Global status of commercialised biotech/GM crops

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) publishes an annual global review of biotech crops commercialisation or the ISAAA Briefs. It is one of the most cited references in modern agri-biotechnology due to its credibility and accuracy. Since the adoption of biotechnological crops in 1996, ISAAA has remained the single most prominent source of this information.

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The year 2016 was momentous, since for the first time Nobel Laureates released a statement in support of biotechnology, condemning critics for their stance against the technology and the development of golden rice. Guided by the 2030 Agenda for Sustainable Agriculture, the Food and Agriculture Organisation of the United Nations, International Food Policy Research Institute, G20 countries and other like-minded bodies have committed to eradicating hunger and malnutrition within 15.

More importantly, the United States (US) National Academies of Sciences, Engineering and Medicine has published a review of 900 studies on biotech crops since 1996 and found that genetically modified (GM) crops and conventionally bred crops do not differ in terms of probable risks to human health and the environment. Biotech crops have had an unblemished record of safe use and consumption for over 20 years. Future generations can benefit greatly from wide choices of biotech crops with improved traits for high yield and nutrition as well as safety regarding use and the environment.

Highlights of 2016 adoption

Planting of hectares worldwide

A year after the second decade of commercialisation of biotech/GM crops in 2016, 26 countries grew 185.1 million hectares of biotech crops – an increase of 5.4 million hectares or 3% from 179.7 million hectares in 2015. Except for the 2015 adoption, this is the 20th series of increases each year; and notably, 12 of the 20 years consisted of double-digit growth rates.

Global area of biotech crops

Global hectarage of biotech crops has increased ~110-fold from 1.7 million hectares in 1996 to 185.1 million hectares in 2016. This makes biotech crops the fastest-adopted crop technology in recent times. An accumulated 2.1 billion hectares or 5.3 billion acres were achieved in 21 years (1996–2016) of biotech crop commercialisation.

Global adoption rates

The 185.1 million hectares of biotech crops were grown in 26 countries, of which 19 were developing and seven industrial countries. Developing countries grew by 54% (99,6 million hectares) of the global biotech crop area compared to 46% (85,5 million hectares) for industrial countries.

The four major biotech crops – soya bean, maize, cotton, and canola, in decreasing area – were the most adopted biotech crops by 26 countries. The area planted to biotech soya bean was the highest at 91.4 million hectares, making up 50% of the global hectarage of 185.1 million hectares for all biotech crops. Although the soya bean area only showed a marginal decrease of 1% from 2015 (92.7 million hectares), the area is still substantial at 91.4 million hectares. Based on the global crop hectarage for individual crops, 78% of soya bean, 64% of cotton, 26% of maize and 24% of canola were biotech in 2016.

Biotech countries

Of the top five countries growing 91% of biotech crops, three are developing (Brazil, Argentina, and India) and two are industrial (US and Canada).

The US leads biotech crop planting in 2016 at 72.9 million hectares, followed by Brazil (49.1 million hectares), Argentina (23.8 million hectares), Canada (11.6 million hectares) and India (10.8 million hectares) for a total of 168.2 million hectares, 91% of the global hectarage.

Ten countries in Latin America grew ~80 million hectares of biotech crops. Except for Chile and Costa Rica which continuously plant biotech crops for export, biotech crop countries in Latin America grew biotech crops for food, feed, and processing. Brazil obtained the highest increase of 11% or 4.9 million hectares of biotech crops in 2016, occupying 27% of the global biotech crop area.

Eight countries in Asia and the Pacific grew ~18,6 million hectares of biotech crops. Biotech crops planted in the eight biotech crop countries of Asia and the Pacific ranged from fibre (cotton), feed (maize and canola) and food (maize and eggplant). Adoption of these biotech crops varied in 2016: India and China's biotech cotton planting was extremely affected by low global cotton prices, while Pakistan and Myanmar maintained their biotech cotton area. The area planted to biotech maize in the Philippines and Vietnam increased due to high demand for livestock and poultry feeds, as well as favourable weather conditions. In Australia, favourable weather conditions after two years of drought permitted increased planting of biotech cotton and canola.

Four countries in the European Union (EU) continued to plant biotech maize at more than 136,000ha. Four countries in the EU continued to plant biotech maize [imidazolinone-resistant (IR) maize event MON 810] in 2016. They consisted of Spain with 129,081ha, Portugal (7,069ha), Slovakia (138ha) and the Czech Republic (75ha) for a total of 136,363ha. Thus, a significant difference of 19,493ha or 17% increase from 116,870ha in 2015 was achieved. The more than 95% of the total biotech maize in the EU was planted in Spain.

On the African continent, South Africa and Sudan increased planting of biotech crops. By 2016, at least four African countries had in the past placed a GM crop in the market – Burkina Faso, Egypt, South Africa, and Sudan. However, due to a temporary setback in Burkina Faso and Egypt, only South Africa and Sudan planted biotech crops at 2.8 million hectares. South Africa is one of the top ten countries planting more than one million hectares in 2016 and continued to lead the adoption of biotech crops on the continent. Biotech maize, soya bean, and cotton area increased to 2.66 million hectares in 2016, a 16% increase from the 2.29 million hectares in 2015.

Contribution of biotech crops

Biotech crops contributed to food security, sustainability and climate change by:

Increasing crop productivity with 574 million tonnes valued at $167.8 billion from 1996 to 2015 and 75 million tonnes valued at $15.4 billion in 2015 alone.
Conserving biodiversity from 1996 to 2015, by saving 174 million hectares and 19.4 million hectares in 2015 alone.
Providing a better environment by saving 620 million kilogrammes of active ingredient of pesticides from 1996 to 2015 and by 37.4 million kilogrammes in 2015 alone.

South African status

South Africa planted its first biotech crops, insect-resistant cotton, 19 years ago in 1998. Insect-resistant maize and herbicide-tolerant soya bean followed in 2000 and 2001, with herbicide-tolerant maize in 2003. In 2016, the country planted 2.66 million hectares of biotech crops comprised of maize (2.16 million hectares), soya bean (494,000ha) and cotton (9,000ha).

This was a 16% increase from the reported biotech crop area of 2.29 million hectares in 2015. The average biotech crop adoption increased marginally to 91% in 2016. The total area planted to maize, soya bean and cotton was 2.93 million hectares, a 15% increase from the last report in 2015.

The El Niño weather pattern persisted from 2015 through to November 2016, seriously damaging all agricultural sectors, water resources, grazing for livestock and resulting in raised food prices. A La Niña pattern developed later during December, with good rainfall in most parts of the country except for the far western provinces. Promising outcomes include increased late planting of food crops and expected higher crop yields per hectare.

Since 1998, the 70 events approved for planting in South Africa include five Argentine canola events, ten for cotton, 42 for maize, one rice event (for food) and twelve soya bean events.

Biotech maize

South Africa is set to harvest the largest maize crop on record, estimated at 15.63 million tonnes. The average maize yield is estimated at 5.95 ton per hectare, which is also the highest ever and constituting the highest national maize average in Africa.

Maize is the main field crop in South Africa and is used for both human consumption (mainly white maize) and animal feed (mainly yellow maize). Biotech maize was planted on 2.16 million hectares at an adoption level of 90%, 22% higher than 2015. This hectarage comprised of 19,5% (420,000ha) insect-tolerant, 18,9% (407,000ha) herbicide-tolerant (HT) and 61,7% (1.33 million hectares) of stacked IR/HT maize.

Biotech white maize was planted on 52% (1.123 million hectares) of the total biotech maize, with yellow maize at 48%. Maize is the most critical staple food in the country and the Southern African Development Community region. The severe drought had hit food production very hard in this area. It soon became clear that South Africa would become a net importer of maize and early 2016 indications were that some three million ton of commodity maize will have to be imported.

The country requires 10.5 million tonnes to be produced annually, but only 7.5 million tonnes were produced in the 2015 harvest season. The price of white maize escalated to a peak of R5,500/ton (~$408), which prompted the government to intensify the issuance of import permits. Approximately 94,9% of the 628 permits were for white maize.

New information on imported volumes and late rains showed higher-than-expected yields of crops on the field and more stocks available with US grain entering, creating a possible surplus, and presenting challenges for local farmers as white maize prices dropped to approximately R2,300/ton (~$170).

Despite these setbacks, farmer confidence has been improved and normalcy returned in early 2017. Hence, the latest estimate in the area of biotech maize planting indicated a 22% increase of up to 2.16 million hectares.

WEMA project

In partnership with Kenya, Mozambique, Tanzania, and Uganda, South Africa is involved in the development and deployment of biotech maize under the Water Efficient Maize for Africa (WEMA) project. Maize varieties with stacked drought tolerance and insect resistance were approved in June 2015, but seeds will only be available in late 2017 to a limited number of smallholders. The official wide-scale release to commercial farms is planned for 2018.

Maize production in South Africa indicates the long-term trend of producing more maize on less area, with the use of more efficient and effective farming methods and practices. These are accompanied by the use of less marginal land in the maize production systems, better seed cultivars and adoption of biotechnology.

With biotechnology, maize yield has doubled over the past 20 years in South Africa (USDA, Agricultural Biotechnology Annual for South Africa, 2016).

Biotech soya bean

Soya bean has been planted in South Africa since 2001 and in 2016 it was planted on 520,000ha, a 3% decrease (15,000ha) from 535,000ha planted in 2015 due to drought. Biotech soya bean was planted on 494,000ha, 95% of the total soya bean area.

Experts believe that the increasing trend in soya bean hectarage before the onset of drought in 2015/16 will continue due to the demand created by the growing investments in the oilseed-processing industry in the country. The United States Department of Agriculture (USDA) post estimates that there will be a 39% growth in the area planted with soya beans in 2016/17, due to the added soya bean crushing capacity and increased affinity by farmers to use soya beans as rotational crop with maize (USDA FAS GAIN Agribiotechnology, South Africa 2016).

The Oilseed Industry Office has been stimulating and supporting soya bean adoption by way of new imported varieties, better use of Rhizobia and farming systems. The Industrial Development Council has provided funding through the Department of Trade and Industry to boost oilseed pressing facilities.

Biotech cotton

Cotton with insect resistance [Bacillus thuringiensis (Bt)] has been planted in South Africa since 1998, and in 2016 there were 9,000ha planted to IR/HT cotton, a 25% decrease in planting due to drought and low global cotton price. All cotton is GM with Bt-Bt stack and glyphosate tolerance. It is expected that cotton prices will increase as global prices stabilise, leading to increased prospects for cotton in the 2017/18 season.

Economic benefits

It is estimated that the economic gains from biotech crops for South Africa for the period 1998 to 2015 was $2.1 billion, and $237 million for 2015 alone (Brookes and Barfoot, 2017, Forthcoming).

Biotechnology continues to be a good investment for millions of farmers across the globe. In 2015, for each additional dollar invested in biotech crop seeds globally, farmers netted an average $3.45. In developing countries, farmers received $5.15 for each extra dollar invested in biotech crop seeds, whereas farmers in developed countries received $2.76 for each extra dollar invested. Biotech crops are here to stay and will continue benefiting the ever-growing population with new GM crops and traits to cater to the needs of farmers and consumers alike.

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