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Feeding the world sustainably: Crop biotechnology continues to make a significant contribution, concludes new research¹

Genetically modified (GM) crops have increased global food, feed and fibre production by nearly 1 billion tonnes (1996-2020), whilst helping farmers who grow these crops to reduce the environmental footprint associated with their crop protection practices by over 17 percent². It has also reduced carbon emissions, by 39.1 billion kilograms, arising from reduced fuel use of 14.7 billion litres and equivalent to removing 25.9 million cars from the roads, according to research released today by PG Economics.

“GM crop technology continues to make an important contribution to reducing the environmental footprint of agriculture and securing global food supplies in a sustainable way. It has reduced pressure to bring new land into agriculture, which is vital if the world is to maintain and restore the natural habitats and vegetation that are best for many species of plants and animal life and for storing carbon” said Graham Brookes, director of PG Economics, author of the research.

Highlights in the peer reviewed³ papers include:

Crop biotechnology has contributed to global food security and reduced pressure to use new land in agriculture

- GM crop technology has increased yields through improved control of pests and weeds. For example, insect resistant (IR) crop technology used in cotton and maize has, between 1996 to 2020 across all users of this technology, increased yields by an average of 17.7 percent for IR maize and 14.5 percent for IR cotton relative to conventional production systems. Farmers who grow IR soybeans commercially in South America have seen an average 9.3 percent increase in yields since 2013.

¹. Available as three separate papers (with open access) covering economic and environmental impacts, in the peer review journal GM Crops and Food. The environmental impact associated with pesticide use is DOI: 10.1080/21645698.2022.2118497. The environmental impact associated with carbon emissions is DOI: 10.1080/21645698.2022.2118495 and the economic impact paper is DOI: 10.1080/21645698.2022.2105626 Also available as a single report at www.pgeconomics.co.uk

² As measured by Cornell University’s Environmental Impact Quotient (EIQ) indicator.

³ Peer reviewed means accepted for publication in a scientific journal after review by independent experts in the subject(s).

- Over 25 years of widespread use, crop biotechnology has been responsible for the additional global production of 330 million tonnes of soybeans, 595 million tonnes of maize, 37 million tonnes of cotton lint, 15.8 million tonnes of canola and 1.9 million tonnes of sugar beet.
- GM crops allow farmers to grow more without needing to use additional land. For example, if crop biotechnology had not been available to farmers in 2020, maintaining global production levels that year would have required the planting of an additional 11.6 million hectares (ha) of soybeans, 8.5 million ha of maize, 2.8 million ha of cotton and 0.5 million ha of canola. This 23.4 million ha total is equivalent to the combined agricultural area of Philippines and Vietnam.

Crop biotechnology has reduced agriculture's environmental impact

- Crop biotechnology has significantly reduced agriculture's greenhouse gas emissions by helping farmers adopt more sustainable practices such as reduced tillage, which decreases the burning of fossil fuels and retains more carbon in the soil. Had GM crops not been grown in 2020, for example, an additional 23.6 billion kilograms of carbon dioxide would have been emitted into the atmosphere, which is the equivalent of adding 15.6 million cars to the roads.
- From 1996 to 2020, crop biotechnology reduced the application of crop protection products by 748.6 million kilograms, a global reduction of 7.2 percent on the area planted to GM crops. This is equal to 1.5 times China's total annual crop protection product use. As a result, farmers who grow GM crops have reduced the environmental impact associated with their crop protection practices by 17.3 percent.

Crop biotechnology delivers an excellent return on investment for the farmers using the technology

- Over the 1996-2020 period, farmers in developing countries received \$5.22 as extra income for each extra dollar invested in GM crop seeds, whereas farmers in developed countries received \$3 as extra income for each extra dollar invested in GM crop seeds. The average return across all GM crop growers represents \$3.76 in extra income for each extra dollar invested over the 1996-2020 period.
- The net farm level economic benefit was just under \$18.8 billion in 2020, equal to an average increase in income of \$103/hectare. From 1996 to 2020, the net global farm income benefit was \$261.3 billion, equal to an average increase in income of \$112/hectare.

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