



BIOTECH COUNTRY **FACTS & TRENDS**

Brazil

Brazil is the second largest grower of biotech crops in the world, next to the US, planting 44.2 million hectares of biotech crops in 2015.

In 2015, the total biotech crop hectares in Brazil comprised: 30.3 million hectares biotech soybean, 13.1 million hectares biotech maize, and 0.7 million hectares biotech cotton.

Of the 48.7 million hectares total area planted to soybean, maize, and cotton in Brazil in 2015, 91%, or 44.2 was biotech.

Biotech soybean was planted in 30.3 million hectares, up from 29.1



million hectares in 2013, equivalent to 4.5% growth, and 94.2% adoption rate.

Biotech maize remained the second important crop with a total of 13.1 million hectares for both summer

(4.5 million hectares) and winter (8.6 million hectares), an increase of 5% from 2014, and 84.6% adoption rate.

Biotech cotton was planted in 0.7 million hectares in 2015, an increase of 27% over 2014, and 73.3% adoption rate.

In 2011, Brazil approved a biotech bean that can resist golden bean mosaic virus. Variety registration trials have been completed and it is expected to be commercialized in 2016.

The economic benefit to Brazil from biotech crops for the nine-year period (2003-2014) is US\$13.9 billion and US\$2.5 billion for 2014 alone (Brookes and Barfoot, 2016).

COUNTRY PROFILE

Population: 207.8 million
GDP: US\$2,253 billion
GDP per Capita: US\$11,340
Agriculture as % GDP: 5%
Agricultural GDP: US\$112.6 billion
% employed in agriculture: 15.3%
Arable Land (AL): 72.3 million hectares
Ratio of AL/Population*: 1.6

Major crops:

- Sugarcane
- Soybean
- Maize
- Cassava
- Oranges

Commercialized Biotech Crops:

- HT & IR/HT Soybean
- HT; IR & IR/HT Cotton
- HT; IR & IR/HT Maize

Total biotech crop area and (%) increase in 2015:
44.2 Million Hectares (+5%)

Increased farm income, 1997-2014: US\$13.9 billion

*Ratio: % global arable land / % global population

BIOTECH CROP ADOPTION

Biotech soybean occupied 94.2% of the 32.2 million hectares total soybean hectareage in Brazil in 2015. The 30.3 million hectares biotech soybean comprised: 18.5 million hectares herbicide tolerant and 11.9 million hectares stacked IR/HT.

The 13.1 million hectares biotech maize in Brazil in 2015 is comprised of 3.3 million hectares IR, 0.94 million hectares HT, and 8.9 million hectares IR/HT. Biotech maize adoption in summer is 77%, or 4.5 million hectares, and 89% in winter, or 8.6 million hectares.

Of the 0.7 million hectares of biotech cotton planted in Brazil in 2015, 17% is IR, 23% is HT, and 33% is IR/HT, with a total of 73% adoption.

FUTURE PROSPECTS

National and multinational companies and public sector research institutions in Brazil are developing various biotech crops, including sugarcane, potatoes, papaya, rice, and citrus.

The Brazilian Agricultural Research Corporation (EMBRAPA) is developing new GM products, including drought resistant soybean and sugarcane, folate-fortified lettuce, soybean as biofactory of HIV antibody, and a virus-resistant bean expected to be commercially launched in 2016. The herbicide (imidazolinone) tolerant soybean "Cultivance™" is expected to be commercialized in 2016.

Brazil's home-grown virus-resistant bean, approved for planting in 2011, has completed variety registration trials and will be commercialized in 2016. In 2011, the transgenic bean event Embrapa 5.1, with resistance to bean golden mosaic virus was approved for commercial release in Brazil.

FuturaGene Brasil Technology Ltd., developed a fast growing GM eucalyptus with 20% higher productivity (between 30-40% percent) for use in other applications,



including bioenergy. Despite environmentalist opposition and vandalism attacks on their experimental greenhouses in Sao Paulo, this GM Eucalyptus was approved for commercial release by the CTNBio in April 2015, but specific plans for commercialization have not been outlined at this time.

BENEFITS FROM BIOTECH CROPS IN BRAZIL

Agricultural biotechnology was first adopted in Brazil 20 years ago. Céleres® has studied and analyzed the economic benefits resulting from the use of this technology for the last seven years. Based on field studies, it is estimated that since the introduction of agricultural biotechnology in Brazil in the 1996/97 to the 2012/13 crop period, the economic benefits to users of this technology have reached US\$24.8 billion and US\$6.3 billion for 2013 alone.

Another annual global study of benefits from biotech crops covering a different period (2003 to 2014) concluded that Brazil gained US\$13.9 billion in 2003 to 2014, and US\$2.5 billion for 2014 alone (Brookes and Barfoot, 2016).

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York.

Food and Agriculture Organization of the United Nations.
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BIOTECH COUNTRY FACTS & TRENDS

Argentina

Argentina maintained its ranking as the third largest producer of biotech crops in the world in 2015, occupying 14% of global biotech crop hectareage.

A total of 24.5 million hectares of biotech crops were planted in Argentina in 2015. Of this, 21.1 million hectares were biotech soybean, 2.9 million hectares were biotech maize, and 0.5 million hectares were biotech cotton.

The 21.1 million hectares of biotech soybean in Argentina in 2015 comprised of 20.4 million hectares HT and 700,000 hectares stacked Bt/HT.



Of the 2.9 million hectares biotech maize in Argentina in 2015, ~69% or 2.0 million hectares were stacked Bt/HT.

A total of 530,000 hectares was planted to biotech cotton in 2015, a 100% adoption. It is composed of 488,000 hectares Bt/HT, and 42,000 hectares HT cotton.

Argentina's benefits from biotech crops from 1996 to 2014 is estimated at US\$19.3 billion, and the benefits for 2014 alone is estimated at US\$1.7 billion.

BIOTECH CROP ADOPTION

In October 6, 2015, Secretary of Agriculture, Livestock and Fisheries Gabriel Delgado approved the conditional marketing in Argentina of drought tolerant soybean (IND-00410-5 event) developed by the Institute of Agricultural Biotechnology of Rosario.

Drought tolerant soybean, which has the potential to increase yields by 14%, was developed by Universidad Nacional del Litoral led by Dr. Rachel Chan who identified and used sunflower gene *hahba-4* which has related natural plant

COUNTRY PROFILE

Population: 43.4 million
GDP: US\$476 billion
GDP per Capita: US\$11,570
Agriculture as % GDP: 9%
Agricultural GDP: US\$42.84 billion
% employed in agriculture: 1%
Arable Land (AL): 38 million hectares
Ratio of AL/Population*: 4

Major crops:

- Soybean
- Maize
- Sugarcane
- Wheat
- Sunflower seed

Commercialized Biotech Crops:

- HT Soybean
- Bt/HT Cotton
- Bt/HT/Bt-HT Maize

Total biotech crop area and (%) increase in 2015:
24.5 Million Hectares (+1%)

Increased farm income, 1996-2014: US\$19.3 billion

*Ratio: % global arable land / % global population



response to abiotic stresses such as drought and salinity.

Insect resistant maize was introduced in Argentina in 1998, and herbicide tolerant maize in 2004. Stacked trait (Bt/HT) varieties became available in 2007, and by 2015, 69% of biotech maize hectareage is planted to stacked varieties.

Argentine scientists have developed potato plants resistant to Potato Virus Y (PVY). For six years, researchers tested 2,000 plants from two different lines in the provinces of Córdoba, Mendoza, and Buenos Aires. Results showed that the genetically modified potatoes were not infected, while the infection rate was 60 to 80 percent in non-GM potatoes.

There are 41 biotech crops approved for commercial planting in Argentina from 1996 to 2015: 29 maize events, 8 soybean events, 3 cotton events, and 1 potato event.

In 2015, 3 soybean events and 1 potato event were approved in Argentina. These events are:

- Soybean DAS-44406-6,
- Soybean IND-00410-5,
- Soybean DP-305423-1 x MON-04032-6, and
- Potato TIC-AR233-5

FUTURE PROSPECTS

National and multinational companies and public sector research institutions in Brazil are developing various biotech crops, including sugarcane, potatoes, papaya, rice, and citrus.

Researchers at INTA in collaboration with a team from University of California Davis, are developing drought resistant wheat. The team used a cytokinin synthesis gene under a water stress inducible promoter to confer drought resistance in wheat. Regenerated plants remain green and do not enter into senescence during drought stress.

Also in the pipeline is a glyphosate tolerant sugarcane being developed at the Obispo Colombres Agricultural Station.

BENEFITS FROM BIOTECH CROPS IN ARGENTINA

Recent data on the benefits from biotech crops estimates that Argentina has enhanced farm income from biotech crops by US\$19.3 billion in the first 19 years of commercialization of biotech crops 1996 to 2014, and the benefits for 2014 alone were estimated at ~US\$1.7 billion (Brookes and Barfoot, 2016).

A comprehensive study on the benefits of biotech crops in Argentina for the 15 years of its commercialization (1996-2010) was conducted by Trigo (2011). The study indicated that gross benefit generated by this adoption process for the period 1996-2010 reached US\$72,363 million.

In a study by Massarani et al. (2013) on perception of small farmers in Argentina about genetically modified crops, results showed that local small farmers are satisfied with the new technology, but also have fears concerning the environment and social impacts. Majority of the farmers said that GM plants are more profitable and

require less work. The generally favorable attitude goes hand-in-hand with other concerns, such as human consumption of genetically modified food or the use of GM technology for research purposes in medicine which are acceptable provided control procedures and access to clear information are improved. In addition, participants agreed that they should be heard in the decision-making process for agricultural questions, but also recognized the difficulties in achieving this objective.

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BIOTECH COUNTRY **FACTS & TRENDS**

India

For the first time in history, India became the top cotton producing country in the world in 2015, planting more than China and the USA.

In 2015, India displaced China to become the world's top cotton producing country, planting 11.6 million hectares of Bt cotton. The US Department of Agriculture and the International Cotton Advisory Committee estimate that India produces more cotton than China in 2015 for the first time in history.

A total of 7.7 million farmers in India planted 11.6 million hectares Bt cotton in 2015, which is 95% of the total 12.2 million hectares of cotton in the country.



India produced 6.51 million tonnes of cotton fiber in 2015, compared to 6.48 million tonnes planted by China.

Commercialization of Bt cotton increased 230-fold at 11.6 million hectares in 2015 from only 50,000 hectares in 2002.

India doubled its market share of global cotton production from 12% in 2002 to 27% in 2015, representing a quarter of the total global cotton production.

India was estimated to have enhanced farm income from Bt cotton by US\$18.3 billion in the 13-year period 2002 to 2014, and US\$1.6 billion in 2014 alone.

COUNTRY PROFILE

Population: 1,311 million

GDP: US\$1,859 billion

GDP per Capita: US\$1,500

Agriculture as % GDP: 18%

Agricultural GDP: US\$334.6 billion

% employed in agriculture: 47%

Arable Land (AL): 174 million hectares

Ratio of AL/Population*: 0.6

Major crops:

- Sugarcane
- Wheat
- Potato
- Rice, paddy
- Vegetables, fresh
- Cotton

Commercialized Biotech Crop: Bt Cotton

Total biotech crop area and (%) increase in 2015:

11.6 Million Hectares (0%)

Increased farm income, 2002-2014: US\$18.3 billion

BIOTECH CROP APPROVAL

Bt technology accelerated the adoption of cotton hybrids in India, from 45% in 2002 to 95% in 2015. By 2015, a total of 1,167 Bt cotton hybrids have been released for commercial cultivation across 10 growing states in India, compared to only three hybrids in 2002.

*Ratio: % global arable land / % global population

In 2014-2015, the GEAC resumed regular meetings, and approved the field trials of GM mustard, chickpea, rice, cotton, maize, sugarcane, and Bt brinjal.

FUTURE PROSPECTS

After the moratorium on Bt brinjal was imposed on February 9, 2010, regulatory approval for field trials and commercial cultivation of biotech crops developed by both public and private sector institutions in India became restrained and sluggish.

In mid-2014, the new Government led by Prime Minister Mr. Narendra Modi revisited the functioning of regulatory committees, including the Genetic Engineering Appraisal Committee (GEAC), which resumed meeting regularly and approved the field trials of GM mustard, chickpea, rice, cotton, maize, sugarcane and brinjal in meetings held in August and September 2014 and in February and September 2015.

Three important biotech crops are in the final stages of regulatory review for commercialization in 2015: biotech mustard, stacked trait biotech cotton, and Bt brinjal.

The biosafety dossiers of BGII-RRF[®] cotton developed by Mahyco and biotech mustard developed by Delhi University have been submitted to GEAC for commercial approval. GEAC has circulated the biosafety dossiers for comments from the experts and is expected to discuss the commercial approval of BGII-RRF[®] cotton and biotech mustard in the near future. Meanwhile, there has been an indication to revisit the moratorium on Bt brinjal due to increasing farmer demand.

BENEFITS FROM BIOTECH CROPS IN INDIA

A cumulative ~61 million small-holder cotton farmers planted Bt cotton in the 14-year period showing high repeat decision of planting Bt cotton.

Notably, the increase from 50,000 hectares of Bt cotton in 2002 to 11.6 million hectares in 2015, represents an unprecedented 230-fold increase in thirteen years. Estimates by Brookes and Barfoot (2016, Forthcoming) indicate that India enhanced farm income from Bt cotton by US\$18.3 billion in the thirteen-year period 2002 to 2014 and US\$1.6 billion in 2014 alone.

Fourteen peer-reviewed research studies have been conducted over the years, three studies were conducted prior to the commercialization of Bt cotton from 1998 to 2001, whereas eleven studies were carried out to assess ex-ante impact of Bt cotton, which were reported during the post commercialization of Bt cotton from 2002 to 2013. The results of these studies on Bt cotton were consistent with the study undertaken by Gandhi and Namboodiri in 2006 showing yield gains of approximately 31%, a significant 39% reduction in the number of insecticide sprays, leading to an 88% increase in profitability, equivalent to a substantial increase of approximately US\$250 per hectare (Gandhi and Namboodiri, 2006).



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BIOTECH COUNTRY **FACTS & TRENDS**

China

In 2015, China planted 3.7 million hectares of biotech crops: 3.7 million hectares of biotech cotton, 7,000 hectares of virus resistant papaya, and 543 hectares of Bt poplar.

Bt cotton was planted by an estimated 6.6 million small, resource-poor farmers in China in 2015.

The total biotech cotton plantings in China in 2015 were estimated at ~3.7 million hectares, which is 96% of its 3.8 million hectares total national cotton area.

The adoption rate of Bt cotton in China was estimated at 96% in 2015, compared to 93% in 2014.



Virus-resistant biotech papaya plantings decreased from 8,475 hectares in 2014 to 7,000 hectares in 2015 due to over supply of papaya in 2014, but the adoption rate remained high at ~90%.

Guangdong is the main province for papaya production in China.

Hainan Island planted in 2012, and Guangxi province in 2014.

Bt poplar has been planted in China since 2003. By 2015, 543 hectares of poplar have been planted.

The economic benefit to China from biotech cotton for the period 1997 to 2014 is US\$17.5 billion and US\$1.3 billion for 2014 alone.

COUNTRY PROFILE

Population: 1,376 million

GDP: US\$8,227 billion

GDP per Capita: US\$6,900

Agriculture as % GDP: 10%

Agricultural GDP: US\$822.7 billion

% employed in agriculture: 35%

Arable Land (AL): 114.7 million hectares

Ratio of AL/Population*: 0.4

Major crops:

- Rice, paddy
- Sweet potato
- Vegetables, fresh
- Sugarcane
- Maize
- Cotton

Commercialized Biotech Crops:

- Bt Cotton
- Bt Poplar
- PRSV Papaya

Total biotech crop area and (%) increase in 2015:

3.7 Million Hectares (-5%)

Increased farm income, 1997-2014: US\$17.5 billion

*Ratio: % global arable land / % global population

BIOTECH CROP APPROVAL

China has planted Bt cotton since 1997, as well as small hectares of GM papaya and poplar. Biosafety certificates for Bt rice and phytase maize were issued in 2009, which were renewed in late 2014. In 2015, Bt cotton plantings decreased to 3.7 million hectares, compared to 3.9

million hectares in 2014. However, adoption rates increased to 96% in 2015, compared to 93% in 2014. The decrease in cotton plantings was due to high reserve stocks and global low cotton prices in 2015.

Since 1994, China has approved 60 biotech crop events for food and feed use and cultivation, including Argentine canola (12 events), cotton (10), maize (17), papaya (1), petunia (1), poplar (2), rice (2), soybean (10), sugar beet (1), sweet pepper (1) and tomato (3).

FUTURE PROSPECTS

Origin Biotechnology, a subsidiary of Origin Agritech Ltd., has reached a comprehensive, worldwide agreement with the Institute of Plant Protection, Chinese Academy of Agricultural Sciences (CAAS) for the exclusive rights of the Bt gene developed by CAAS. Origin Biotechnology has the rights to this genetic trait in China, and has been passing this product through the Ministry of Agriculture regulatory trials.

Scientists at Hainan University and Hunan Provincial Academy of



Agricultural Sciences are developing a high yielding salt tolerant rice variety. The initial results showed that the biotech rice could produce 6 tonnes per hectare. The harvest in October 2013 also showed one variety has similar output as those varieties grown in normal farmlands.

China's homegrown biotech maize (Bt or phytase maize) will be commercialized in the next three years, opening up an enormous potential market of 35 million hectares of maize. Biotech crops could help China become less dependent on increasing imports of soybean and maize, over 90% of which are biotech.

BENEFITS FROM BIOTECH CROPS IN CHINA

A study led by KM Wu in 2008 suggested that the potential number of small farmers actually benefiting indirectly from Bt cotton in China might be 10 million more, which was confirmed by a separate study led by WD Hutchinson in 2010. The research estimated that the 10 million beneficiary farmers are those cultivating 22 million hectares of crops other than cotton, which also host cotton bollworm, but where infestations have decreased to up to 10-fold, because of lower infestations in Bt cotton.

The most promising benefit that the farmers derived from Bt cotton adoption is the reduction of pesticide use, which was evident in all of the four provinces. In Hebei, where the adoption rate for Bt cotton is at 100%, the farmers now spray pesticide only 4 times compared to more than 25 times before adopting Bt cotton. Majority of farmers also reported that planting Bt cotton enabled them to use less labor input, but higher yield with good cotton quality. This reduced their farming cost compared to the conventional cotton.

Based on studies conducted by the Center for Chinese Agricultural

Policy (CCAP), it was concluded that at the farm level, Bt cotton increases yield by 10%, reduces insecticide use by 60%, and generates a substantial US\$220 per hectare increase in income which makes a significant contribution to their livelihood as the income of many cotton farmers can be as low as around US\$1 per day (Jikun Huang, 2008, Personal Communication). At the national level, it is estimated that increased income from Bt cotton was approximately US\$1 billion per year in 2011.

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BIOTECH COUNTRY **FACTS & TRENDS**

Paraguay

Paraguay, the world's fifth largest exporter of soybean, has successfully grown biotech soybean for 11 years since 2004.

In 2015, Paraguay planted 3.6 million hectares of biotech soybean, maize, and cotton.

Of the 3.6 million hectares of biotech crops planted in Paraguay in 2015, 3.3 million hectares were biotech soybean, 305,000 hectares were biotech maize, and 12,000 hectares were biotech cotton.

Of the total national soybean hectarage of 3.4 million hectares in Paraguay in 2015, 3.3 million hectares were biotech, including up to 98,000 of stacked Bt/HT product.

Economic gains over the period 2004 to 2014 were estimated at US\$1.1 billion and the benefits for 2014 alone at US\$131 million.

BIOTECH CROP APPROVALS AND ADOPTION

In 2015, Paraguay approved 20 biotech events with insect resistance, herbicide tolerance, and stacked traits: soybean (3), maize (14), and cotton (3).

Six biotech maize events were officially approved in 2015. These are: GA21; GA21 x Bt11; Bt11 x GA21 x MIR162; TC1507 x MON810; TC1507 x MON810 x NK603; and MIR162 x GA21.

In 2015, Paraguay planted a total of 305,000 hectares of biotech maize comprised of 53,000 hectares Bt;

8,000 hectares HT, and 244,000 hectares Bt/HT maize.

Intacta, a new stacked HT/IT soybean approved in 2013, was grown on 98,000 hectares in 2015.

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COUNTRY PROFILE

Population: 6.6 million
GDP: US\$25.5 billion
GDP per Capita: US\$6,040
Agriculture as % GDP: 22%
Agricultural GDP: US\$5.6 billion
% employed in agriculture: 23.5%
Arable Land (AL): 4.4 million hectares
Ratio of AL/Population*: 3.0

Major crops:
• Cassava • Soybean • Sugarcane
• Maize • Wheat
Commercialized Biotech Crops:
• HT Soybean • HT Cotton • Bt/HT Maize
Total biotech crop area and (%) increase in 2015:
3.6 Million Hectares (-8%)
Increased farm income, 2004-2014: US\$1.1 billion

*Ratio: % global arable land / % global population

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BIOTECH COUNTRY **FACTS & TRENDS**

Pakistan

In 2015, the adoption of insect resistant Bt cotton varieties in Pakistan increased to 93%.

In 2015, Pakistan achieved a 93% adoption rate of Bt cotton, or 2.9 million hectares of the national total area planted to cotton which is 3.2 million hectares.

The Seed Amendment Act was enacted in Pakistan in 2015 to strengthen the legislation of its seed sector. This Act amends the Seed Act of 1976 (XXIX of 1976), which aims to fulfill the requirements of modern seed industries, and boost the development, certification, registration, and commercialization



of improved open pollinated varieties and hybrid seeds in Pakistan.

Around 750,000 small, resource-poor farmers in Pakistan planted and benefited from Bt cotton in 2015.

It is estimated that the economic gains from Bt cotton in Pakistan for 2010 to 2014 was US\$1.9 billion, and US\$299 million for 2014 alone.

BIOTECH CROP ADOPTION

Around 30 open pollinated and 2 hybrid Bt cotton varieties were approved for planting in 4 cotton growing provinces of Pakistan from 2010 to 2014.

In 2015, the Technical Advisory Committee (TAC) recommended the release of 21 Bt cotton varieties to the National Biosafety Committee (NBC) of the Ministry of Climate Change, the administrative agency of the biosafety regulation in Pakistan. However, the statutory authority of NBC was challenged

COUNTRY PROFILE

Population: 188.9 million

GDP: US\$225 billion

GDP per Capita: US\$1,260

Agriculture as % GDP: 24%

Agricultural GDP: US\$54.0 billion

% employed in agriculture: 44%

Arable Land (AL): 21.6 million hectares

Ratio of AL/Population*: 0.4

Major crops:

- Cotton
- Wheat
- Sugarcane
- Rice
- Maize

Commercialized Biotech Crop: Bt Cotton

Total biotech crop area and (%) increase in 2015:

2.9 Million Hectares (0%)

Increased farm income, 2010-2014: US\$1.9 billion

*Ratio: % global arable land / % global population

in the Lahore High Court in the wake of the 18th Amendment of the Constitution and therefore has not approved new Bt cotton varieties in 2015.

These 21 new Bt cotton varieties are likely to be approved later to provide farmers with a choice of high yielding Bt cotton varieties with tolerance to cotton leaf curl virus (CLCV) and other sucking pests.

BENEFITS FROM BT COTTON IN PAKISTAN

The results of a 2012 study conducted by Hina Nazli and colleagues indicate a positive impact of Bt cotton on the wellbeing of farmers in Pakistan.

Also in 2012, Kouser and Qaim on their research study “Valuing a financial, health and environmental benefits of Bt cotton in Pakistan”, concluded that Bt cotton adoption results in significantly lower chemical pesticide use, higher yields, and higher gross margins, which is consistent with the results from other countries.

The study noted that the lower pesticide use brings about significant health advantages in terms of reduced incidence of acute pesticide poisoning, and environmental advantages in terms of higher farmland biodiversity and lower soil and groundwater contamination.

The authors noted that “These positive externalities are valued at US\$79 per acre (US\$195/hectare), which adds another 39% to the benefits in terms of higher gross margins. Adding up financial and external benefits results in total benefits of US\$284 per acre (US\$701/hectare), or US\$1.7 billion for the entire Bt cotton area in Pakistan.”

Nasir et al. (2015) published the study “Estimation of Cost Benefit Ratio of Bt Cotton Growers in District Khanewal-Pakistan in 2015”, which reveals that large farmers of Khanewal district

earned more net revenue and gross margin compared with medium and small farmers of Khanewal district because more inputs induced profitability.

Also in 2015, Noonari et al. published the research study “Comparative Economics Analysis of Bt Cotton v/s Conventional Cotton Production in Khairpur District, Sindh, Pakistan, which demonstrates that higher profit was observed in cultivating Bt cotton than conventional cotton.

FUTURE PROSPECTS

In recent years, Pakistan built more biotech institutions to conduct further research. The crops under genetic transformation by different public sector institutions are: wheat, rice, sugarcane, cotton, soybean, chickpea, groundnut, brassica, potato, tomato and chili.

It is estimated that with the expected release of stacked traits of biotech cotton before 2015, Pakistan could gain significant benefits of approximately US\$800 million per year to its farm economy, at 90% adoption of biotech cotton. Increased adoption of biotech cotton would substantially reduce insecticide sprays, less exposure of farmers and farm laborers to insecticides, higher quality of cotton and higher return to cotton farmers, and overall gains to the farm economy at national level.

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BIOTECH COUNTRY **FACTS & TRENDS**

South Africa

South Africa planted 2.3 million hectares of biotech crops in 2015.

In recent years, African spring rains came late, decreasing maize crop production in South Africa. The projected El Niño in 2015 was even more severe and lasted longer, decreasing the intended hectareage of all biotech crops in South Africa by 25%, or ~700,000 hectares. The devastating drought in 2015 decreased biotech crop hectareage from an intended record of 3.0 million hectares to 2.3 million hectares.

The total biotech crop area in South Africa in 2015 was 2.3 million hectares, down from 2.7 million hectares in 2014, a 15% decrease.



Biotech maize area in South Africa for 2015 is estimated at 1.8 million hectares at an adoption level of 90% of the 2 million total maize hectares. This hectareage is broken down into 550,000 hectares insect tolerant; 284,000 hectares herbicide

tolerant; and 940,000 hectares of stacked Bt/HT.

Herbicide tolerant soybean is projected at 508,000 hectares, to be planted in 95% of 535,000 hectares in 2015 — down 8% from 552,000 hectares biotech in 2014, and down by ~160,000 hectares (24% decrease) from an intended 670,000 hectares in 2015.

In 2015, 12,000 hectares were planted with insect resistant biotech cotton, a 100% adoption rate.

BIOTECH CROP ADOPTION

South Africa planted insect resistant cotton, its first biotech crop, in

COUNTRY PROFILE

Population: 54.5 million

GDP: US\$384 billion

GDP per Capita: US\$7,350

Agriculture as % GDP: 3%

Agricultural GDP: US\$11.5 billion

% employed in agriculture: 5%

Arable Land (AL): 12.1 million hectares

Ratio of AL/Population*: 1.4

Major crops:

- Sugarcane
- Maize
- Wheat
- Grapes
- Potato

Commercialized Biotech Crops:

- HT/Bt/HT-Bt Cotton
- HT/Bt/HT-Bt Maize
- Ht Soybean

Total biotech crop area and (%) increase in 2015:
2.3 Million Hectares (-15%)

Increased farm income, 1998-2014: US\$1.8 billion

*Ratio: % global arable land / % global population

1998. Insect resistant maize was planted in 2000, herbicide tolerant soybean in 2001, and herbicide tolerant maize in 2003.

In 2015, 67 biotech events have been approved for food, feed and cultivation, including 4 Argentine canola events, 10 cotton events, 40 maize events, and 12 soybean events.

FUTURE PROSPECTS

The first biosafety guidelines in South Africa was developed by a small group of scientists in 1978. The GMO Act was approved in 1997, and entered into force in 1999 when GMO regulations were approved. Applications for permits are assessed by the national scientific Advisory Committee and their subcommittees, with recommendations forwarded to the national government's GMO Executive Council.

South African scientists interact and collaborate with international biotech counterparts, and conduct research on genomics and all other 'omics. The first sequencing of an organism in Africa was done by local scientists on the livestock

heart water parasite, as was the first animal cloning of a goat.

Some new local innovations in biotech are: a patent on RNA hairpin duplexes for resistance to plant viruses, exploring valuable proteins in cassava leaves and modifying cassava to resist viruses, developing tobacco plants as biopharma factories for antibodies, a new anti-malaria drug, and marker genes for improved detection of new gene mutations that cause cystic fibrosis.

Awaiting regulatory approvals are: novel promoters, drought tolerance genes, maize streak virus resistance, and a range of experimental GM sugarcane events.

BENEFITS FROM BIOTECH CROPS IN SOUTH AFRICA

It is estimated that the economic gains from biotech crops for South Africa for the period 1998 to 2014 was US\$1.8 billion and US\$245 million for 2014 alone (Brookes and Barfoot, 2016).



SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/>
The World Bank. <http://www.worldbank.org/>

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BIOTECH COUNTRY **FACTS & TRENDS**

Uruguay

HT soybean occupies 100% of Uruguay's national soybean hectareage.

In 2015, Uruguay had reduced planting of biotech soybean and maize at ~1.4 million hectares, a 12% decrease from 1.64 million hectares in 2014. Consistent with other countries, the decrease in total plantings of the two crops was probably due to low prices, along with other factors.

Biotech soybean occupies 100% of the national soybean hectareage of ~1.33 million hectares.

Biotech maize occupied 88,000 hectares in 2015, compared with 90,000 hectares in 2014. Of the

88,000 hectares of biotech maize, 97% was the stacked Bt/HT product.

ADOPTION OF BIOTECH CROPS

Uruguay introduced biotech soybean in 1996, followed by Bt maize in 2003. The country approved five events on the same day in early 2011. In September 2012, Uruguay approved 3 stacked insect resistant (IR) and herbicide tolerant (HT) biotech corn, 2 HT soybean and 1 stacked IR/HT soybean for commercialization.

In 2014, herbicide tolerant soybean CV127, insect tolerant corn MIR 162 and stacked Bt/HT MON 89034 × TC1507 × NK603 were approved for planting, for a total of 17 event approvals from 1996 to 2014.

BENEFITS OF BIOTECH CROPS IN URUGUAY

Uruguay is estimated to have enhanced farm income from biotech soybean and maize of US\$179 million in the period 2000 to 2014 and the benefits for 2014 alone is estimated at US\$30 million.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York.
Food and Agriculture Organization of the United Nations.
<http://www.fao.org/countryprofiles/>
The World Bank.
<http://www.worldbank.org/>

COUNTRY PROFILE

Population: 3.4 million
GDP: US\$49.9 billion
GDP per Capita: US\$15,780
Agriculture as % GDP: 10%
Agricultural GDP: ~US\$5 billion
% employed in agriculture: 10%
Arable Land (AL): 1.8 million hectares
Ratio of AL/Population*: 2.2

Major crops:

- Rice
- Maize
- Soybean
- Wheat
- Barley
- Sugarcane

Commercialized Biotech Crops:

- HT Soybean
- Bt Maize

Total biotech crop area and (%) increase in 2015:
1.4 Million Hectares (-12%)

Increased farm income, 2000-2014: US\$179 million

*Ratio: % global arable land / % global population

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BIOTECH COUNTRY **FACTS & TRENDS**

Bolivia

Bolivia grew ~1.1 million hectares biotech soybean in 2015.

There are approximately 2 million hectares of cropland in Bolivia, and soybean is a major crop in the eastern region occupying 1.28 million hectares.

Biotech RR[®]soybean was grown on ~1.1 million hectares in 2015 in Bolivia, a slight increase from the 2014 hectares of ~1 million hectares.

The adoption rate of RR[®]soybean in 2015 was ~80% of the total 1.3 million hectares.

Soybean from Bolivia is exported to Chile, Colombia, Ecuador, Peru, and Venezuela. The total soybean export in 2014 was 1.5 MMT at

US\$1.1 billion and an estimated 1.7 MMT in CY2015.

ADOPTION OF BIOTECH CROPS

According to the 2015 FAO estimates, Bolivia ranks eighth in global soybean production with 1.2 million hectares, after the USA (31 million hectares), Brazil (28), Argentina (19), India (12), China (6.6), Paraguay (3), and Canada (1.8).

In 2008, Bolivia became the tenth country to officially grow RR[®]soybean of 600,000 hectares.

BENEFITS OF BIOTECH SOYBEAN IN BOLIVIA

The growth rate of biotech soybean plantings in Bolivia from 2008 to 2015 has significantly doubled.

It estimated that economic gains from biotech crops for Bolivia for the period 2008 to 2014 was US\$636 million and US\$107 million for 2014 alone.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/> The World Bank. <http://www.worldbank.org/>

COUNTRY PROFILE

Population: 11 million

GDP: US\$59.2 billion

GDP per Capita: US\$5,364

Agriculture as % GDP: 10%

Agricultural GDP: ~US\$2.4 billion

% employed in agriculture: 32%

Arable Land (AL): 4.3 million hectares

Ratio of AL/Population*: 2.0

Major crops:

- Soybean • Maize • Coffee • Cocoa
- Sugarcane • Cotton • Potato

Commercialized Biotech Crop: HT Soybean

Total biotech crop area and (%) increase in 2015:
1.1 Million Hectares (+10%)

Increased farm income, 2008-2014: US\$636 million

*Ratio: % global arable land / % global population

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BIOTECH COUNTRY FACTS & TRENDS

Philippines

350,000 small, resource-poor farmers in the Philippines planted 702,000 hectares of biotech maize in 2015.

In 2015, the area planted to biotech maize in the Philippines decreased to 702,000 hectares from 831,000 hectares in 2014 due to drought conditions in the maize-growing areas of the country.

The adoption rate of biotech maize in 2015 is similar to 2014 at 63%.

The area occupied in 2015 by the stacked traits Bt/HT maize is 646,600 hectares or 92% of the total area planted for biotech maize; and with only 8% for herbicide tolerant maize at 55,000 hectares.



The number of small resource-poor farmers, growing on average 2 hectares of biotech maize in the Philippines in 2015 was estimated at 350,000.

In December 2015, the Supreme Court of the Philippines ruled that

Bt eggplant, already successfully grown in Bangladesh for two years, was not approved for the Philippines.

Farm level economic gains from biotech maize in the Philippines in the period 2003 to 2014 is estimated at US\$560 million and for 2014 alone at US\$89 million (Brookes and Barfoot, 2016).

BIOTECH CROP ADOPTION

The total hectareage planted to the single trait Bt maize decreased by 76% in 2012, with no single trait Bt maize being planted since 2013.

Single trait herbicide tolerant (HT) maize was planted on 70,000

COUNTRY PROFILE

Population: 100.7 million
GDP: US\$250 billion
GDP per Capita: US\$2,590
Agriculture as % GDP: 12%
Agricultural GDP: US\$30 billion
% employed in agriculture: 32%
Arable Land (AL): 5.4 million hectares
Ratio of AL/Population*: 0.2

Major crops:

- Sugarcane
- Coconut
- Rice
- Maize
- Banana
- Cassava
- Pineapple
- Mango

Commercialized Biotech Crop: Bt/HT/Bt-HT Maize

Total biotech crop area and (%) increase in 2015:
0.702 Million Hectares (-12%)

Increased farm income, 2003-2014: US\$560 million

*Ratio: % global arable land / % global population

hectares in 2014, which is only 8.4%, of the total biotech maize planted in the country, and this was further reduced to 8% or 55,000 hectares in 2015.

On a percentage basis, biotech yellow maize has consistently increased by about 5% of the total yellow maize hectareage every single year from the first year of commercialization in 2003, reaching the highest level of 63% in 2014 (up from 62% in 2013).

A total of 13 biotech maize events have been approved for commercial planting in the Philippines since 2002: 3 single Bt, 4 single HT, 2-two Bt genes stacked, and 4 Bt/HT stacked trait.

In addition, a total of 75 biotech crops and products are currently approved for direct use as food, feed and for processing in the Philippines that include alfalfa, canola, cotton, maize, potato, rice, soybean, and sugar beet.

FUTURE PROSPECTS

New biotech crop products are being developed by national and international institutions in the Philippines.

Golden Rice (GR), is a biofortified rice being developed by the Philippine Rice Research Institute (PhilRice) and the International Rice Research Institute (IRRI). IRRI has reported that as of March 2014, the research, analysis, and testing of beta-carotene-enriched GR continues, in collaboration with national research agencies in the Philippines, Indonesia, and Bangladesh.

In March 2015, the anticipated global impact of the Golden Rice project in alleviating malnutrition was acknowledged when it was granted by the United States Patent and Trademark Office (USPTO) the prestigious 2015 Patents for Humanity Award on nutrition (IRRI, 20 April 2015). The award recognized the vision of Golden Rice (GR) co-inventors Ingo Potrykus and Peter Beyer, and the GR Humanitarian Board Secretary



Adrian Dubock for their royalty free access patent application for the Project, enabling small holder farmers to benefit from Golden Rice. This royalty free access has enabled IRRI and partner public institutions to continue research and development of Golden Rice on a not-for-profit basis.

The fruit and shoot borer resistant Bt eggplant project led by the Institute of Plant Breeding of the University of the Philippines at Los Baños (IPB-UPLB), was also a royalty-free technology donated by the Maharashtra Hybrid Seed Company (Mahyco) through a sublicense agreement. The proponents already completed field trials of promising hybrid varieties in the approved multi-location trial sites in Luzon and Mindanao in 2012.

Biotech papaya with delayed ripening and papaya ring spot virus (PRSV) resistance, by IPB-UPLB, has already been tested in confined field trials in 2012.

Bt cotton is being developed by the Philippine Fiber Development Administration (PFIDA, formerly the Cotton Development Authority). The technology, provided by Nath Biogene Ltd. and the Global Transgene Ltd. from India was tested for the first time in a confined

field trial in 2010, started multi location field trials in 2012, and in 2013, data to complete regulatory dossiers are being collected in 2015 for commercialization purposes.

BENEFITS FROM BIOTECH CROPS IN THE PHILIPPINES

The benefits of biotech maize to Filipino farmers' livelihood, income, the environment and health have been well studied and documented. Farms planted with Bt maize in the Northern Philippine provinces have significantly higher populations of beneficial insects such as flower bugs, beetles, and spiders than those planted with conventional hybrid maize (Javier et al. 2004).

The farm level economic benefit of planting biotech maize in the Philippines in the period 2003 to 2014 is estimated to have reached US\$560 million. For 2014 alone, the net national impact of biotech maize on farm income was estimated at US\$89 million (Brookes and Barfoot, 2016).

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/>
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BIOTECH COUNTRY **FACTS & TRENDS**

Burkina Faso

2015 was the eighth year for farmers in Burkina Faso to benefit significantly from Bt cotton (Bollgard II™).

The total Bt cotton planted in Burkina Faso in 2015 was 350,000 hectares, or 50% of the total cotton planting area in the country. This represents a 23.8% drop in adoption from the 73.8% in 2014. The anxiety created by two coups in a span of one year and subsequent government transitions may have contributed to a downside on the agricultural sector in general.

Based on average cotton holding of 3.16 hectares, the number of farmers growing Bt cotton in 2015 was approximately 110,760.

Burkina Faso has maintained a leadership role on biotechnology

and biosafety matters in the Western African region. Aside from sustained Bt cotton adoption, the country provides a model of how effective partnerships with diverse stakeholders – public, private sector, and the farming community can deliver the benefit of biotechnology sustainably.

BENEFITS OF BT COTTON IN BURKINA FASO

Bt cotton adoption generates an economic benefit of more than US\$70 million/year for Burkina Faso, based on yield increases of 20.5%, plus 66.7% reduction in insecticides sprays, from a total of 6 sprays required for conventional cotton, to only 2 for Bt cotton.

The real and potential economic impacts of insect resistant cotton are therefore highly significant

as increases in the prices of agricultural inputs used to combat destructive cotton pests remain a major challenge in the other West African states that have not embraced the technology.

It is estimated that the economic gains from Bt cotton for Burkina Faso for the period 2008 to 2014 was US\$178 million, and US\$41 million for 2014 alone.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/>
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COUNTRY PROFILE

Population: 18.2 million

GDP: US\$10.7 billion

GDP per Capita: US\$1,480

Agriculture as % GDP: 34%

Agricultural GDP: ~US\$3.6 billion

% employed in agriculture: 92%

Arable Land (AL): 6 million hectares

Ratio of AL/Population*: 2.0

Major crops:

- Cotton • Millet • Peanuts • Maize
- Sorghum • Rice • Shea nuts

Commercialized Biotech Crop: Bt Cotton

Total biotech crop area and (%) increase in 2015:
0.350 Million Hectares (-20%)

Increased farm income, 2008-2014: US\$178 million

*Ratio: % global arable land / % global population

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BIOTECH COUNTRY **FACTS & TRENDS**

Myanmar

2015 is the 10th consecutive year of planting Bt cotton in Myanmar.

Myanmar has significantly benefited from planting the long staple insect resistant Bt cotton variety named "Silver Sixth" or "*Ngwe chi 6*" for 10 years.

In 2015, *Ngwe chi 6* was planted on 325,000 hectares, a marginal increase from 318,000 hectares in 2014, with an adoption rate of 93%.

The 93% adoption rate in 2015 is 5% increase from 88% adoption in 2014.

Around 460,000 small farmers (average of 0.7 hectare of cotton) planted Bt cotton this year, an increase from 454,000 in 2014.

BENEFITS OF BT COTTON IN MYANMAR

In the last ten years (2006 to 2015), smallholder cotton farmers in Myanmar rapidly adopted Bt cotton variety *Ngwe chi-6* which replaced almost all conventional cotton varieties. The large scale adoption of *Ngwe chi-6* significantly increased the total area under long staple cotton in the country.

Myanmar for the first time in 2015, planted its new home-grown Bt cotton variety *Ngwe chi-9* on 60 hectares. Myanmar's National Seed Committee (NSC) officially registered and approved the commercial cultivation of insect resistant cotton *Ngwe chi-9* developed by the Department of Industrial Crops Development

of the Ministry of Agriculture and Irrigation.

Estimates indicated that enhanced farm income from Bt cotton is US\$185 million for the period 2006 to 2014 and the benefits for 2014 alone at US\$37 million.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/>
The World Bank. <http://www.worldbank.org/>

COUNTRY PROFILE

Population: 59.3 million

GDP: US\$55.8 billion

GDP per Capita: US\$1,160

Agriculture as % GDP: 38.8%

Agricultural GDP: US\$22.3 billion

% employed in agriculture: 66%

Arable Land (AL): 10.8 million hectares

Ratio of AL/Population*: 0.8

Major crops:

- Rice
- Beans
- Groundnuts
- Cotton
- Pulses
- Sesame
- Sugarcane

Commercialized Biotech Crop: Bt Cotton

Total biotech crop area and (%) increase in 2015:

0.325 Million Hectares (0%)

Increased farm income, 2006-2014: US\$185 million

*Ratio: % global arable land / % global population

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BIOTECH COUNTRY **FACTS & TRENDS**

Mexico

Mexico is the last of the six "founder biotech crop countries" having grown Bt cotton since 1996.

In 2015, Mexico planted 141,000 hectares of biotech crops, down from 170,000 hectares in 2014, comprised of 123,000 hectares of biotech cotton, and 18,000 hectares of biotech soybean.

The adoption rates for biotech cotton is 96%, and 10% for biotech soybean.

Of the total 128,000 hectares of cotton planted in Mexico in 2015, 123,000 hectares, or 96% is biotech.

Of the 123,000 hectares of biotech cotton planted in Mexico in 2015, 118,000 hectares are stacked and 5,000 hectares are herbicide tolerant (HT).

ADOPTION OF BIOTECH CROPS

Soybean adoption in Mexico in 2015 at 18,000 hectares is almost double the 2014 hectareage of 10,000 hectares with an adoption rate of 10% for both years.

Since 1996, Mexico has approved 158 biotech events for food/feed use and cultivation: alfalfa (5 events), Argentine canola (13), cotton (30), maize (68) potato (13), rice (1) soybean (22), sugar beet (1), and tomato (5).

A legal ban on planting biotech maize in Mexico was introduced in 2013, which was overturned in August 2015 by a court decision.

It is hoped that Mexico will adopt a national, science-based strategy that will protect the centers of origin of maize, and will ensure that Mexico

will benefit from biotech maize which can contribute to national food security and mitigate new challenges, such as more frequent and severe droughts.

BENEFITS FROM BIOTECH CROPS IN MEXICO

Mexico is estimated to have enhanced farm income from biotech cotton and soybean by US\$293 million in the period 1996 to 2014 and the benefits for 2014 alone is US\$55 million.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York.
Food and Agriculture Organization of the United Nations.
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COUNTRY PROFILE

Population: 127 million
GDP: US\$1,178.1 billion
GDP per Capita: US\$9,750

Agriculture as % GDP: 4%
Agricultural GDP: US\$47.1 billion
% employed in agriculture: 13%

Arable Land (AL): 25.8 million hectares
Ratio of AL/Population*: 1.0

*Ratio: % global arable land / % global population

Major crops:

- Maize
- Wheat
- Soybean
- Rice
- Cotton
- Coffee

Commercialized Biotech Crops:

- Bt Cotton
- HT Soybean

Total biotech crop area and (%) increase in 2015:
0.141 Million Hectares (-50%)

Increased farm income, 1996-2014: US\$384 million

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BIOTECH COUNTRY FACTS & TRENDS

Colombia

Biotech cotton has been grown for 13 years in Colombia.

Colombia grew a total of 89,000 hectares of biotech crops in 2015, a 10% decrease from 99,000 hectares in 2014 probably due to low crop prices driving farmers to decrease plantings of both maize and cotton.

Of the 89,000 hectares biotech crops planted in Colombia in 2015, 16,000 were biotech cotton and 73,000 hectares were biotech maize.

Of the 73,000 hectares biotech maize, 94% (68,620 hectares) is stacked trait insect resistant (IR)/ herbicide tolerant (HT), and 6% HT (4,380).

In 2015, 96% of biotech cotton in Colombia have the stacked traits Bt/ HT.

BIOTECH CROP ADOPTION

Biotech maize was previously grown under a pre-commercial project "controlled planting program" in two regions, one on the Coast and Llanos region and the other in the interior of the country.

Biotech cotton has been grown for 13 years in Colombia.

Since 2009, Colombia has approved 73 events for food/feed use and cultivation: cotton (9 events), flax (1 event), maize (39 events), rice (2 events), soybean (10 events), wheat (1 event), rose (2 events), and carnation (8 events).

BENEFITS FROM BIOTECH CROPS IN COLOMBIA

A 2011 study on the benefits of biotech cotton for women in

Colombia indicates that it saved them time and money from spending less time on weeding and hiring men to spray insecticides.

Colombia is estimated to have enhanced farm income from biotech crops by US\$124 million in the period 2002 to 2014 and the benefits for 2014 alone is estimated at US\$22 million.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/> The World Bank. <http://www.worldbank.org/>

COUNTRY PROFILE

Population: 48.2 million

GDP: US\$370 billion

GDP per Capita: US\$7,750

Agriculture as % GDP: 7%

Agricultural GDP: US\$25.9 billion

% employed in agriculture: 17%

Arable Land (AL): 2.2 million hectares

Ratio of AL/Population*: 0.1

*Ratio: % global arable land / % global population

Major crops:

- Coffee
- Maize
- Cotton
- Bananas
- Rice
- Sugarcane

Commercialized Biotech Crops:

- Bt Maize
- Bt Cotton

Total biotech crop area and (%) increase in 2015:

0.089 Million Hectares (-10%)

Increased farm income, 2002-2014: US\$124 million

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BIOTECH COUNTRY FACTS & TRENDS

Sudan

2015 was the fourth year of commercial planting of Bt cotton in Sudan.

The introduction of Bt cotton in Sudan enhanced cotton productivity and restored cotton as a main cash crop and a major contributor to the country's economy.

A total of 120,000 hectares of Bt cotton were planted in Sudan in 2015, up from 90,000 hectares, a 33% increase from 2014.

Close to 45,000 farmers planted Bt cotton compared with the initial 10,000 beneficiaries who have an average of about 1 to 2.5 hectares of land.

In just four years, Sudan has recorded a 95% adoption rate of Bt cotton.

A key development in 2015 was the approval of three additional GM varieties (Hybrid JKCH1974; Hybrid JKCH1050 and O.P SCRC37) for commercial planting by the National Biosafety Council (NBC) and the National Variety Release Committee. The approval will expand the choice for farmers and complement the first and only Bt cotton variety "Seeni 1" that was released for commercial production in 2012.

The new varieties yield about 2-3 times higher than local non-Bt varieties Abdin and Hamid, and significantly higher than "Seeni 1."

Bt cotton saved 37% of the direct cost of cotton production: the cost of producing non-Bt cotton was much higher at US\$372 for one feddan (0.42 hectares) compared with US\$246 for Bt cotton. The

net profit for a farmer planting Bt cotton was US\$170 per feddan (equivalent to US\$410 per hectare).

The increase in hectareage of Bt cotton between 2012 and 2015 is clear evidence that farmer experience was positive in the first year of planting in 2012 and has provided the incentive for a large increase in adoption in 2015.

SOURCES

James, Clive. 2015. 20th Anniversary (1996 to 2015) of the Global Commercialization of Biotech Crops and Biotech Crop Highlights in 2015. ISAAA Brief No. 51. ISAAA: Ithaca, New York. Food and Agriculture Organization of the United Nations. <http://www.fao.org/countryprofiles/>
The World Bank. <http://www.worldbank.org/>

COUNTRY PROFILE

Population: 40.2 million

GDP: US\$58.8 billion

GDP per Capita: US\$2,160

Agriculture as % GDP: 33%

Agricultural GDP: US\$19.4 billion

% employed in agriculture: 48%

Arable Land (AL): 21.05 million hectares

Ratio of AL/Population*: 3.0

*Ratio: % global arable land / % global population

Major crops:

- Cotton
- Wheat
- Sugarcane
- Cassava
- Sorghum
- Millet

Commercialized Biotech Crop: Bt Cotton

Total biotech crop area and (%) increase in 2015:
0.120 Million Hectares (+33%)

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