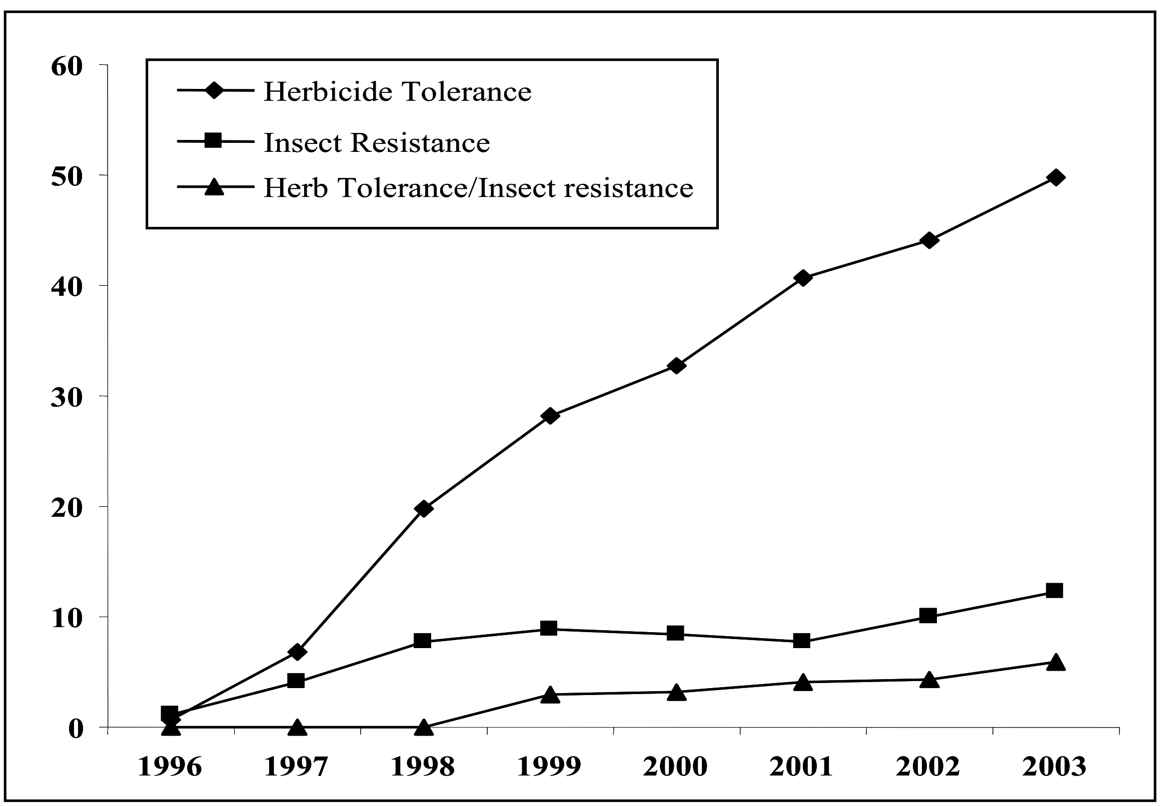
During the eight-year period 1996 to 2003, herbicide tolerance has consistently been the dominant trait with insect resistance being second (Figure 5). In 2003, herbicide tolerance, deployed in soybean, maize and cotton, occupied 73% of the 67.7 million

Table 5. Global Area of Transgenic Crops in 2002 and 2003: by Trait (Million Hectares)

Trait	2002	%	2003	%	+/-	%
Herbicide tolerance	44.2	75	49.7	73	+ 5.5	+ 12
Insect resistance (Bt)	10.1	17	12.2	18	2.1	+ 20
Bt/Herbicide tolerance	4.4	8	5.8	9	1.4	+ 32
Virus resistance/Other	<0.1	<1	<0.1	<1	< 0.1	- -
Global Total	**58.7**	**100**	**67.7**	**100**	**+ 9.0**	**+ 15**

Source: Clive James, 2003.

Figure 5. Global Area of Transgenic Crops, 1996 to 2003: by Trait (Million Hectares)



Source: Clive James, 2003.

hectares (Table 5). There were 12.2 million hectares planted to Bt crops, equivalent to 18%, and stacked genes for herbicide tolerance and insect resistance deployed in both cotton and maize occupying 9% of the global transgenic area in 2003. It is noteworthy that whereas the area of herbicide tolerant crops increased by a significant 12% (5.5 million hectares), Bt crops increased at a much higher rate of 20% (2.1 million hectares) between 2002 and 2003. This increase in Bt crops reflects the significant increase in the single gene Bt maize in 2003 (1.4 million hectares) and the increase of 0.7 million hectares in the maize with stacked genes of Bt/herbicide tolerance for a total of 2.1 million hectares. Whereas most of the growth in Bt maize occurred in the US, significant increases in Bt maize hectarage also occurred in Argentina, South Africa and Spain.

Dominant Transgenic Crops in 2003

Herbicide tolerant soybean continued to be the dominant transgenic crop grown commercially in seven countries in 2003 – USA, Argentina, Canada, Mexico, Romania, Uruguay and South Africa (Table 6). Globally, herbicide tolerant soybean occupied 41.4 million hectares, representing 61% of the global transgenic crop area

Table 6. Dominant Transgenic Crops, 2003

Crop	Million Hectares	% Transgenic
Herbicide tolerant Soybean	41.4	61%
Bt Maize	9.1	13%
Herbicide tolerant Canola	3.6	5%
Bt/Herbicide tolerant Maize	3.2	5%
Herbicide tolerant Maize	3.2	5%
Bt Cotton	3.1	5%
Bt/Herbicide tolerant Cotton	2.6	4%
Herbicide tolerant Cotton	1.5	2%
Total	**67.7**	**100%**

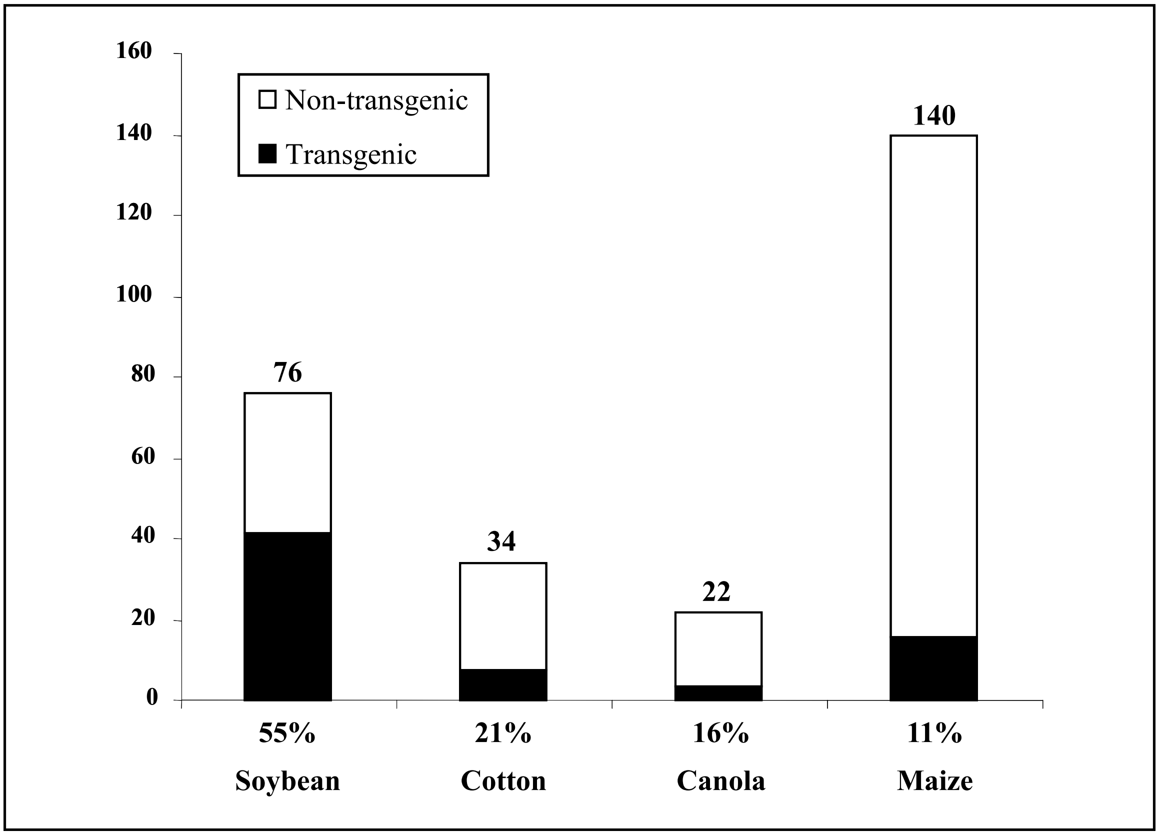
Source: Clive James, 2003.

of 67.7 million hectares for all crops. The second most dominant crop was Bt maize, which occupied 9.1 million hectares, equivalent to 13% of global transgenic area and planted in nine countries – USA, Canada, Argentina, South Africa, Spain, Philippines, Honduras, Uruguay and Germany. It is noteworthy that Bt maize, deployed as a single Bt gene and in the stacked product Bt/HT, occupied a total of 12.3 million hectares compared with 9.9 million hectares in 2002. The third most dominant crop was herbicide tolerant canola, which occupied 3.6 million hectares, equivalent to 5% of global transgenic area and planted in two countries, Canada and the USA. Three other crops listed in Table 6 also occupy 5% each of global transgenic crop area and include, in descending order of area: Bt/herbicide tolerant maize on 3.2 million hectares (5%); herbicide tolerant maize on 3.2 million hectares (5%); and Bt cotton (5%) on 3.1 million hectares. Bt/herbicide tolerant cotton on 2.6 million hectares occupied 4% and herbicide tolerant cotton was grown on 1.5 million hectares (2%).

Global Adoption of Transgenic Soybean, Maize, Cotton and Canola

Another way to provide a global perspective of the status of transgenic crops is to characterize the global adoption rates as a percentage of the respective global areas of the four principal crops – soybean, cotton, canola and maize – in which transgenic technology is utilized (Table 7 and Figure 6). The data indicate that in 2003, 55% of the 76 million hectares of soybean planted globally were transgenic - up from 51 % in 2001. Of the 34 million hectares of cotton, 21% or 7.2 million hectares were planted to transgenic cotton in 2003. The area planted to transgenic canola, expressed on a percentage basis, increased from 12% in 2002 to 16 % or 3.6 million hectares of the 22 million hectares of canola planted globally in 2003. Similarly, of the 140 million hectares of maize planted in 2003, 11% was planted to GM maize, up significantly from 9% in 2002. If the global areas (conventional and transgenic) of these four crops are aggregated, the total area is 272 million hectares, of which 25% were GM - up from 22% in 2002. It is noteworthy that two-thirds of these 272 million hectares are in the developing countries where yields are lower, constraints are greater, and the need for improved production of food, feed, and fiber crops is the greatest.

Figure 6. Global Adoption Rates (%) for Principal Transgenic Crops (Million Hectares) in 2003



Source: Clive James, 2003.

Table 7. Transgenic Crop Area as % of Global Area of Principal Crops, 2003 (Million Hectares)

Crop	Global Area	Transgenic Crop Area	Transgenic Area as % of Global Area
Soybean	76	41.4	55%
Cotton	34	7.2	21%
Canola	22	3.6	16%
Maize	140	15.5	11%
Total	**272**	**67.7**	**25%**

Source: Clive James, 2003.

Concluding Remarks and Future Prospectives

By far the most important development for GM crops in 2003 was the passage in September of a Presidential decree by the Government of Brazil to allow, for the first time, the planting of herbicide tolerant soybeans for the 2003–2004 crop. This is the first approval for commercialization of any GM crop in Brazil. The decree is an interim measure pending passage of a new law to regulate the procedures for evaluation and approval of all GM crops and thus is a provisional approval for one year to allow planting of herbicide tolerant soybean for the 2003-2004 crop. It is expected that the new law will be in place by the latter part of 2003. The President of Brazil, Luiz Inacio Lula de Silva, had earlier officially approved the sale of the harvest from the 2002-2003 herbicide tolerant soybean crop. This was a very welcome development for the farmers of Rio Grande do Sul, who have planted herbicide tolerant soybean unofficially for several years. The farmers opted for herbicide tolerant soybean because it requires less herbicide and tillage, contributes to sustainability and in conjunction with direct seeding through control of soil erosion and conservation of moisture, all resulting in higher productivity and profitability. It is conservatively estimated that about 3 million hectares of the 2003-2004 soybean crop will be planted with herbicide tolerant soybean, but the final hectarage may be significantly higher. Most of the herbicide tolerant soybean will be planted in the southern state of Rio Grand do Sul, but there are some indications that it will not be entirely restricted to the southern state.

Brazil, with an estimated hectarage of 17 million hectares of soybean in 2002-2003 was second only to the US, which had 30 million hectares. The average yield in Brazil, 2.8 MT per hectare, is higher than the US yield at 2.6 MT per hectare. It is speculated that in the near-term, Brazil could become the top soybean producer in the world, with soy products already accounting for 5% of Brazil's total exports, valued at $80 billion. Agriculture in Brazil, with a population of 175 million, is a very important sector, employing 26% of the labor force and contributing between 8 and 9% to the Gross Domestic Product of over $750 billion. Brazil now joins the US and Argentina, the other two major producers and exporters of herbicide tolerant soybean, which are closely monitoring the reaction of Europeans, who until now, have had the privilege to purchase non-GM soybean without a premium. At the time when this publication goes to press, there is an indication that non-GM soybean may command a premium over herbicide tolerant soybean. All the developments in relation to herbicide tolerant soybean in Brazil coincide with the introduction of new regulations on labeling and traceability in the EU that will apply to both GM food and feed products and result in additional costs for consumers. The new European regulations are expected to be passed into law in late 2003, despite the fact that many practitioners have cautioned that the system will be very difficult, if not impossible to implement, impracticable, and very expensive. The cost of the regulations will be borne by European consumers. They may elect not to pay the higher prices for non-GM soybean products and opt for the more affordable products derived from herbicide tolerant soybean, which the EU Commission has endorsed along with other GM foods as safe and wholesome products.

There has been much speculation recently by observers of China about its future strategy re. GM crops. A recent publication by Dr Jikun Huang of the Chinese Academy of Sciences and Dr Qinfang Wang from the Chinese Academy of Agricultural Sciences sheds light on the subject. It clearly reaffirms that Chinese policymakers view agricultural biotechnology as a strategic element for increasing productivity, improving national food security and being competitive internationally. Drs Huang and Wang report that China has clearly stated that it intends to be one of the world leaders in biotechnology because Chinese policymakers have concluded that there are unacceptable risks with dependence on imported technologies for ensuring food security. It is noteworthy that despite the continuing debate on GM crops, China has not wavered in its commitment to biotechnology since its first investments in the mid 1980s and there are twelve GM crops being field-tested including maize and rice, with a view to commercialization. The authors note that "the growth of government investment in agricultural biotechnology research has been remarkable". The research agenda on GM crops has been formulated to meet national food/feed security objectives as well as the needs of farmers in high potential areas and the needs of small resource-poor farmers requiring abiotic and biotic stress resistant crops grown on marginal land. China is cognizant of the need to better integrate its myriad of biotechnology activities and to progress biosafety management in order to ensure protection of the environment and consumers within the context of a more sustainable agriculture. Drs Huang and Wang conclude that based on strong demand from both producers (higher productivity and profit) and consumers (more affordable prices), and the past success and increasing investments in agricultural biotechnology, "products from China's plant biotechnology are likely to become widespread in China in the near future."

It is also noteworthy that Pakistan, which has yet to deploy GM crops, has initiated collaboration with China in biotechnology as of August 2003, with particular focus on plant genomics. Pakistan has developed a national strategy in which improved crop yields have been assigned a high priority, with the Minister for Science and Technology declaring that "Pakistan can become a player in the global biotechnology market in the next three to five years". During the last three years Pakistan has invested $16.5 million in 50 biotechnology projects.

China and India, the two most populous countries in the world, with a combined population of 2.3 billion and 250 million hectares of crop land could provide the role models and stimulus for other developing countries in Asia, Latin America, and Africa to make their own investments in crop biotechnology. The incentive for countries like China and India, two countries with a strong tradition in trading, is not only to develop GM products to meet their own food, feed and fiber needs, but also to develop new markets for their GM crops in other developing countries of the South, where the majority of the 1.5 billion hectares of crop land is cultivated, and where the need for food, feed and fiber is greatest.

The World Food Program recently reported that in 2002 the number of people suffering from malnutrition increased by 25 million from 815 to 840 million globally. The most compelling case for biotechnology as applied to GM crops is its capability to:

- increase crop productivity and thus contribute to global food, feed and fiber security;
- conserve biodiversity, as a land-saving technology capable of higher productivity;
- efficiently use external inputs for a more sustainable agriculture and environment;
- increase stability of production to lessen suffering during famines due to abiotic and biotic stresses;
- and provide economic and social benefits for the alleviation of abject poverty in developing countries.

The experience of the first eight years, 1996 to 2003, during which a cumulative total of over 300 million hectares (approximately 750 million acres, equivalent to almost one-third of the total land area of the US or China) of GM crops were planted globally in 21 countries, has met the expectations of millions of large and small farmers in both industrial and developing countries. In 2003, coincidental with evidential confirmation that commercialized GM crops continue to deliver significant economic, environmental, and social benefits to both small and large farmers in developing and industrial countries, the global area of transgenic crops continued to grow at an annual sustained double-digit growth rate of more than 10%. The number of farmers that benefited from GM crops continued to grow, and reached 7 million in 2003, up from 6 million in 2002. Notably more than 85% of these 7 million farmers benefiting from GM crops in 2003, were resource-poor farmers planting Bt cotton, mainly in nine provinces in China and also in the Makhathini Flats in KwaZulu Natal province in South Africa.

In 2003 the global market value of GM crops is estimated to be $4.50 to $4.75 billion, having increased from $4.0 billion in 2002 when it represented 15% of the $31 billion global crop protection market and 13% of the $30 billion global commercial seed market. The market value of the global transgenic crop market is based on the sale price of transgenic seed plus any technology fees that apply. The global value of the GM crop market is projected at $5 billion or more for 2005.

Despite the on-going debate in the European Union, there is cause for cautious optimism that the global area and the number of farmers planting GM crops will continue to grow in 2004 and beyond. Taking all factors into account, the outlook for the next five years points to continued growth in the global hectarage of GM crops to approximately 100 million hectares, with up to 10 million farmers growing GM crops in 25, or more, countries. The global number and proportion of small farmers from developing countries growing GM crops is expected to increase significantly. Established GM country markets will continue to grow in GM area with a more diversified portfolio of GM crop products. New GM crop countries from the South, like India and Brazil, will increase their hectarage of Bt cotton and herbicide tolerant soybean respectively, and also approve new products like GM maize already deployed in other countries. New input trait products from industry will contribute to sustained growth. Those already commercially available in North America in 2003 include the dual Bt gene product (*cry1Ac* and *cry2Ab*) in cotton, and 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 GM maize area with insect resistance and herbicide tolerance traits, as well as the stacked traits, is likely to increase significantly in the near to mid-term. With the approval of GM soybean in Brazil for 2003/04, global GM soybean area is likely to experience renewed high growth rates in the near to mid-term.

In 2003, the three most populous countries in Asia – China, India, and Indonesia, (total population 2.5 billion and a combined GDP of over $1.5 trillion), the three major economies of Latin America – Argentina, Brazil and Mexico (population 300 million and a GDP of $1.5 trillion), and the largest economy on the continent of Africa, South Africa (population 45 million and GDP of $130 billion) are all officially growing GM crops for the benefit of their combined population of 2.85 billion with a total GDP of over $3 trillion. The top ten GM crop countries, each of which grew 50,000 hectares or more of GM crops in 2003, had a combined population of approximately 3 billion, close to half the world's population, with a combined GDP of $13 trillion, almost half of the global GDP of $30 trillion. In 2003, GM crops were grown in 18 countries with a combined population of 3.4 billion, living on six continents. Thus, despite the continuing controversy about GM crops, the hectarage and number of farmers growing GM crops have continued to grow every year since their introduction in 1996, with 7 million farmers benefiting from the technology in 2003. GM crops have been embraced by most of the principal economies of the continents of South America, North America, Asia and Oceania. The continent of Europe is also growing GM crops, with Romania and Bulgaria in Eastern Europe growing GM soybeans and maize respectively, and Spain within the European Union planting Bt maize.

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