A technology packaged into the seed?

High performance seeds can be extremely easily deployed since the GM technology is incorporated into the seed. Thus, they are a fast and efficient way to enable farmers in developing countries to earn a better living. Increasing productivity goes very well hand in hand with decreasing the environmental impact[xvii]. And increasing agricultural productivity in developing countries is of utmost importance to improve food security. As many farmers in developing countries cannot afford tractors or modern ICT equipment, the focus has to be on easily deployable technologies such as high performance seeds, but also on knowledge transfer and using available inputs as efficiently as possible.

Fast Facts

- **108.7 million ha** of land were saved from being farmed between 1996 and 2011 with the use of biotech crops.[xviii]
- **474 million kg** reduction in pesticides applied from 1996 to 2011 because of insect-resistant biotech crops.
- **In 2009,** plant scientists unveiled the discovery of a naturally-occurring gene that can help maize plants combat drought conditions and provide yield stability during dry spells.[xix]

What others say:

"National Academy of Sciences has found no adverse health effects from GMOs, and also concluded that they can be environmentally beneficial in some ways."
Mark Tercek, President Nature Conservancy[xx]

"Agricultural biotechnology has the potential for huge impacts on many facets of agriculture-crop and animal productivity, yield stability, environmental sustainability, and consumer traits important to the poor."
World Development Report (World Bank 2008)[xxi]

"I'm convinced that modern genetic technology could help get better yields from local and regional crops in Africa and South-East Asia."
Jason Clay, Senior Vice President for market transformation, World Wide Fund[xxii]

Want to know more?

- Farming First www.farmingfirst.org
- Sustainable intensification in agriculture: www.fcrn.org.uk/sites/default/files/SI_report_final_0.pdf
- CropLife International: www.croplife.org/view_document.aspx?docId=3509

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ii World Bank (2007). http://data.worldbank.org/products/data-books/WDI-2007

iii www.epa.gov/climatechange/ghgemissions/global.html

iv CGIAR: www.cgiar.org/consortium-news/how-can-we-avoid-an-era-of-permanent-food-crisis/

v Brookes G, Yu TH, Tokgoz S, Elobeid A. (2010), www.agbioforum.org/v13n1/v13n1a03-brookes.pdf

vi A. M. Mannion & S. Morse. (2013) www.surrey.ac.uk/ces/activity/publications/index.htm, University of Surrey, UK.

vii www.pgeconomics.co.uk/page/35/ (2013)

viii Field to Market (2012). www.fieldtomarket.org/report/

ix See, for example, Seufert et al, (2012). www.ncbi.nlm.nih.gov/pubmed/22535250

x Carpenter JE (2010). www.nature.com/nbt/journal/v28/n4/abs/nbt0410-319.html

xi Field to Market (2012). www.fieldtomarket.org/report/

xii Gottlieb Basch (2009), www.ecaf.org/docs/ecaf/no%20tillage%20worldwide.pdf ECAF General Assembly – Helsinki

xiii Includes Bt events and stacked traits. Source: ISAAA

xiv G. Brookes & P. Barfoot. (2013). www.landesbioscience.com/journals/gmcrops/article/24459/ PG Economics Ltd.

xv Céleres® Ambiental. www.celeres.com.br/1/english/RelBiotechBenefits2010_Ambiental_vf1_Eng.pdf

xvi G. Brookes & P. Barfoot. (2013). www.landesbioscience.com/journals/gmcrops/article/24459/ PG Economics Ltd.

xvii See for example www.fcm.org

xviii J. Clive (2012) Global status of commercialized Biotech/GM crops

xix BASF (2009). www.basf.com/group/pressrelease/P-09-274

xx www.huffingtonpost.com/mark-tercek/a-new-diet-for-the-planet_b_3189719.html (1 May 2013) Huffington Post.

xxi The World Bank (2008). http://siteresources.worldbank.org/INTWDRS/Resources/477365-1327599046334/8394679-1327606607122/WDR08_12_ch07.pdf

xxii Gavin McEwan (2012). WWF vice president backs intensification and GM. www.truthabouttrade.org/2012/12/20/wwf-vice-president-backs-intensification-and-gm/

GREEN BIOTECHNOLOGY FACTSHEET

FARMING AND THE ENVIRONMENT

How can biotech crops contribute to sustainable intensification globally?

EuropaBio

Agriculture has a substantial impact on the environment. As population and demand continue to increase, the question is how modern agriculture can produce more, and more efficiently.

Sustainable intensification is an approach to produce more food with less impact on the environment, while preserving scarce natural resources. Agricultural biotechnology is one of several tools available to farmers in many parts of the world to take this pathway.

GM technology builds desirable characteristics into the seeds, and has already contributed to significant environmental progress. Evidence from countries around the world shows that it enables farmers to save inputs and/ or to grow more on the same amount of land. In Europe, because GM crops are allowed to be grown only on a limited amount of land, farmers are deprived of using a technology that has clear environmental benefits.

What is the environmental impact of agriculture?

Agriculture uses 70% of the world's fresh water[i], occupies close to 40% of all land (12% for crops and 27% for grassland[ii]) and accounts for 14% of global greenhouse gas emissions[iii]. Agriculture has played a significant role in the loss of biodiversity, soil degradation, global warming and water pollution.

Why produce more with less?

To feed a growing world population with changing consumption patterns, in particular in emerging economies, we will need to produce the same amount of food in the next 40 years as we did in the past 8,000[iv].This needs to be done on the limited available land, and as environmentally friendly as possible. There is a growing political consensus that some form of "sustainable intensification" is needed. This will require massive investments and the use of all available technologies to empower farmers to further improve land management.

How to safeguard biodiversity?

Land use by agriculture has a tremendous impact on biodiversity. Biodiversity in fields is much lower than in untouched natural surroundings, as the purpose is to grow a certain type of crop and avoid the presence of too many other organisms, such as weeds and pests, on the same field. If greater productivity on existing land can satisfy demand, then there is less pressure to extend agriculture into additional natural habitats. GM crops can increase yields by 6%-30% on the same amount of land, avoiding the need to plough up land that is currently a haven for biodiversity.[v]

How land efficient is modern farming?

With the help of technology, farming has become more efficient in its use of inputs such as plant protection products, water, fertilisers, energy. Modern plant breeding including GM technology has contributed significantly to higher yields per surface unit.[vi] Researchers estimate that without biotech crops, maintaining global production levels at the 2011 levels would have required additional plantings of over 15 million ha, an extra area equivalent to 28% of the cereal area in the EU (27)[vii].
For example, in the USA, land use per unit of production has decreased since 1980 for maize (-30%), cotton (-30%), and soybeans (-35%), which are predominantly GM varieties in the USA today (ca. 90%)[viii]. Organic farming tends to be less productive per surface unit than conventional farming[ix].

How to tackle soil degradation?

On ploughed farmland, the exposed topsoil can easily be blown away by wind or washed away by rain. This leads to loss of arable land, flooding due to clogged up waterways, and water pollution. This can be tackled for example by ploughing across slopes following their elevation contour lines (contour ploughing) and crop rotation. Probably the most important solution is reduced ploughing and tilling. No-till is an agricultural technique which increases the amount of water and organic matter (nutrients) in the soil and decreases erosion. It increases the amount and variety of life in and on the soil.

Less ploughing benefits soil, water and climate

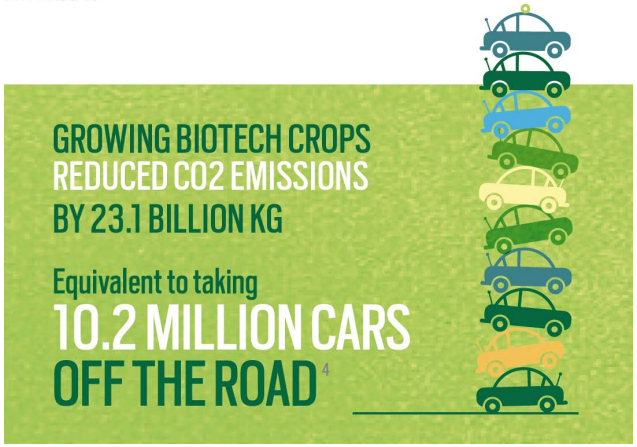
Soil conserving farm practices are easy to combine with GM cultivation. Herbicide-tolerant crops make it practical for growers to control weeds with reduced or no ploughing or tillage. In Argentina and the U.S., the use of herbicide-tolerant soybean crops has reduced the number of tillage operations by up to 58%[x]. In the USA, soil erosion per unit of production has decreased by about two thirds since 1980 for maize, cotton and soybeans, which are predominantly GM[xi]. No-till or low-till practices also contribute to more efficient water use by better trapping soil moisture, and to better carbon sequestration by carbon-enriched soils. No-till is wide spread and increasing in countries where GM crops are widely cultivated, while in the EU no-till is very rare[xii].

Pest and Insect Resistant crops?

Greenhouse gas emissions from tractors can also be reduced by reducing spraying and fertiliser distribution. Insect resistant biotech crop varieties can protect themselves from insect damage, and were grown on close to 70 million hectares world-wide in 2012[xiii], equivalent to more than the entire surface area of France. Outside Europe, where they are given the choice, millions of farmers continue to choose these varieties, because they can reduce pesticide applications, which allow for savings on labour and fuel costs. In the period 1996-2011, farmers reduced pesticide applications globally by 8.9%, equivalent to 474 million kg reduction of pesticide applications.[xiv]

Emissions savings are a reality

More efficient use of fertilisers is another important way to reduce greenhouse gas emissions, as nitrous oxide has a very high global warming potential. Emissions have already been massively reduced in US agriculture since 1980 for maize (-36%), cotton (-22%) and soybeans (-49%)[viii]. In Brazil, between 1996 and 2010, the use of GM crops reduced CO_2 emissions, by 357,000 tonnes along with saving 134.6m litres of diesel, enough to power 56,000 vehicles[xv]. It has been estimated that at the global level, GM crops have helped to save greenhouse gas emissions equivalent to taking 10.2 million cars off the roads[xvi].



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How can farmers adapt to climate change?

Climate change will entail more weather extremes, and strongly affect many farmers across the globe. Drought-tolerant crop varieties derived from modern breeding programmes are becoming more and more widely available in countries where farmers are allowed to grow them. Drought-tolerant maize varieties are now available in the USA, enabling farmers to produce more food per drop of water. A major public private project with the aim of developing new African drought-tolerant maize varieties is showing good progress. Traits are being added to crops such as maize, rice, canola, sorghum, soybean and cotton to decrease demands for irrigation and increase productivity under periods of drought.

Can modern farming reduce inputs?

Input savings are a win-win opportunity for farmers and the environment. Farmers want to earn a living, and they want to leave their land and business in a healthy state for the next generation. It is clearly in their own interest to save unnecessary fuel and time on the tractor, use plant protection products and fertilisers in a targeted and cost efficient way, and avoid soil degradation. Available data for the USA show that significant input reductions are indeed possible in modern farming systems, and that GM crops are perfectly compatible with those efforts, and even encourage certain input savings.