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Global economic benefits of GM crops reach $150 billion[1]

In the nineteenth year of widespread adoption, crop biotechnology has continued to provide substantial economic and environmental benefits, allowing farmers to grow more, with fewer resources, whilst delivering important environmental benefits for all citizens.

'Where farmers have been given the choice of growing GM crops, the economic benefits realized are clear and amounted to an average of over $100/hectare in 2014' said Graham Brookes, director of PG Economics, co-author of the report. 'Two-thirds of these benefits derive from higher yields and extra production, with farmers in developing countries seeing the highest gains. The environment is also benefiting as farmers increasingly adopt conservation tillage practices, build their weed management practices around more benign herbicides and replace insecticide use with insect resistant GM crops'

Highlights from this comprehensive review include:

Higher yielding crops

- The insect resistant (IR) technology used in cotton and corn has consistently delivered yield gains from reduced pest damage. The average yield gains over the 1996-2014 period across all users of this technology has been +13.1% for insect resistant corn and +17.3% for insect resistant cotton relative to conventional production systems. 2014 was also the second year IR soybeans were grown commercially in South America, where farmers have seen an average of +9.4% yield improvements;

- The herbicide tolerant (HT) technology used has also contributed to increased production; improving weed control and providing higher yields in some countries and helping farmers in Argentina grow 'second crop' soybeans after wheat in the same growing season[2];

Better returns for farmers – especially in developing countries

- Crop biotechnology helps farmers earn more secure incomes due mainly to improved control of pests and weeds. The net farm level economic benefit in 2014 was $17.7 billion, equal to an average increase in income of $101/hectare. For the 19 years (1996-2014), the global farm income gain has been $150.3 billion;

- The total farm income benefit of $150.3 billion was divided almost equally between farmers in developing (51%) and developed countries (49%);

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[1] Report available to download at www.pgeconomics.co.uk. Also contents available as two papers (with open access), separately, covering economic and environmental impacts, in the peer review journal GM Crops at http://www.tandfonline.com/action/showAxaArticles?journalCode=kgmc20#.V1KSa6PruUk - GM Crops forthcoming in 7:1, issue 1, Jan-March 2016 (economic impact paper) and vol 7.2, issue 2, April-June 2016 forthcoming for environmental impact paper

[2] By facilitating the adoption of no tillage production systems this effectively shortens the time between planting and harvest of a crop

- The highest yield gains continue to be for farmers in developing countries, many of which are resource-poor and farm small plots of land;

Excellent investment returns for farmers

- Crop biotechnology continues to be a good investment for millions of farmers. The cost farmers paid for accessing crop biotechnology in 2014 ($6.9 billion[3][4] payable to the seed supply chain) was equal to 28% of the total gains (a total of $24.6 billion). Globally, farmers received an average of $3.59 for each dollar invested in GM crop seeds;

- Farmers in developing countries received $4.42 for each dollar invested in GM crop seeds in 2014 (the cost is equal to 23% of total technology gains), while farmers in developed countries received $3.14 for each dollar invested in GM crop seed (the cost is equal to 32% of the total technology gains). The higher level of technology gains realised by farmers in developing countries relative to farmers in developed countries reflects weaker provision of intellectual property rights coupled with higher average levels of benefits in developing countries;

Reduced pressure on scarce land resources and contribution to global food security

- Between 1996 and 2014, crop biotechnology was responsible for additional global production of 158.4 million tonnes of soybeans and 321.8 million tonnes of corn. The technology has also contributed an extra 24.7 million tonnes of cotton lint and 9.2 million tonnes of canola;

- GM crops are allowing farmers to grow more without using additional land. If crop biotechnology had not been available to the (18 million) farmers using the technology in 2014, maintaining global production levels at the 2014 levels would have required additional plantings of 7.5 million ha of soybeans, 8.9 million ha of corn, 3.7 million ha of cotton and 0.6 million ha of canola. This total area requirement is equivalent to 12% of the arable land in the US, or 33% of the arable land in Brazil or 14% of the cropping area in China;

Environmental improvements

- Crop biotechnology has contributed to significantly reducing the release of greenhouse gas emissions from agricultural practices. This results from less fuel use and additional soil carbon storage from reduced tillage with GM crops. In 2014, this was equivalent to removing 22.4 billion kg of carbon dioxide from the atmosphere or equal to removing 10 million cars from the road for one year;

- Crop biotechnology has reduced pesticide spraying (1996-2014) by 581 million kg (-8.2%). This is equal to the total amount of pesticide active ingredient applied to crops in China for more than a year[5]. As a result, this has decreased the environmental impact associated with herbicide and insecticide use on the area planted to biotech crops by 18.5%[6].

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[3] The cost of the technology accrues to the seed supply chain including sellers of seed to farmers, seed multipliers, plant breeders, distributors and the GM technology providers

[4] A typical 'equivalent' cost of technology share for non GM forms of production (eg, for new seed or forms of crop protection) is 30%-40%

[5] Equal to 1.25 times annual use

[6] As measured by the Environmental Impact Quotient (EIQ) indicator (developed at Cornell University)