





GMOs: How is this affecting us?

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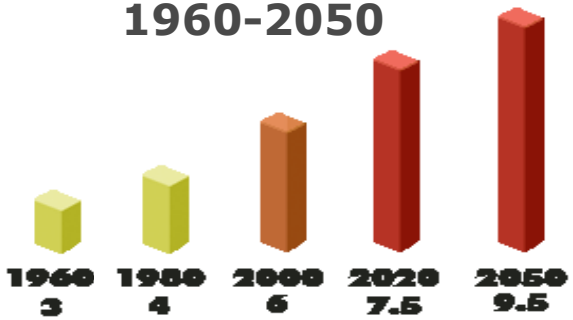
Agriculture is at the center of global trends

Population Growth 1960-2050

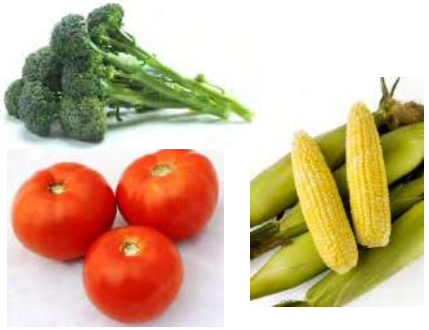


World Population (billions)

Changing Economies & Diets

43% increase in calories from animal protein

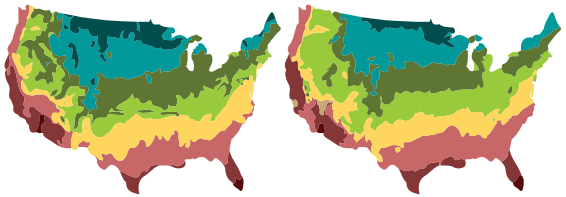
Demand For Healthier Options



= 2X Food Demand By 2050

in a more challenging production environment

Decreasing Water Availability



Changing Climate & Declining Arable Land

Evolving Ag Policies

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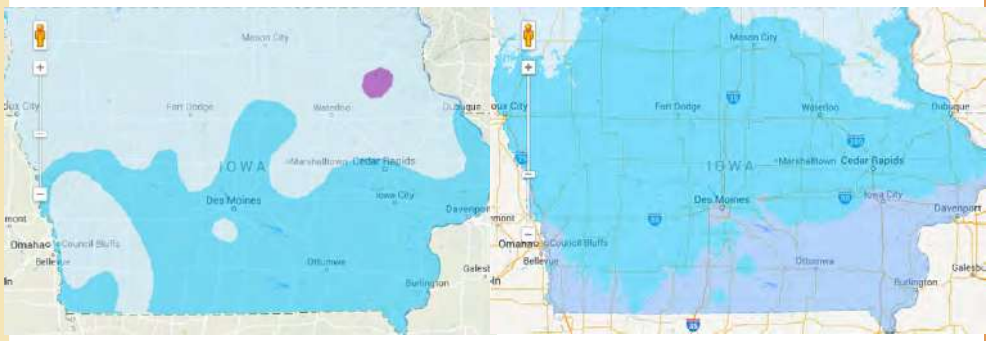
Source: U.S. Census Bureau, International Data Base, June 2010 Update. And UN FOA

Source: Ray DK, Mueller ND, West PC, Foley JA (2013) Yield Trends Are Insufficient to Double Global Crop Production by 2050. PLoS ONE 8(6): e66428.

Climate: greater variability in outcomes

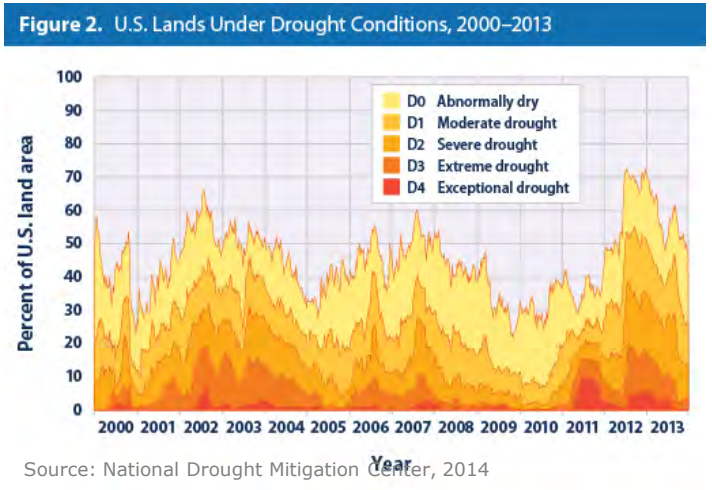
SHIFTING PLANTING ZONES



-25 to -20 (F) 1990

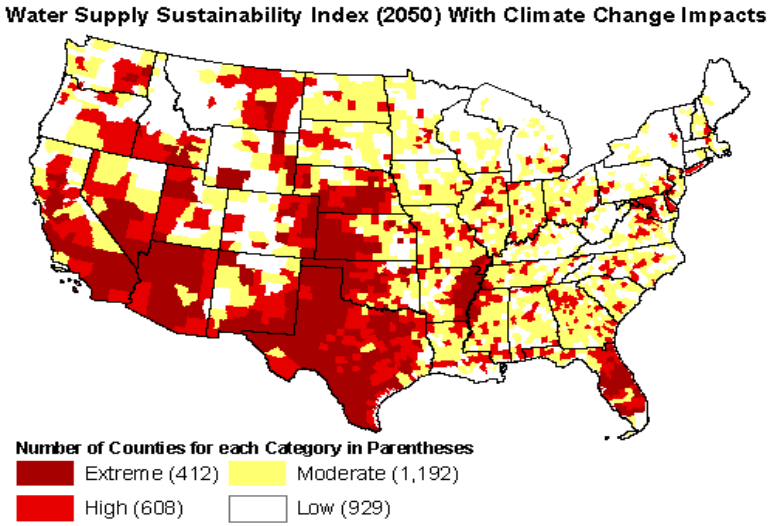
-20 to -15 (F) 2012

INCREASING ADVERSE WEATHER

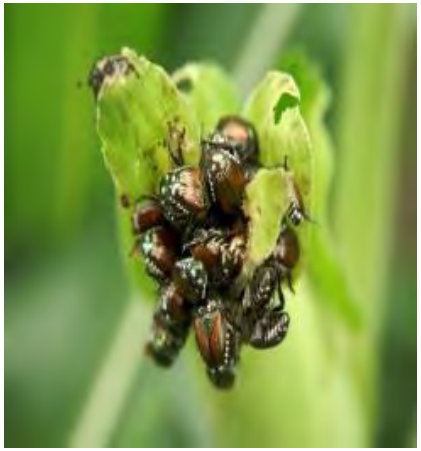


Source: National Drought Mitigation Center, 2014

DECREASING WATER AVAILABILITY



INCREASING PEST PRESSURE



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Animals are the largest users of row crops

About 85% of the world's soybean crop is processed into meal and vegetable oil, and virtually all of that meal is used in animal feed.

Over 62% of the U.S. corn crop was used for feed.

That includes over 3.7 Billion layers since the introduction of GMOs in 1996*

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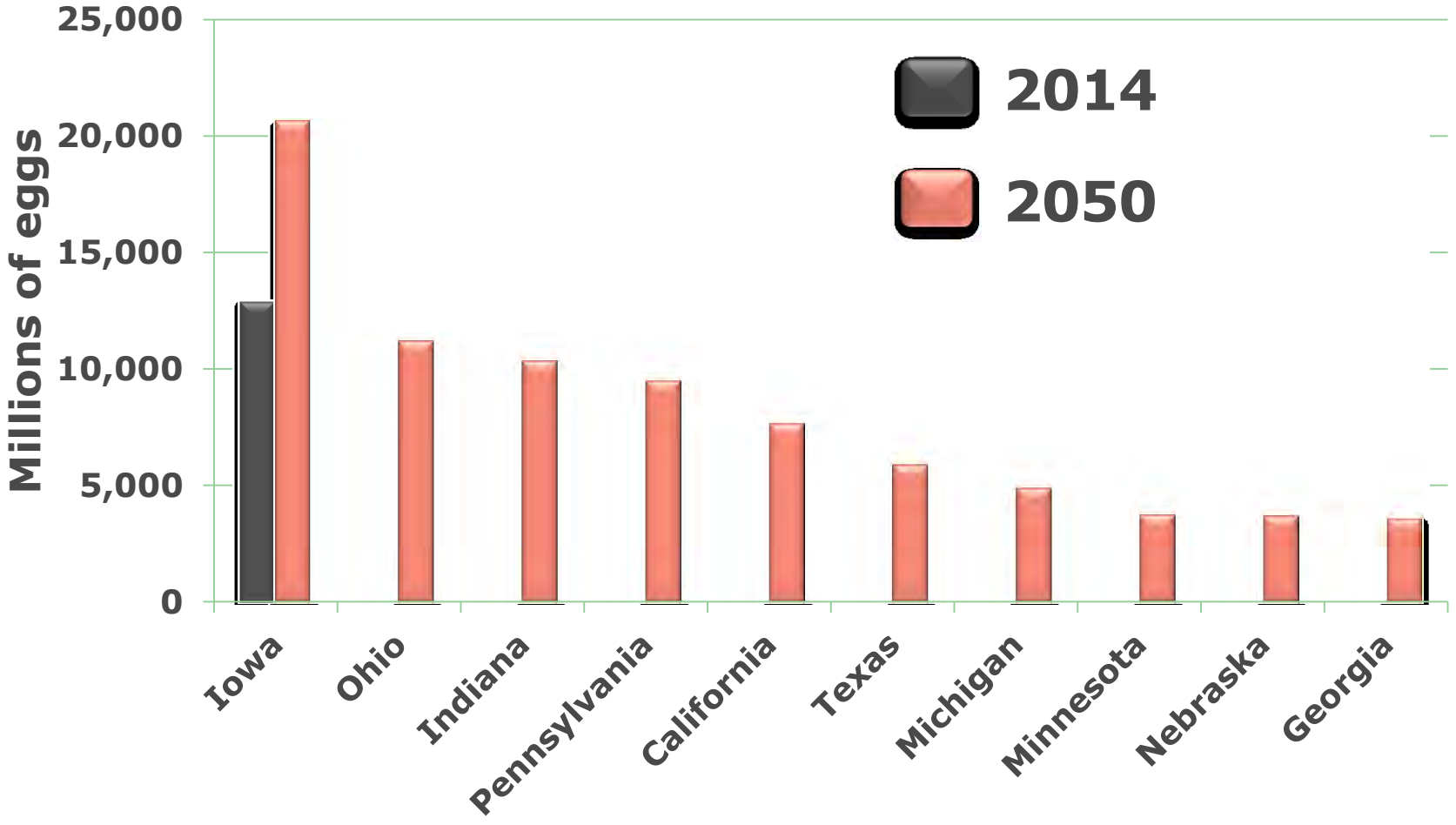
*Source: Van Eenennaam, A. L. and A. E. Young. 2014 . Journal of Animal Science.
Source: federation of animal science societies references - feeding transgenic crops to livestock *updated may 2014*
references pertaining to transgenic DNA and protein and livestock products (meat, milk, eggs) *updated april 2014*

The top ten egg producing states and future demand



Source: U.S. Dept. of Agriculture, American Egg Board and USAPEEC/UN FAOSTAT/Internal Monsanto calculations

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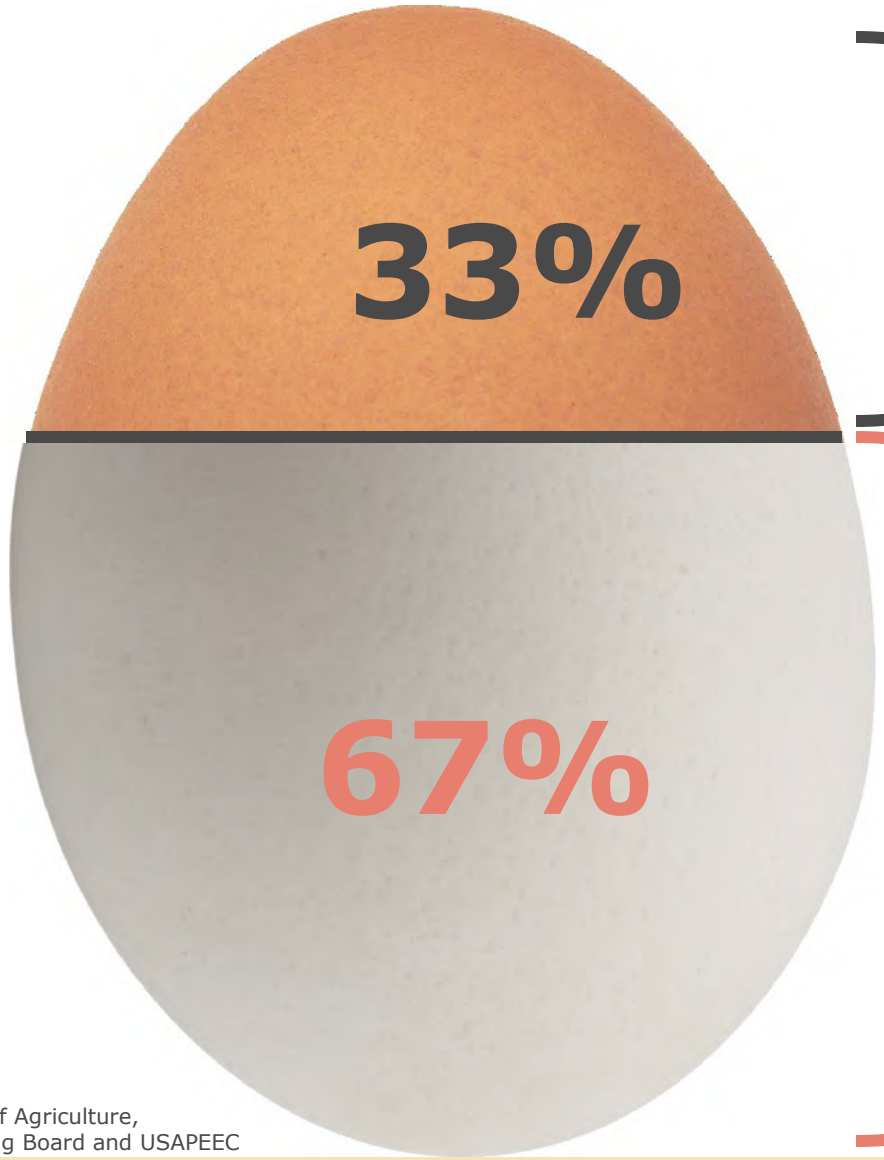
What are the costs for Iowa eggs?



Everything else:
Pullets, equipment, labor, utilities, other

Feed

U.S. Dept. of Agriculture,
American Egg Board and USAPEEC

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To increase egg production, we must also increase ag production

Feed needed for Iowa's egg Industry:

64M bushels

2014

86M bushels

2050

Source: U.S. Dept. of Agriculture, American Egg Board and USAPEEC/UN FAOSTAT/Internal Monsanto calculations

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Six R&D platforms focused on supporting farmers, productivity demands, sustainability

CORE PLATFORM OPPORTUNITY | **NEW PLATFORM OPPORTUNITY**

CROP PROTECTION
New technologies that improve in-field protection

THE CLIMATE CORPORATION
Precision Ag adds in-the-field efficiency

BIOTECHNOLOGY
Weed, pest and other agronomic traits focus on yield potential

MICROBIALS
Microbial solutions provide new Ag technology options for soil health, yield, pests

MONSANTO novozymes

BREEDING
Breeding engine and global library focus on higher yield

BIODIRECT™ TECHNOLOGY
Approaches to new pest, disease and honey bee health

BioDIRECT™

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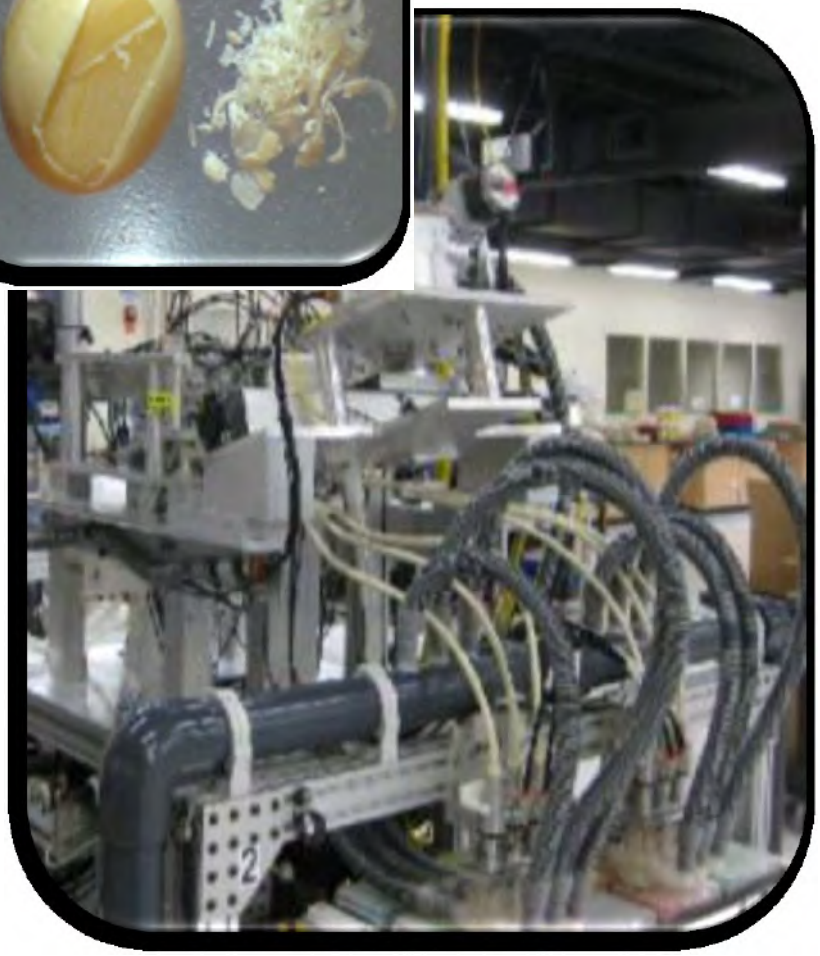
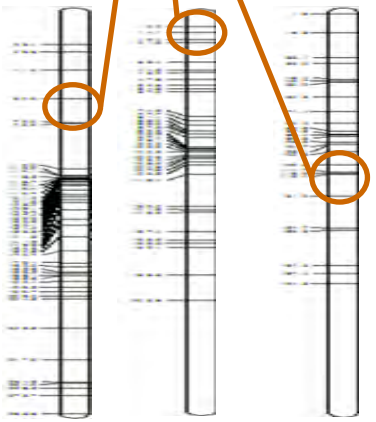
Molecular markers and seed chipping enable breeding crops seed by seed…gene by gene

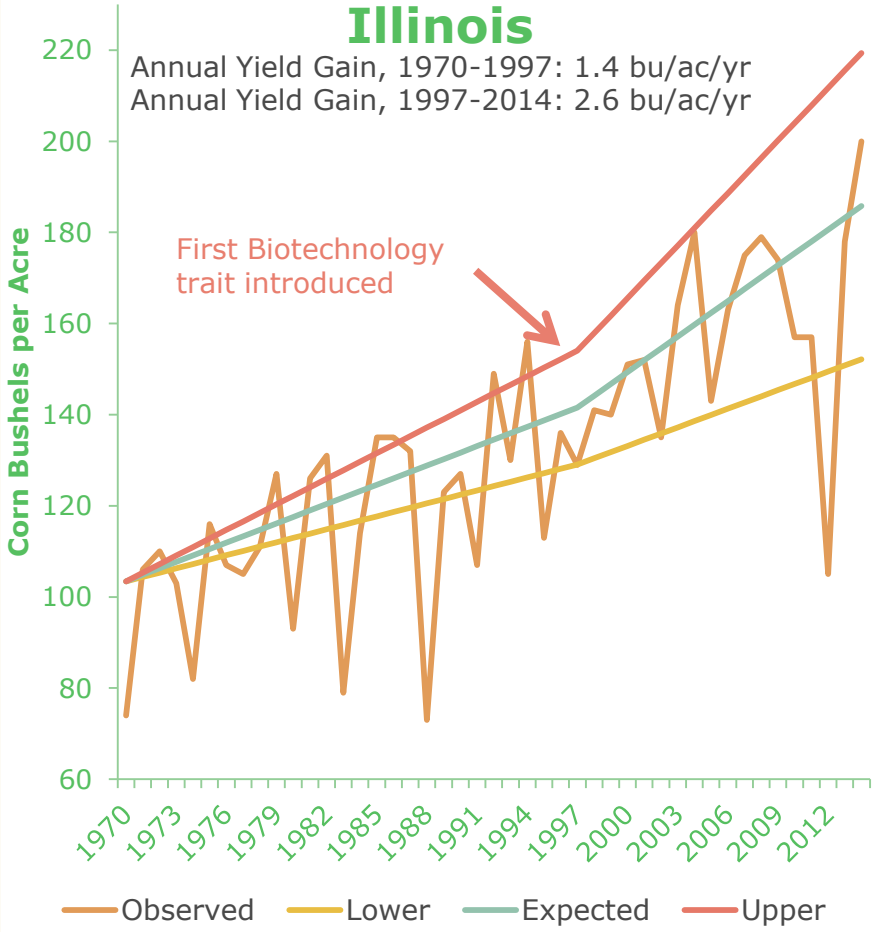


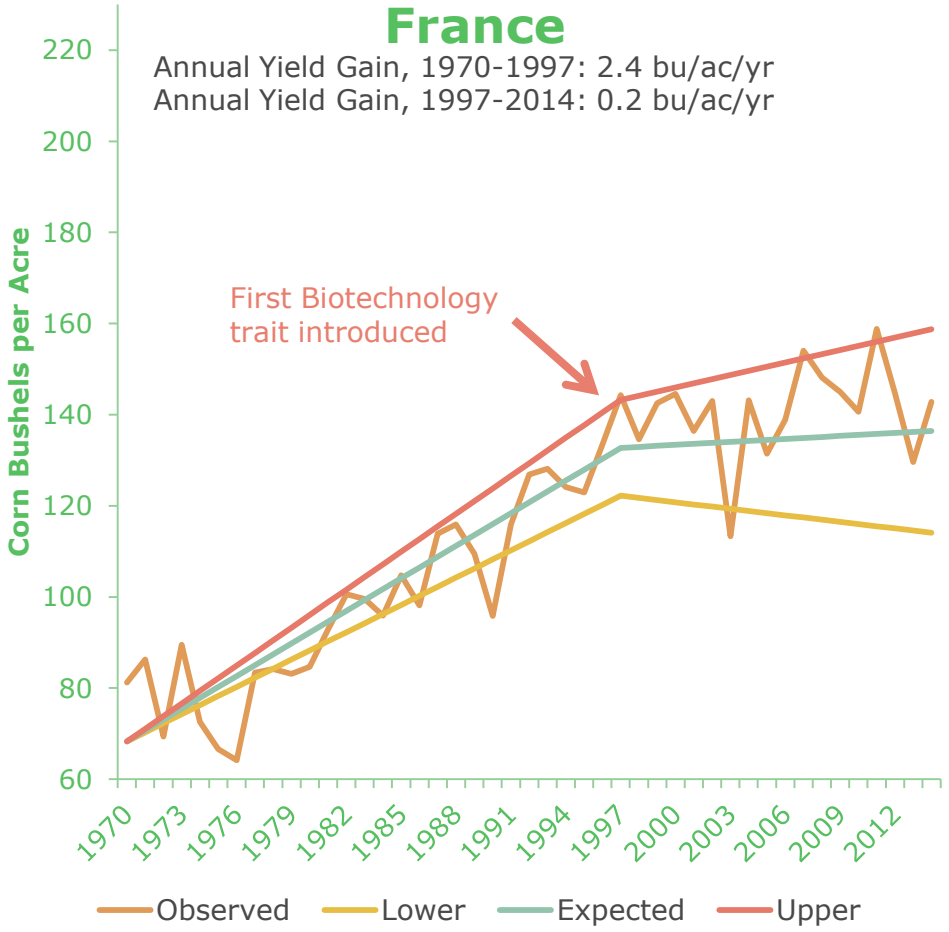
MOLECULAR BREEDING Is Accelerating The Rate Of Gain Over Conventional Breeding

Identifying molecular markers can unlock key genes in combating diseases such as Goss's Wilt



Yield gains in markets adopting biotech have significantly outperformed those in non-traited markets





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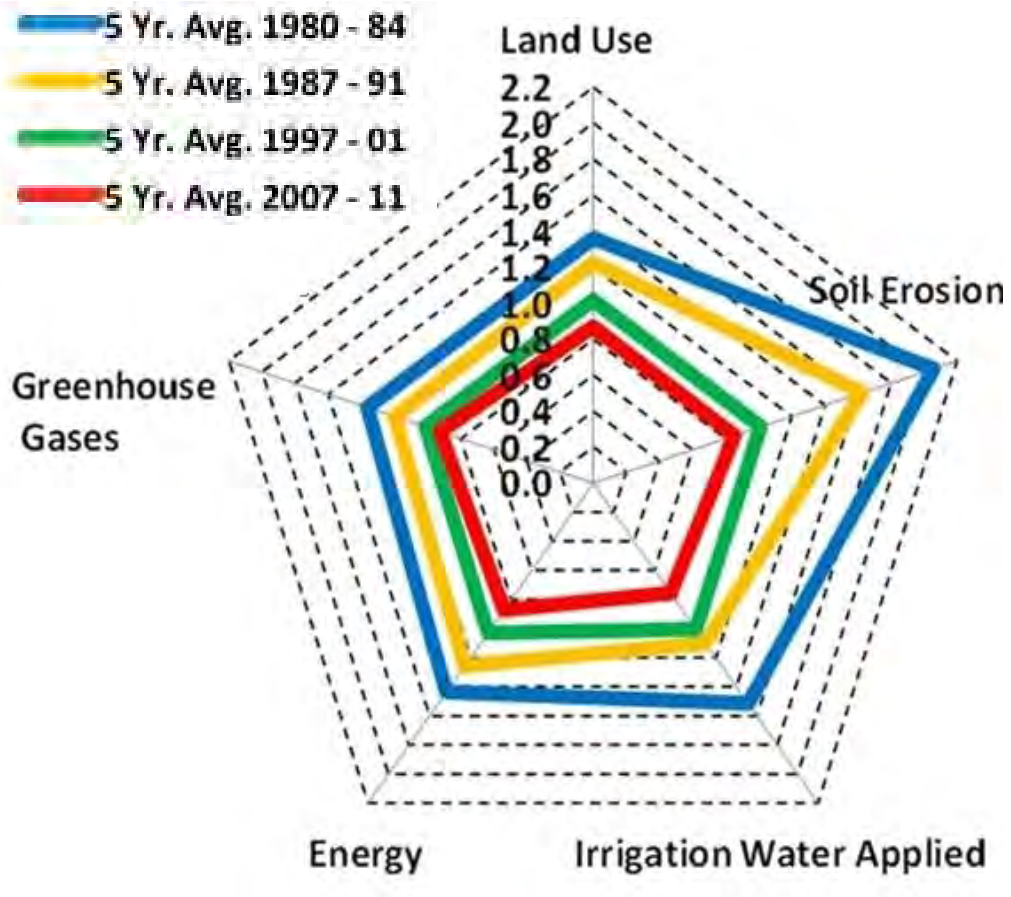
Source: USDA/FAO *Monsanto Model*

Ag innovations help improve the footprint of farming



Ag innovations & GMO crops have helped farmers reduce the environmental impacts for every bushel of corn produced in the U.S.

Between 1980-2011, corn increased in total production (+101%) and bushels per acre (+64%).

Between 1980-2011, the resource efficiency of corn production (per bushel) saw decreases in:
land use (-30%)
soil erosion (-67%)
irrigation water applied (-53%)
energy use (-4%)
greenhouse gas emission (-36%).

Field to Market (2012 v2). Environmental and Socioeconomic Indicators for Measuring Outcomes of On-Farm Agricultural Production in the United States; Summary Report: Second Report (Version 2), December 2012

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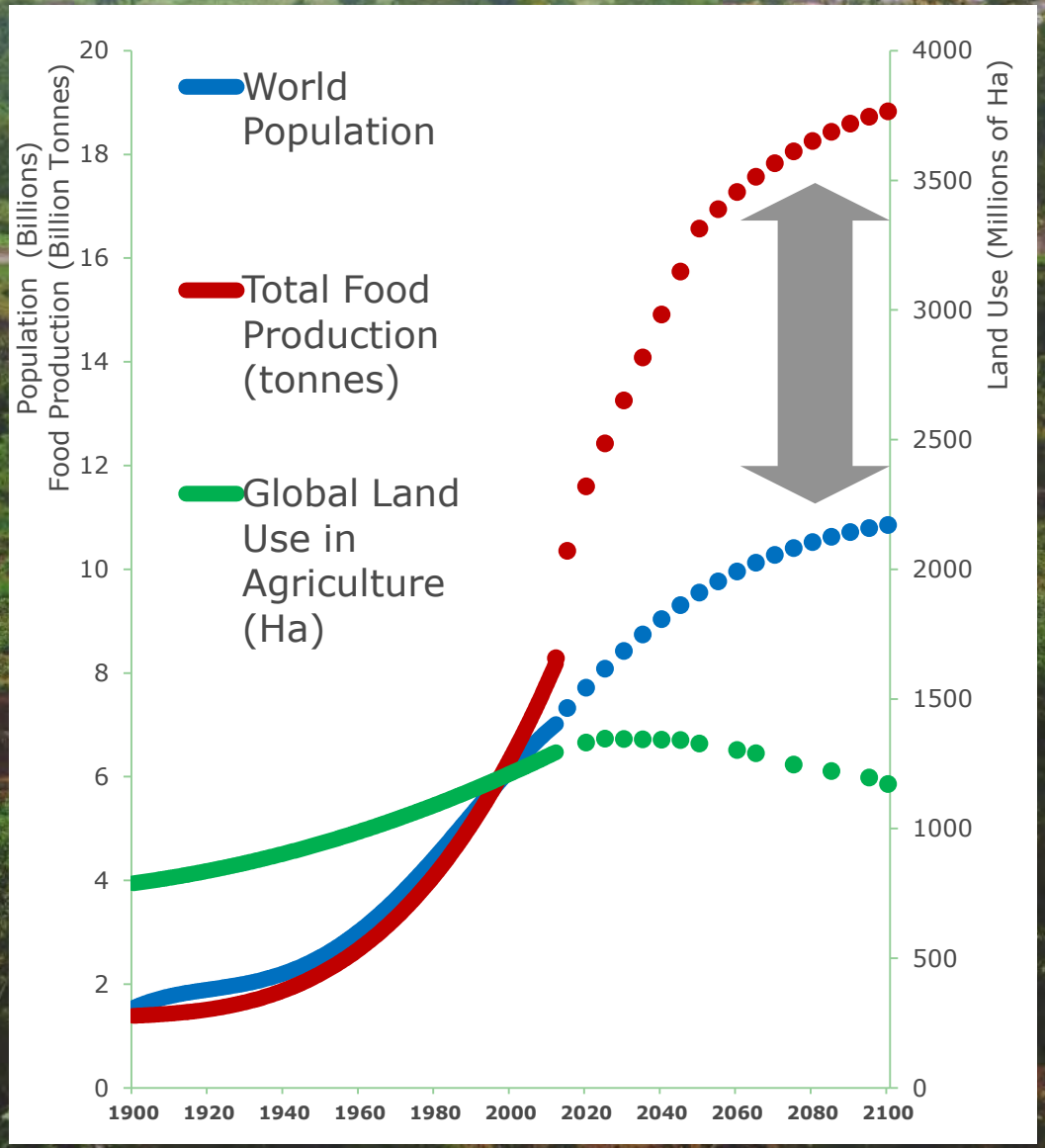
Agriculture's role in creating a food secure world and preserving its natural resources

Sustainably Supporting Demand and Preserving Natural Landscapes

- ✓ **Reduce the footprint of farming**
- ✓ **Increase crop yields**
- ✓ **Improve efficiency**
- ✓ **Reduce waste**
- ✓ **Improve diets**

By 2060: 150M hectares can be restored to nature or land equivalent to almost 10 Iowas

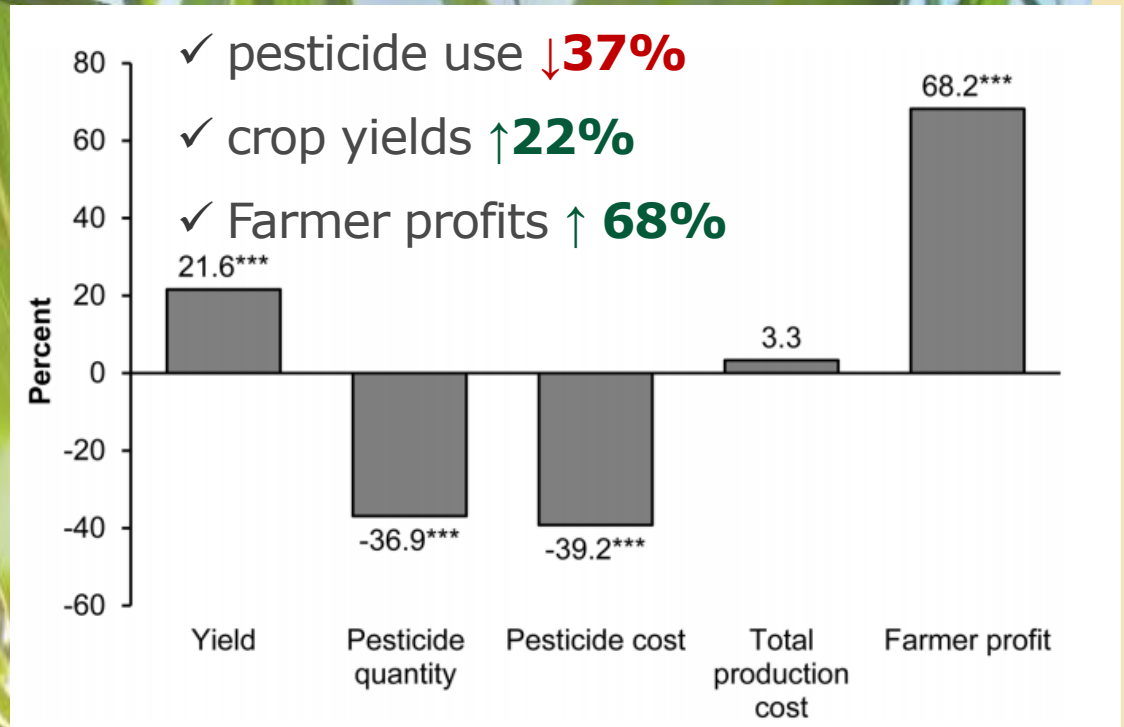


Source: National Geographic ,"Feeding the World", 2014
Source: UN FAO, 2014, Monsanto internal calculations; Ausubel, et al., Peak Farmland and the Prospect for Land Sparing Population and Development Review Volume, , 38: 221–242

Meta analysis confirms "agronomic and economic benefits of GM crops are large and significant"

147 studies; **20** years:

- Pesticides down, yields and profits up
- Gains higher in developing countries
- Industry funding – "not significant" factor in study conclusions



Klümper W, Qaim M (2014), PLoS ONE 9(11): e111629. doi:10.1371/journal.pone.0111629

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Economic Benefits

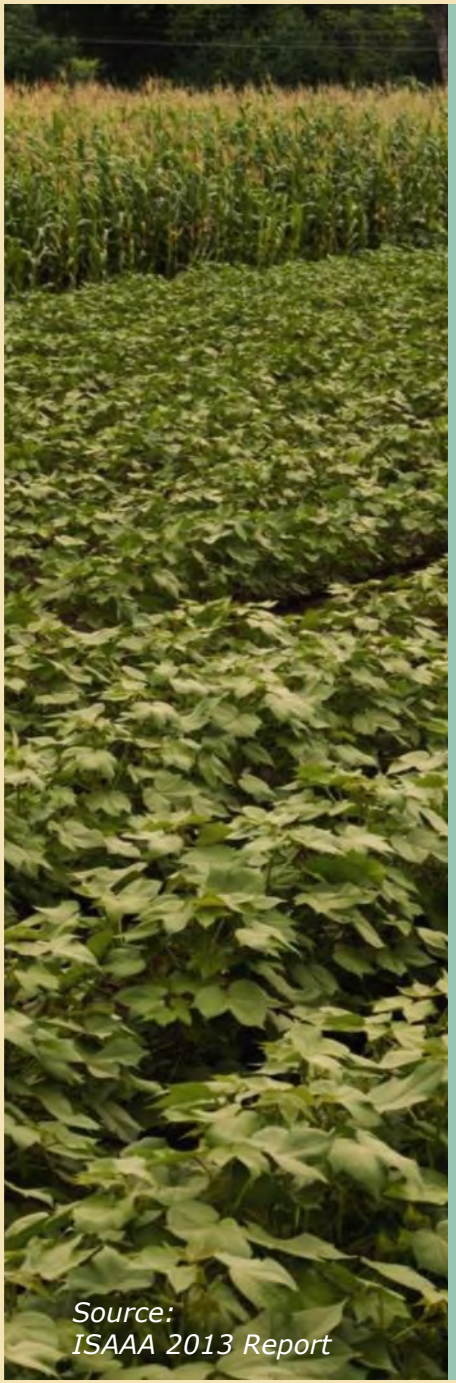
Economic gains of ~US$116.9 billion were generated globally by biotech crops between 1996 to 2012.

58% Due to reduced production costs

42% Due to substantial yield gains of **377 million tons**

Biotech cotton in developing countries has already made a significant contribution to the income of >16.5 million smallholder resource-poor farmers in 2013.

Source: ISAAA 2013 Report



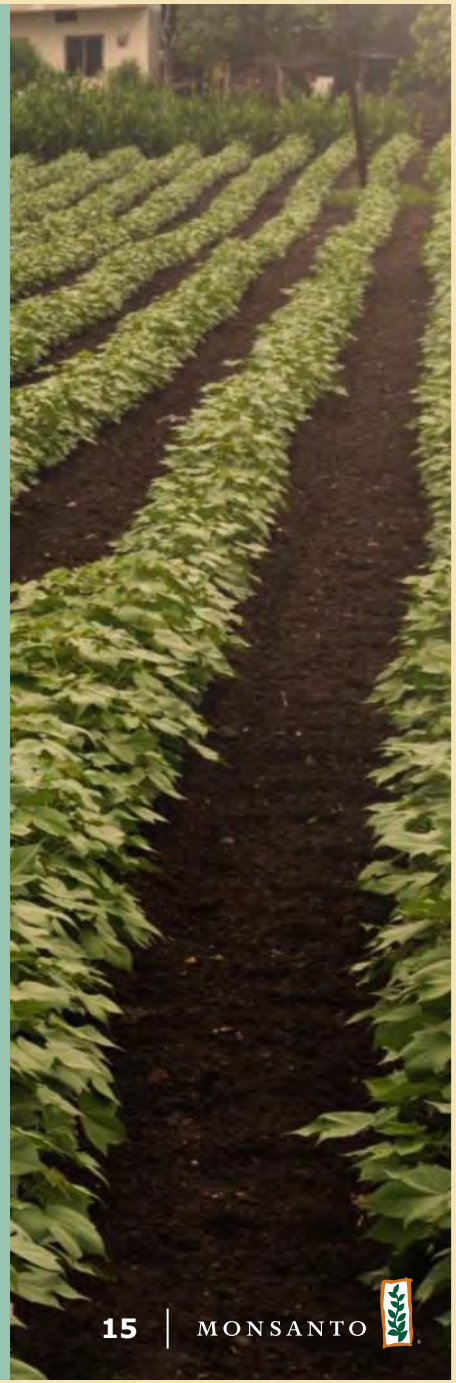
Environmental Benefits

The reduction in pesticides from 1996 to 2012 was estimated at **497 million kilograms** or **18.5% reduction**

In 2012 alone, biotech helped prevent an estimated **26.7 billion kg of CO_2 emissions**, equivalent to removing **11.8 million cars** from the road for a year.

Without biotech, it would take an additional **123 million hectares** to produce the same amount of food produced in 2012.

Source:
ISAAA 2013 Report

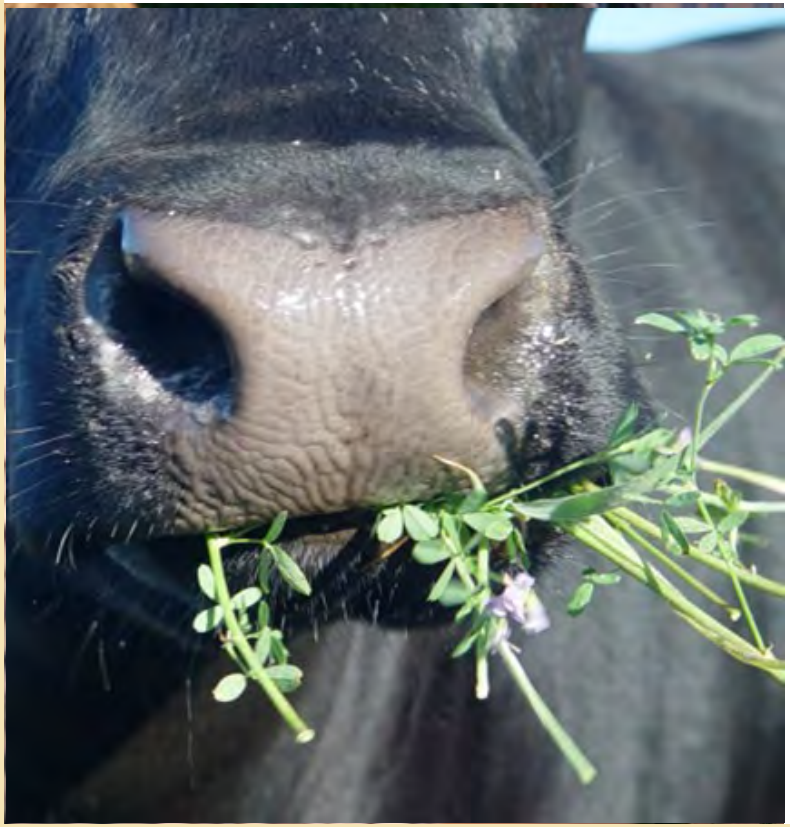


Consumer Benefits

- Corn based products would be 6% higher
- Soy based products would be 10% higher
- The drop in price of food is due to increased productivity by farmers, which have arisen via the adoption of new technologies

If livestock eat GMO grain, there will be GMOs in my meat….

MYTH



GE crops are digested in the same way as conventional crops

- In the U.S., livestock have been consuming feed made from GM crops for almost 20years.
- GMOs have never been detected in the milk, meat or eggs derived from animals fed GM feed.
- Feeding livestock GE crops is equivalent to feeding conventional feed sources in terms of nutrient composition, digestibility and feeding value.

Stand by The Science

World Health Organization	American Medical Association Council on Science and Public Health	
FEBRUARY 2002	JUNE 2012	
American Council on Science and Health	Anne Glover, European Commission Chief Scientific Advisor	U.S. Food and Drug Administration
FEBRUARY 2013	JULY 2012	MAY 2013
American Dietetic Association	European Academies Science Advisory Council	The Royal Society
FEBRUARY 2006	JUNE 2013	FEBRUARY 2002

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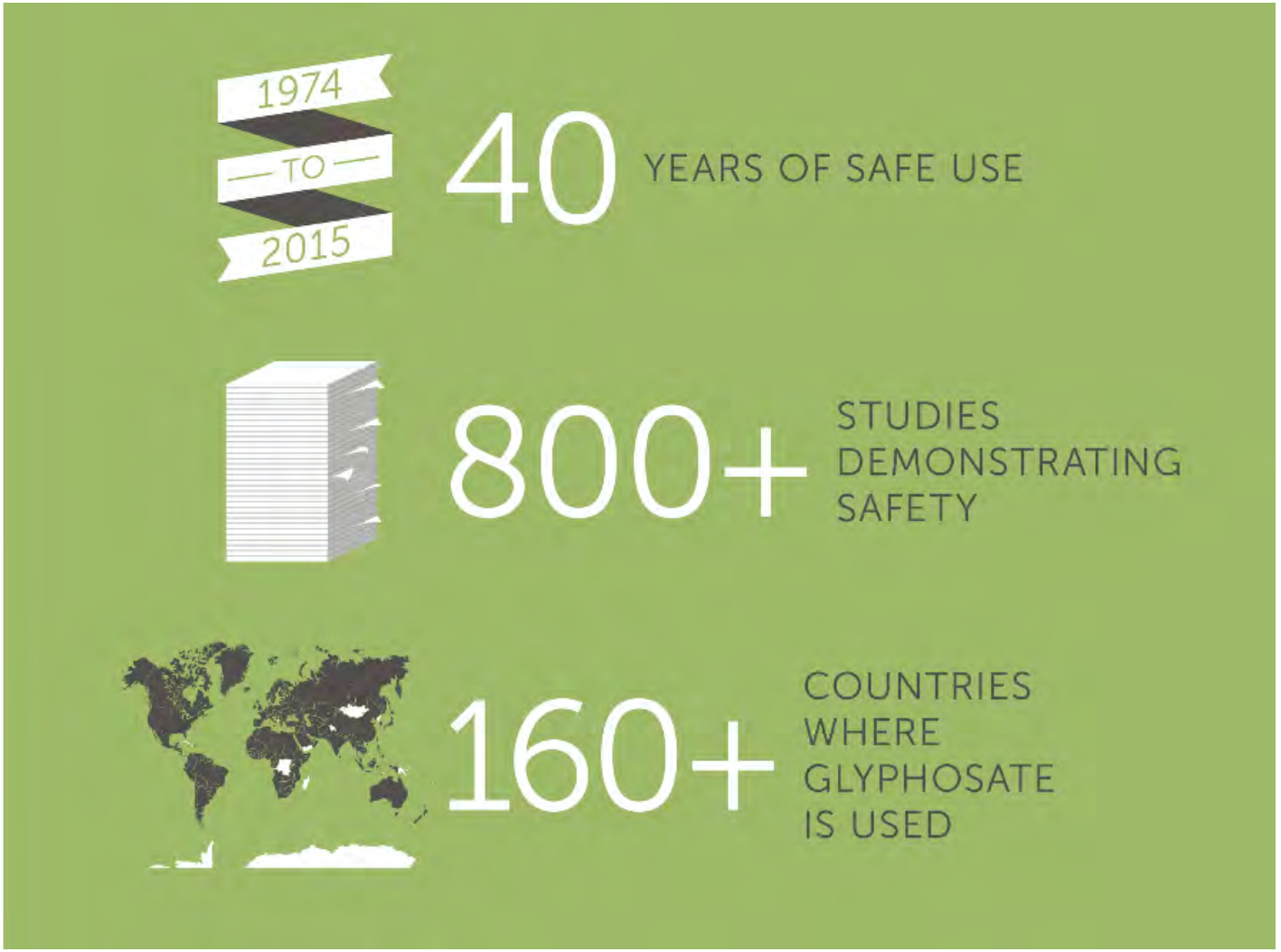
Glyphosate continues to be one of the safest tools on the market



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The experts consistently agree on glyphosate safety

1991: EPA placed glyphosate in the agency's lowest cancer classification (Category E) evidence of non-carcinogenicity for humans
1994: WHO states Animal studies show that glyphosate is not carcinogenic
2000: Williams et al peer-reviewed assessment: Multiple lifetime feeding studies have failed to demonstrate any tumorigenic potential for glyphosate
2002: The European Commission review: No evidence of carcinogenicity and is Not genotoxic
2004: WHO study of carcinogenicity in mice: no toxic effects observed at up to the highest dose tested
2012: Kier and Kirkland: glyphosate and typical GBFs are not genotoxic in these core assays
2012: Mink et al: no pattern of associations indicating relationship between total cancer to glyphosate
2013: Australian Pesticides and Veterinary Medicines Authority(APVMA): no data suggesting glyphosate present any unacceptable risks to human health
2013: APMVA: evidence shows that glyphosate is not genotoxic, carcinogenic or neurotoxic
2014: Glyphosate Reevaluation Assessment Report Germany Rapporteur Member State for the European Annex I Renewal of Glyphosate: there was no evidence of carcinogencity there were no effects on fertility, reproduction and development or of neurotoxicity that might be attributed to glyphosate.

For more information: http://www.monsanto.com/products/pages/roundup-safety-background-materials.aspx

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Is teaching others <u>about</u> what you do

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gmo answers *gmoanswers.com*