



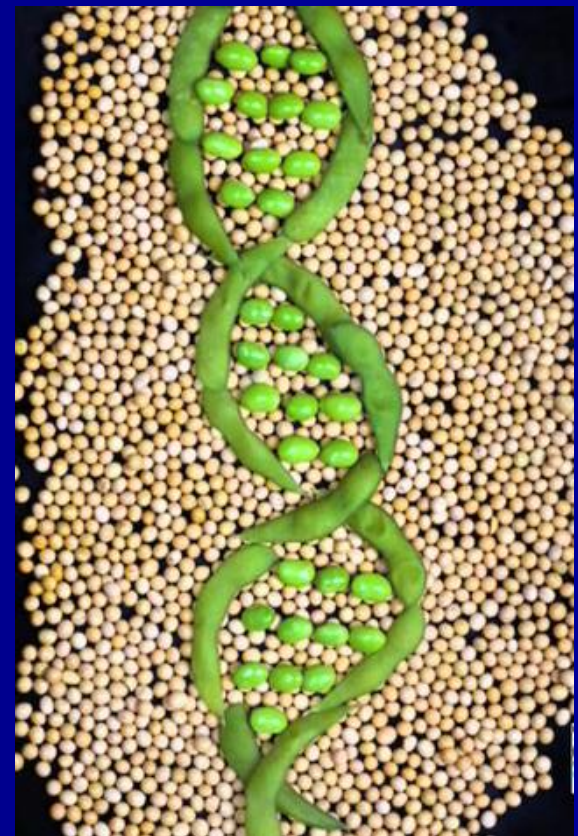
“GMO: Why It’s Safe For You and Animals and How to Talk to Consumers About It?”

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What are GMOs? Genetically modified organisms – too general of a term!!



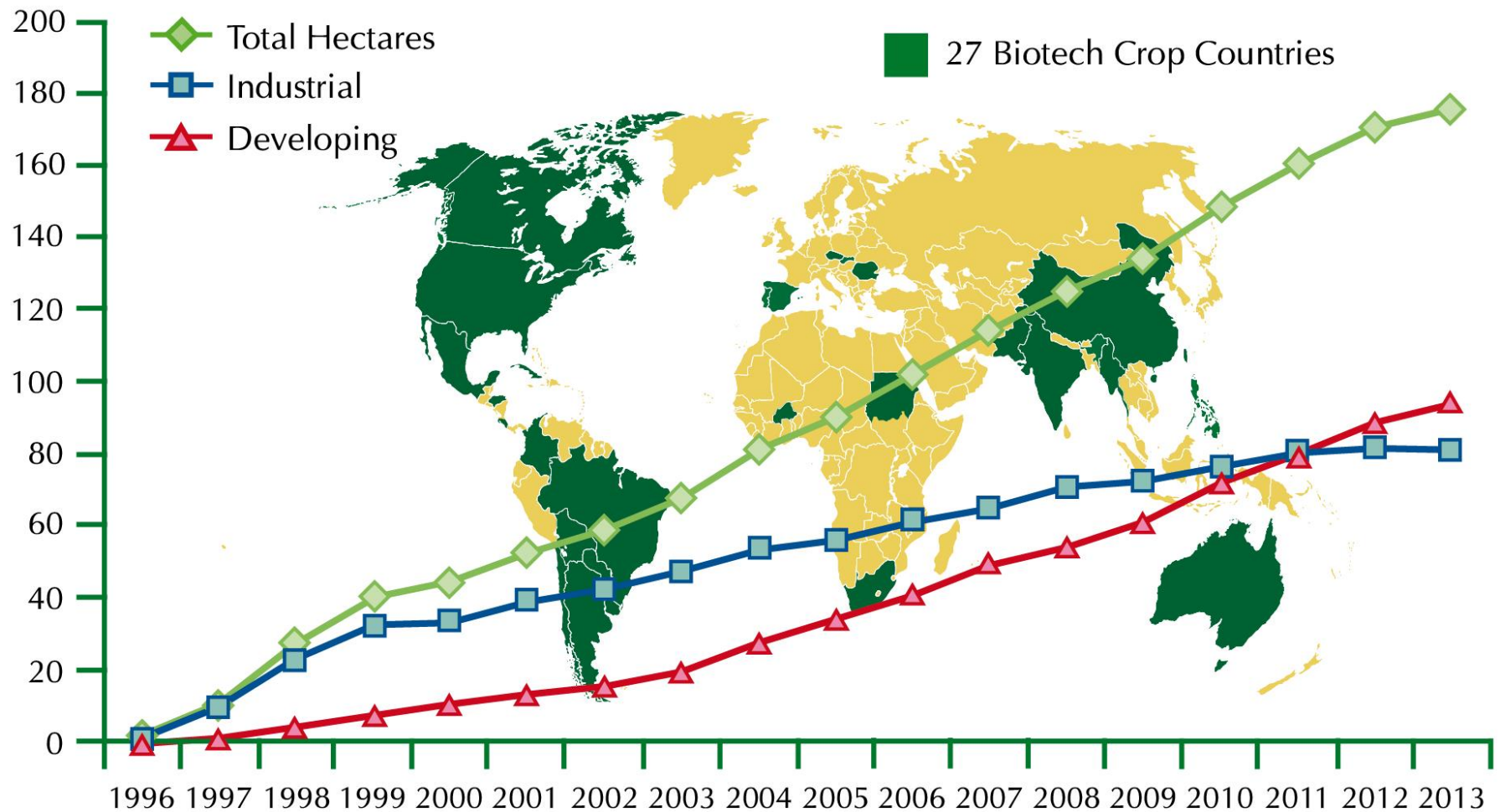


I prefer the term genetic engineering (GE) as it means something specific

- The USDA's current definition of genetic engineering is “manipulation of an organism’s genes by introducing, eliminating or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant DNA (rDNA) techniques.”
- Also known as genetically modified, GM, GMO, transgenic, bioengineered, biotech, made with modern biotechnology, Frankenfood



Global Area of Genetically Engineered (GE) crops Million hectares (1996-2013)



A record 18 million farmers, in 27 countries, planted 175.2 million hectares (433 million acres) in 2013, a sustained increase of 3% or 5 million hectares (12 million acres) over 2012.



What crops are GE in US?

- 
- ✓ 90% of all **corn** planted in U.S. was GE in 2013
 - ✓ 90% of all **cotton** planted in U.S. was GE in 2013
 - ✓ 93% of all **soybeans** planted in U.S. was GE in 2013
 - ✓ 95% of all **sugar beet** planted in U.S. was GE in 2013
 - ✓ 90% of all **alfalfa** seeds sold in US were GE in 2013
 - ✓ Also canola, papaya, some squash, melons and sweetcorn

NON-GE FEEDSTUFFS CURRENTLY INCLUDE

- Wheat
- Sorghum
- Oats
- Rice
- Millett
- Barley

Genetically engineered citrus greening (also called huanglongbing or HLB)-resistant citrus trees – research lead by public-sector researcher (Texas A&M)



**Engineering Innate GE potato
to reduce levels of acrylamide,
a potential carcinogen and
known neurotoxin, developed
by J. R. Simplot, Idaho**

SOURCE: Wu, L., Bhaskar, P.B., Busse, J.S., Zhang, R., Bethke, P.C. and Jiang, J. 2011. Developing Cold-Chipping Potato Varieties by Silencing the Vacuolar Invertase Gene. Crop Science 51: 981-990.



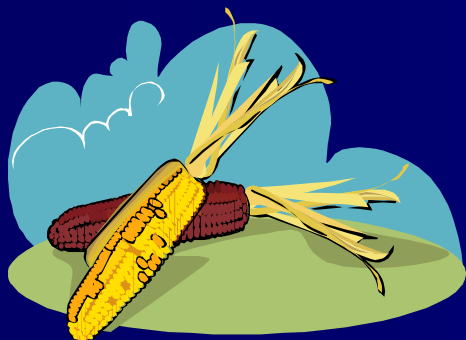
Non-browning “Artic” GE apple, developed by Okanagan Specialty Fruits in Canada



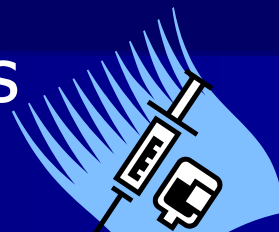
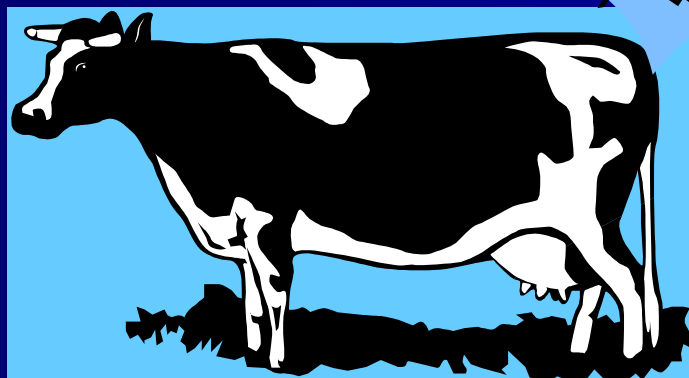
Where is GE used in Animal Agriculture?

GE products are used in animal feed, vaccines (chickens, pigs, horses, dogs, cats), pharmaceuticals, food processing aids, and food

GMO feed



rDNA vaccines
rBST



GMO food & ingredients



GE rennet, and
other food
processing aids

Currently
no GM
animals
in market





Top Ten Myths about GE food and feeding GE crops to livestock

1. There is scientific uncertainty/lack of consensus about safety of GE





There is scientific consensus

600+ published safety assessments

An estimated 2 trillion meals containing GE ingredients have been eaten around the world over the last 16 years without a single substantiated case of ill-health.

Some summary statements of leading science organizations include:

- “No effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved.”(World Health Organization)
- “No adverse health effects attributed to genetic engineering have been documented in the human population.” (National Academy of Sciences)
- “The science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe.” (American Association for the Advancement of Science)
- “There is no scientific justification for special labeling of bioengineered foods. Bioengineered foods have been consumed for close to 20 years, and during that time, no overt consequences on human health have been reported and/or substantiated in the peer-reviewed literature.” (American Medical Association)
- “No scientific evidence associating GMOs with higher risks for the environment or for food and feed safety than conventional plants and organisms.” (European Commission)



There is a scientific consensus: Professional Scientific and/or Medical bodies with an opinion on safety of GE

Generally Positive

- ✓ The U.S. National Research Council (NRC)
- ✓ U.S. National Academy of Sciences (NAS)
- ✓ The American Medical Association, (AMA)
- ✓ U.S. Department of Agriculture (USDA)
- ✓ U.S. Environmental Protection Agency (EPA)
- ✓ U.S. Food and Drug Administration (FDA)
- ✓ European Food Safety authority (EFSA)
- ✓ American Society for Plant Biology (ASPB)
- ✓ Federation of Animal Science Societies (FASS)
- ✓ World Health Organization (WHO)
- ✓ Food and Agriculture Organization (FAO)
- ✓ Royal Society (London)
- ✓ Brazil National Academy of Science,
- ✓ Chinese National Academy of Science
- ✓ Indian National Academy of Science
- ✓ Mexican Academy of Science
- ✓ Third World Academy of Sciences

Generally Negative

x The American Academy of
Environmental Medicine (AAEM)

The AAEM also opposes

- water fluoridation
- the use of mercury-containing compounds in any product for human consumption, including mercury in vaccines
- radiofrequency (RF) exposure from wireless devices *"because multiple studies correlate RF exposure with diseases such as cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity."*

Quackwatch.org lists AAEM as a questionable organization, and its certifying board, the American Board of Environmental Medicine as a dubious certifying board. The AAEM is not recognized by the American Board of Medical Specialties.



Top Ten Myths about GE food and feeding GE crops to livestock

1. There is scientific uncertainty/lack of consensus about safety of GE
2. There have been no independent safety studies on GE crops





There have been hundreds of animal feeding studies using GE crops

Animal species/ category	Number of experiments	Nutritional assessment
Ruminants		No unintended effects in composition (except lower mycotoxin concentration in Bt-plants)
Dairy cattle	23	
Beef cattle	14	
Others	10	
Pigs	21	No significant differences in digestibility and poultry health as well as no biological relevant unintended effects on performances of animals and composition of food of poultry origin
Poultry		
Broilers	48	
Laying hens	12	
Other poultry	1	
Others (fish, rabbits etc.)	8	



FASS maintains a list of animal feeding studies with GE crops; and transgenic DNA and protein in livestock products



← → FASS http://www.fass.org/page.asp?pageID=43 🔍 ↻ FASS Federation of Animal Scien... x

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 Federation of Animal Science Societies®



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Scientific References

FASS is committed to assisting in the dissemination of scientific information to accomplish our goal for the pursuit of scientific and educational good of animal agriculture. To support this effort, we have assembled the following list of references. We hope that you find value in this list of scientific articles, organized by topic and species when planning your research.

References - Feeding Transgenic Crops to Livestock

 [PDF Available](#)

Updated May 2012

References Pertaining to Transgenic DNA and Protein and Livestock Products (Meat, Milk, Eggs)

 [PDF Available](#)

Updated April 2012



Top Ten Myths about GE food and feeding GE crops to livestock

1. There is scientific uncertainty/lack of consensus about safety of GE
2. There have been no independent safety studies on GE crops
3. There have been no long term studies on the effects of GE crops





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Review

Assessment of the health impact of GM plant diets in long-term and multigenerational animal feeding trials: A literature review

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^d Laboratoire Physiologie Cellulaire Végétale, CNRS – Université Joseph Fourier – INRA, Institut de Recherches en Technologies et Sciences pour le Vivant, 38054 Grenoble, Cedex 9, France

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Multigenerational studies

Systematic review

ABSTRACT

The aim of this systematic review was to collect data concerning the effects of diets containing GM maize, potato, soybean, rice, or triticale on animal health. We examined 12 long-term studies (of more than 90 days, up to 2 years in duration) and 12 multigenerational studies (from 2 to 5 generations). We referenced the 90-day studies on GM feed for which long-term or multigenerational study data were available. Many parameters have been examined using biochemical analyses, histological examination of specific organs, hematology and the detection of transgenic DNA. The statistical findings and methods have been considered from each study. Results from all the 24 studies do not suggest any health hazards and, in general, there were no statistically significant differences within parameters observed. However, some small differences were observed, though these fell within the normal variation range of the considered parameter and thus had no biological or toxicological significance. If required, a 90-day feeding study performed in rodents, according to the OECD Test Guideline, is generally considered sufficient in order to evaluate the health effects of GM feed. The studies reviewed present evidence to show that GM plants are nutritionally equivalent to their non-GM counterparts and can be safely used in food and feed.

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Meta-analysis of long-term and multigenerational animal feeding trials

- Published long-term feeding studies using a GE-based diet ranged from 110-728 days
- The longest multigenerational study involved 10 generations.
- The authors concluded that none of the long-term or multigenerational studies they evaluated revealed any new effect that had not been found in the 90-d rodent toxicology study

"The studies reviewed present evidence to show that GM plants are nutritionally equivalent to their non-GM counterparts and can be safely used in food and feed."

Snell C, Bernheim A, Berge JB, Kuntz M, Pascal G, Paris A, Ricroch AE. 2012. **Assessment of the health impact of GM plant diets in long-term and multigenerational animal feeding trials: a literature review.** *Food Chem Toxicol* **50**:1134–1148.





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However poorly-designed, sensational studies on small numbers of animals get all the media attention with no mention of the hundreds of other independent studies finding no effect of GE feed (e.g. Seralini *et. al.* 2012 *Food Chem Toxicol* 50:4221–4231)



Control image downloaded from <http://www.ratfanclub.org/mamtumpics.html>
Approx. 70% of female Sprague–Dawley rats get mammary tumors by 2 years of age



This rat study (subsequently retracted by the journal) was given a lot of coverage by popular media, including the Dr. Oz Show





The majority of the more than 100 billion food animals raised in the US between 2000-2011 consumed varying levels of GE feed.



Industry ^a	U.S. ^b
Broiler	105,426,000,000
Beef cattle	410,000,000
Dairy Cows	35,000,000
Hogs	105,000,000
Total	105,976,000,000

^a Numbers for broilers, hogs (barrows and gilts) and beef cattle (steers) are for slaughtered animals during calendar year. Dairy animals are number of dairy cows in a calendar year divided by three to account for three lactations per animal.

^b USDA: The USDA Economics, Statistics and Market Information System (ESMIS). 2013
<http://usda.mannlib.cornell.edu/MannUsda/homepage.do>.



Global livestock populations have been eating predominately GE feed for well over a decade

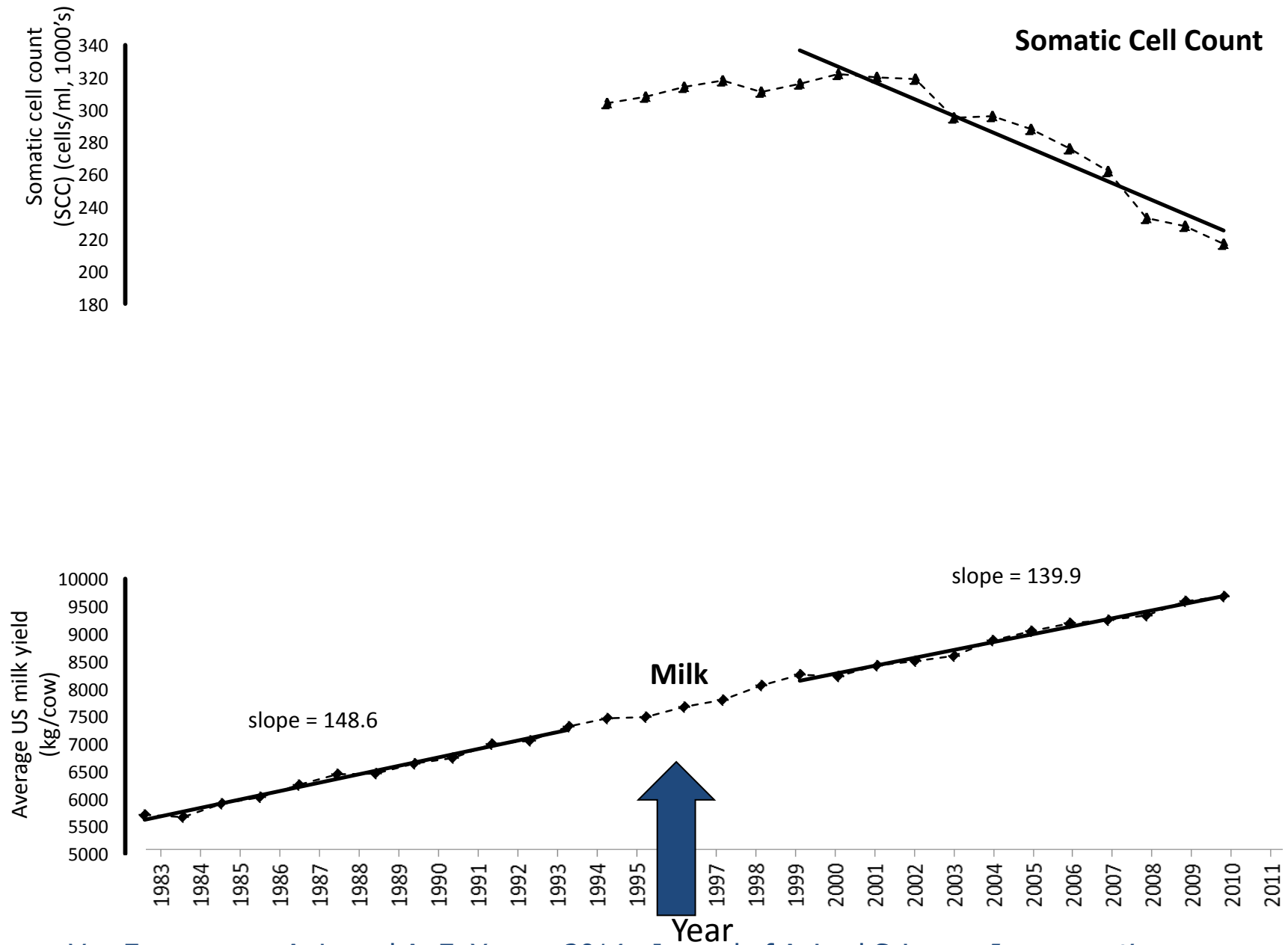
70-90% of harvested GE biomass is fed to food producing animals



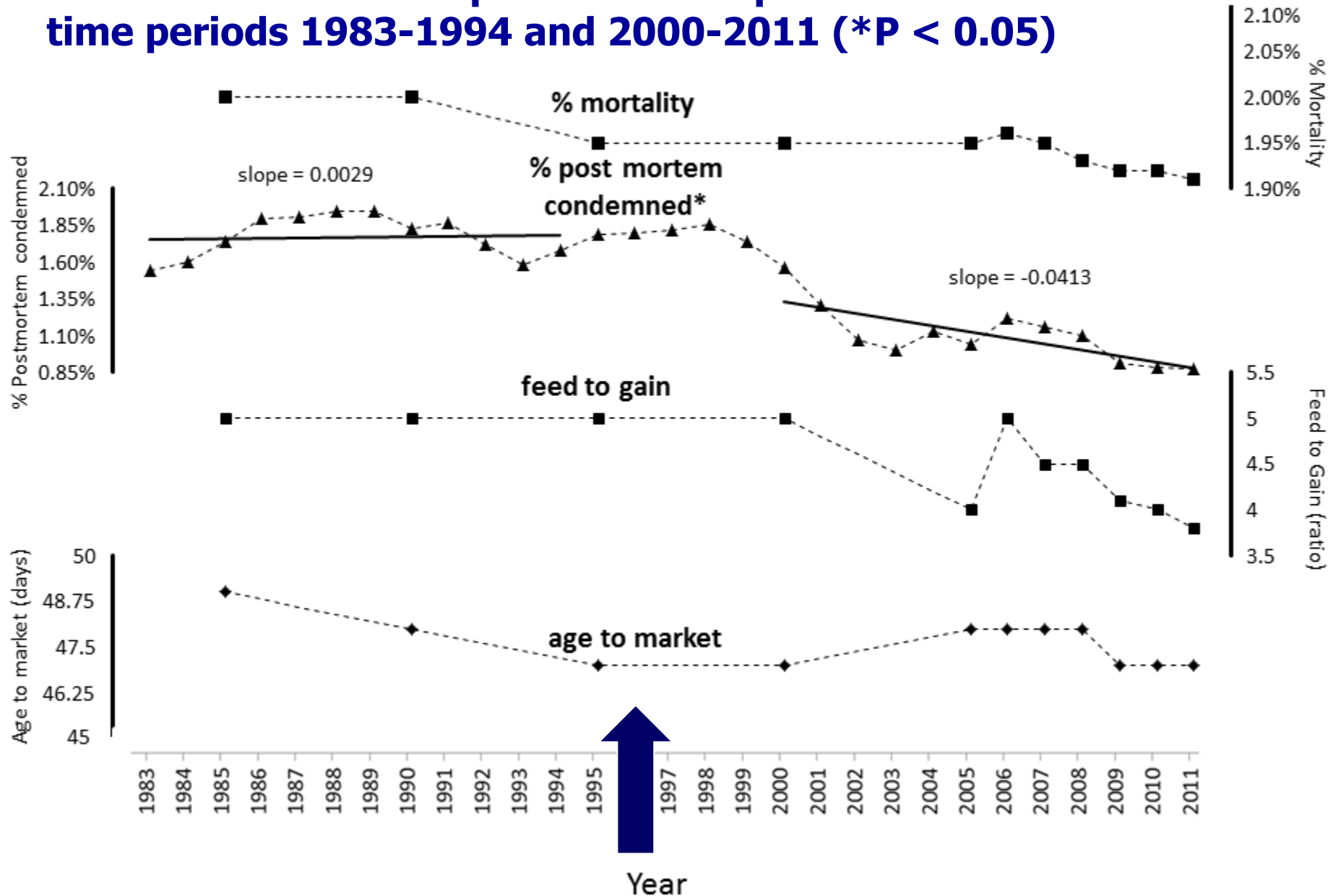
Flachowsky G, Schafft H, Meyer U: 2012 **Animal feeding studies for nutritional and safety assessments of feeds from genetically modified plants: a review.** (*Journal of Consumer Protection and Food Safety*) :179–194.



Milk production and somatic cell counts (SCC) in US dairy cattle prior to and subsequent to the introduction of GE crops in 1996



US broiler statistics prior to and subsequent to the introduction of GE crops in 1996. Slope differs between time periods 1983-1994 and 2000-2011 (*P < 0.05)



Top Ten Myths about GE food and feeding GE crops to livestock



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5. Meat, milk and eggs from animals that have eaten GE crops is unsafe/different/dangerous



Does it affect livestock (milk, meat, eggs) from animals eating GE feed?

- No GE rDNA or the newly expressed proteins encoded have ever been found to be present in the milk, meat, or eggs from animals that have eaten GE feed in many peer-reviewed studies in different animals
- It is not possible to distinguish any differences in the nutritional profile of animal products following consumption of GE feed
- **Labeling of such animal products is not currently mandatory in either US or Europe.**





Freely available publication from Council for Agricultural Science and Technology (<http://www.cast-science.org>)

CAST[®] Issue Paper

Number 34
July 2006

Safety of Meat, Milk, and Eggs from Animals Fed Crops Derived from Modern Biotechnology

Animal Agriculture's Future through Biotechnology, Part 5

SUMMARY

As the global land area of biotechnology-derived crops modified for agronomic input traits such as herbicide tolerance and/or insect resistance continues to increase, these crops have become an increasingly important source of feed-stuffs for farm animals, and it is important to review the safety of meat, milk, and eggs derived from animals fed these crops. Once the safety of the newly expressed protein has been established, then nutritional equivalence between



Safety of Meat, Milk, and Eggs from Animals Fed Crops Derived from Modern Biotechnology

<http://www.cast-science.org/download.cfm?PublicationID=2910&File=1e30ecea828a9b1ea77c6773b63647251564TR>



Top Ten Myths about GE food and feeding GE crops to livestock

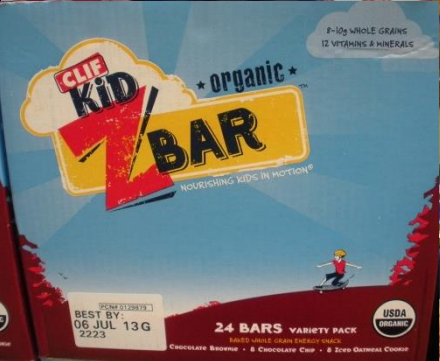
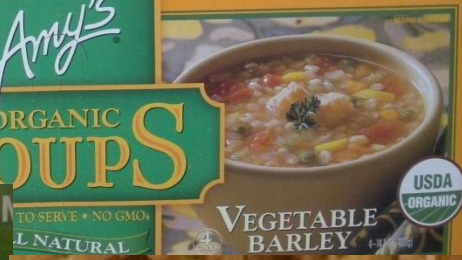
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Mandatory labeling of GE food

Consumers who want non-GE food have a choice already – voluntary labeling

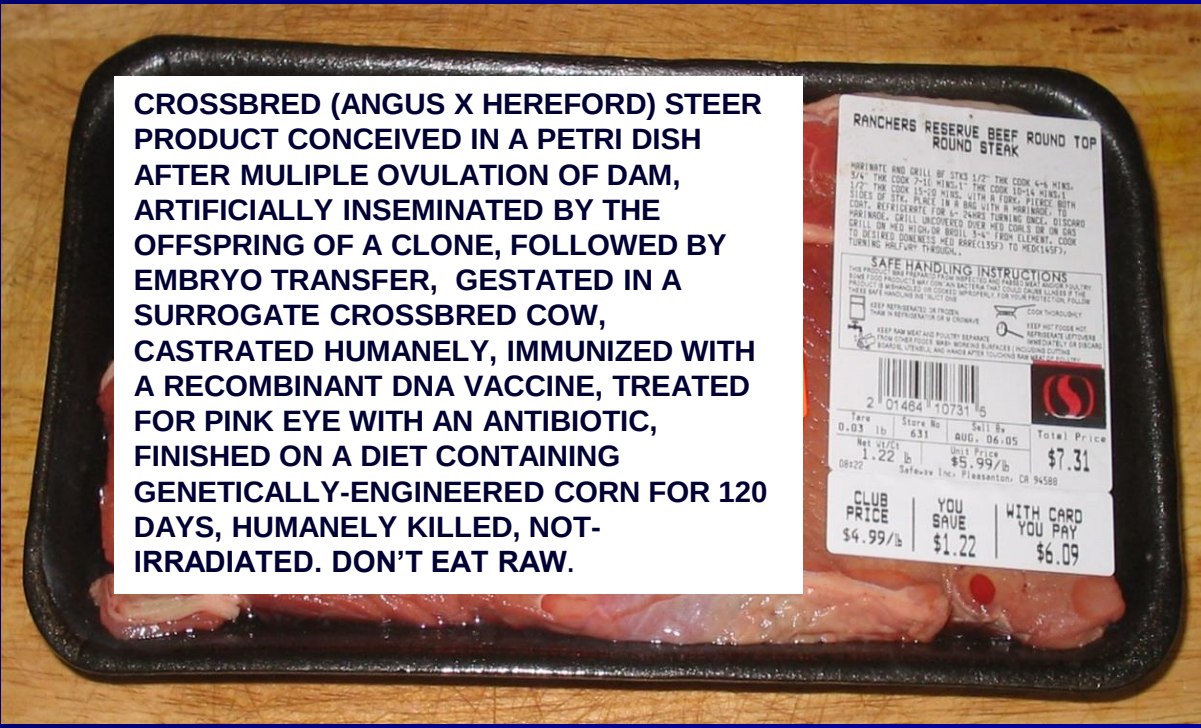






Mandatory process-based labeling singles out GE process in absence of difference in product – there are many processes used in food production

What would be the implications of mandatory consumer “right to know” process-based labeling about all production processes used in obtaining animal products?





**Chobani uses milk from cows fed GMOs.
How “natural” is THAT?**



Monsanto Latte?

**Tell Starbucks to serve
only organic, non-GMO milk.**

GMOiNSiDE
Coalition Powered by Green America



Mandatory GE labeling in other countries has actually removed GE choice from the marketplace



- ***"Our objective is to eliminate GMOs [from the US food supply] but we also see GMO labeling as a useful tool in the meantime because we know that transitioning to a non-GMO supply chain will take time".***
Elizabeth O'Connell, campaigns director for GMO Inside/Green America, 2014
<http://www.foodnavigator-usa.com/Markets/GMO-Inside-calls-on-Starbucks-to-source-organic-milk-from-cows-not-fed-GM-feed>
- **"How – and how quickly – can we move healthy, organic products from a 4.2% market niche, to the dominant force in American food and farming? ...The first step is to change our labeling laws."**
Ronnie Cummings, Organic Consumers, 2012
<https://www.commondreams.org/view/2012/08/02-0>
- **"Personally I believe GM foods must be banned entirely, but labeling is the most efficient way to achieve this."**
Dr. Joseph Mercola – 2012
<http://articles.mercola.com/sites/articles/archive/2012/02/29/new-vermont-gmo-labeling-policy-officially-introduced.aspx>
- **"We are going to force them to label this food. If we have it labeled we can organize people not to buy it."**
Andrew Kimbrell – Center for Food Safety, 2013
<http://www.examiner.com/article/washington-state-s-voters-are-still-confused-as-i-522-vote-approaches>



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 5. Meat, milk and eggs from animals that have eaten GE crops is unsafe/different
 6. Food from animals that have eaten GE feed needs to carry a mandatory label to give consumers choice
 7. **Mandatory GE labeling will have no impact the price of food**



If GE labeling becomes mandatory there are different implications if food made with GE ingredients has to be labeled vs..

Until now proposed labeling initiatives/regulations have included food containing ingredients derived from GE plants unless....

EXEMPTIONS

- Animals fed "GMO feed" or treated with GE drug or vaccine (e.g. rBST)
- Any processed food made with GE processing aids
- Certified Organic food

Washington Initiative. 2012. I 2570, http://sos.wa.gov/assets/elections/initiatives/FinalText_285.pdf



In 2013 six states (MA, MO, NM, OR, TN, and WV) considered bills without the GMO feed consumption exemption; and some retailers (e.g. Whole Foods) plan to label animal products from GE-fed animals; or to use only non-GE fed animals (e.g. Chipotle)

Broiler and livestock production in U.S. during 2011 reported for organic and conventional production.

Type	Number of farms	Organic¹ Number animals	Total² Number animals	Organic as a Percent of Total
Broiler	153	28,644,354	8,683,067,000	0.3%
Beef cows	488	106,181	31,400,000	0.3%
Dairy cows	1,848	254,711	9,200,000	2.8%
Hogs	97	12,373	110,860,000	<0.1%

¹USDA. 2011 Certified Organic Production Survey.

<http://usda01.library.cornell.edu/usda/current/OrganicProduction/OrganicProduction-10-04-2012.pdf>

²USDA. 2011. The USDA Economics, Statistics and Market Information System (ESMIS).

<http://usda.mannlib.cornell.edu/MannUsda/homepage.do>.



Background in costs of organic (non-GE) feed

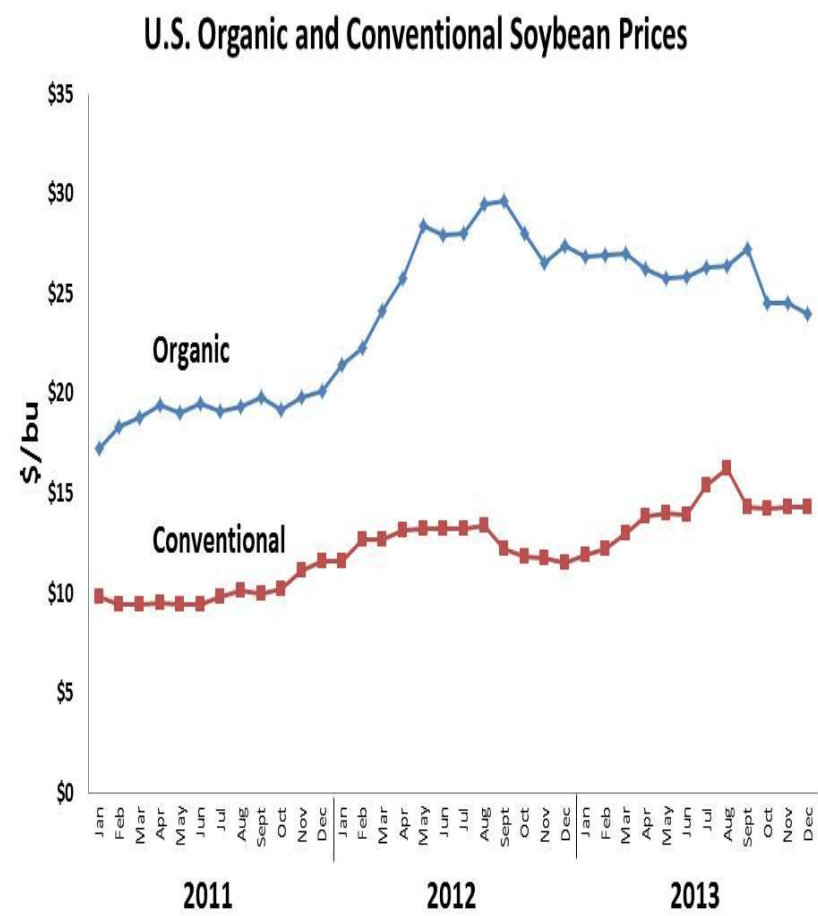
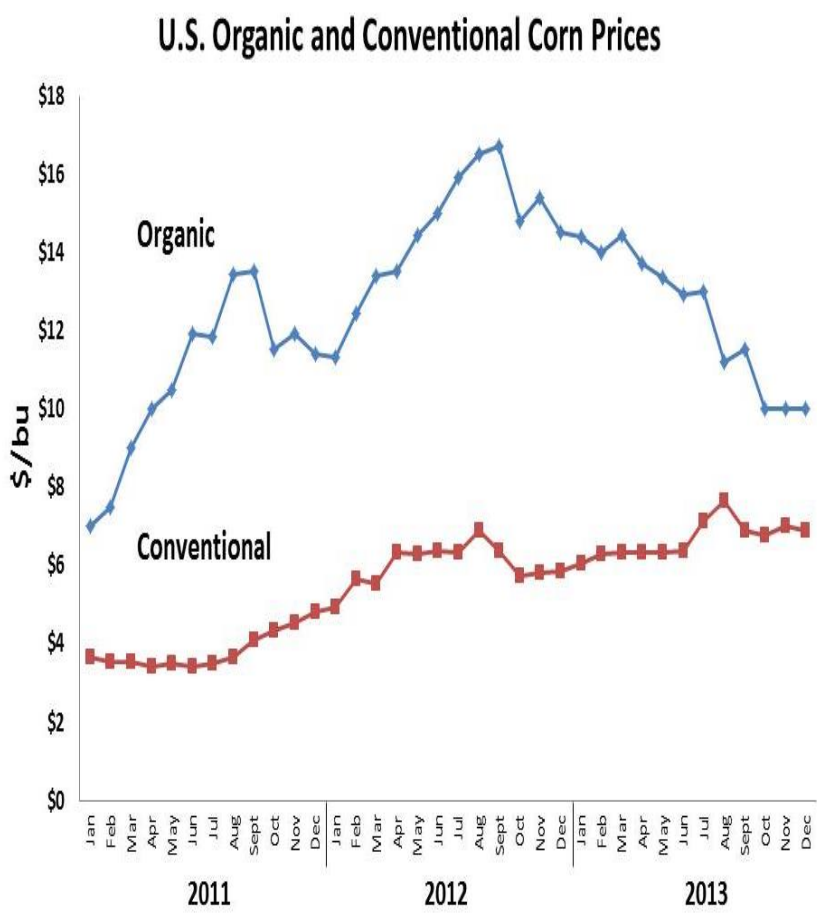


- ✓ 90% of all **corn** planted in U.S. was some form of GE in 2013
- ✓ 90% of all **cotton** planted in U.S. was some form of GE in 2013
- ✓ 93% of all **soybeans** planted in U.S. was some form of GE in 2013
- ✓ 95% of all **sugar beets** planted in U.S. was some form of GE in 2013
- ✓ 90% of all **alfalfa** seeds sold in US were GE in 2013
- Premiums for organic feeds were 57 percent above conventional feeds. In some years, organic grains may only carry premiums of 25% or so, although premiums are generally much higher, sometimes more than 100 % higher.
- Assuming enough price differential producers would respond by growing more non-GE feed – which would be more expensive as there are significant cost savings associated with growing GE crops

Non-GE crops	• Wheat	• Millett	• Rice
	• Sorghum	• Barley	• Oats



Prices received for conventional and organic corn and soybean (\$/bushel) 2011- 2013 (USDA–NASS 2013; USDA–LPS 2013).





Will shoppers be willing to pay more for Non-GE?

Shoppers Unwilling to Pay More for Non-GMO Products

Posted Tue, 2014-02-18 10:59 by **BMM**

CHICAGO — The labeling of genetically modified (GMO) food is at the center of debate across the country, but the decision to buy or not buy non-GMO food often is based on price. A recent NPD food market research study on GMO awareness and concern among consumers finds that 67 percent of all primary grocery shoppers are not willing to pay a higher price for non-GMO food.

Over half of U.S. consumers express some level of concern about genetically modified organisms, but when asked to describe GMOs, many primary grocery shoppers are unclear. The NPD study, **Gauging GMO Awareness and Impact**, thinks that is likely a factor in the unwillingness of shoppers to pay a higher price for non-GMO food. Also unclear to consumers is the prevalence of GMO versus non-GMO items at the grocers. Four out of ten primary grocery shoppers feel that they mostly buy non-GMOs while the same ratio of consumers says they are not sure.



GMO corn field on the island of Oahu, Hawaii. Photo by BMM



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6. Food from animals that have eaten GE feed needs to carry a mandatory label to give consumers choice
7. Mandatory labeling will have no impact the price of food
8. **GE crops have no benefit to farmers or the environment and have resulted in a huge increase in the use of pesticides**



Globally there are substantial benefits from GE crops

- "From 1996 to 2012, biotech crops contributed to Food Security, Sustainability and the Environment/Climate Change by: increasing crop production valued at US\$116.9 billion; providing a better environment, by saving 497 million kg a.i. of pesticides; in 2012 alone reducing CO₂ emissions by 26.7 billion kg, equivalent to taking 11.8 million cars off the road for one year; conserving biodiversity by saving 123 million hectares of land from 1996-2012; and helped alleviate poverty for >16.5 million small farmers and their families totalling >65 million people, who are some of the poorest people in the world"¹.
- Biotech crops are essential but are not a panacea and adherence to good farming practices such as rotations and resistance management, are a must for biotech crops as they are for conventional crops².

1. International Service for the Acquisition of Agri-Biotech Applications www.isaaa.org/ ;

2. Carpenter J.E. (2013). "The socio-economic impacts of currently commercialised genetically engineered crops," *International Journal of Biotechnology*, 12 (4) 249. DOI: 10.1504/IJBT.2013.059248



In the US there have been substantial benefits from GE crops



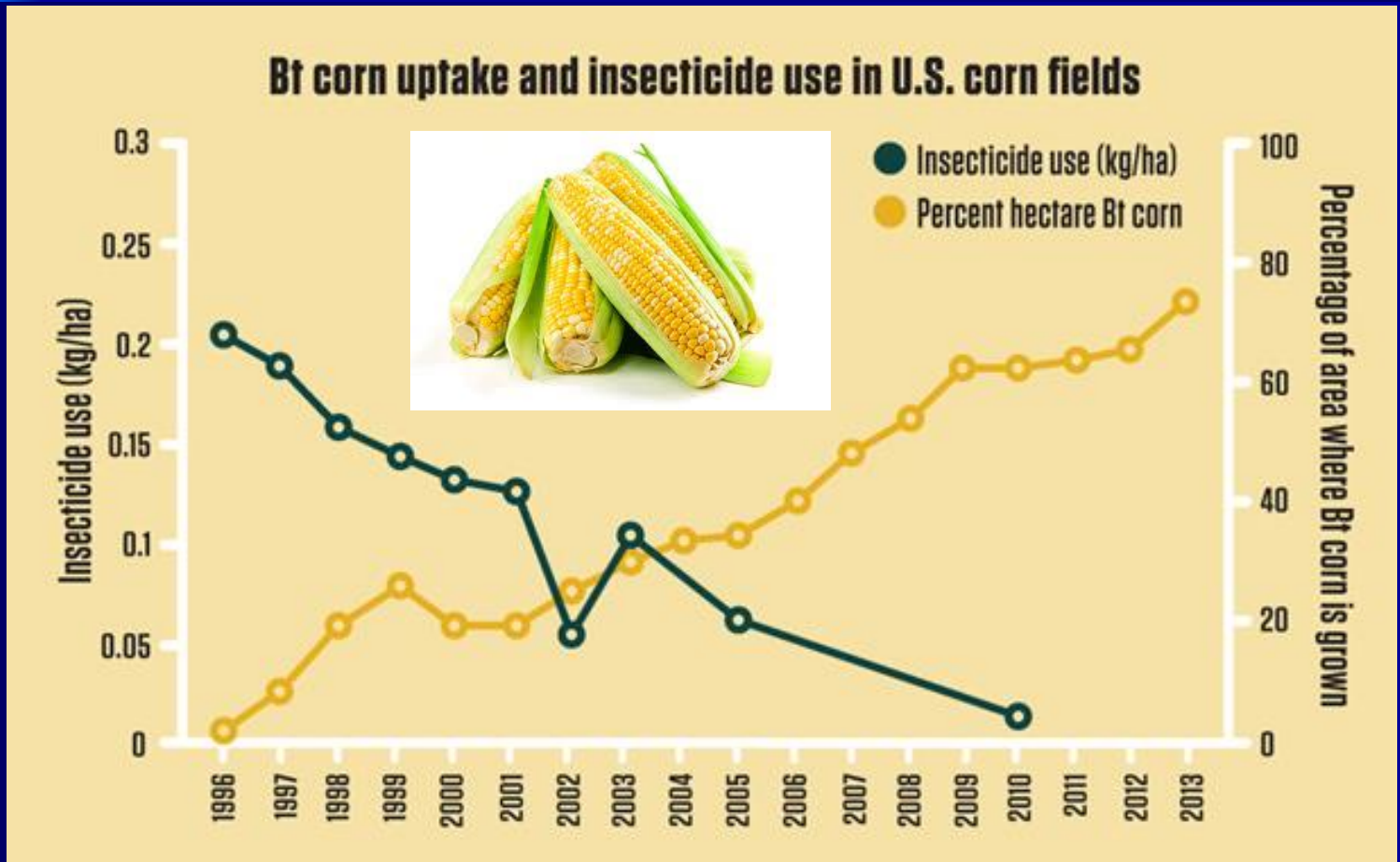
Since GE seeds were introduced in the mid-1990s, farmers have opted for these products. A recent report from the National Research Council of the **U.S. National Academy of Sciences**, "The Impact of Genetically Engineered Crops on Farm Sustainability in the United States," offers an insight as to why. The report concludes that U.S. farmers growing biotech crops "***..are realizing substantial economic and environmental benefits — such as lower production costs, fewer pest problems, reduced use of pesticides, and better yields — compared with conventional crops.***"

National Research Council. Impact of Genetically Engineered Crops on Farm Sustainability in the United States . Washington, DC: The National Academies Press, 2010. See also

Fernandez-Cornejo, Jorge, Seth Wechsler, Mike Livingston, and Lorraine Mitchell. *Genetically Engineered Crops in the United States*, ERR-162 U.S. Department of Agriculture, Economic Research Service, February 2014.



Overall insecticide use in the United States has declined 0.6% per year



<http://www.washingtonpost.com/blogs/wonkblog/files/2013/08/bt-corn.png>



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 8. GE crops have no benefit to farmers or the environment and have resulted in a huge increase in the use of pesticides
 9. **The world does not need GE feed for its livestock populations**

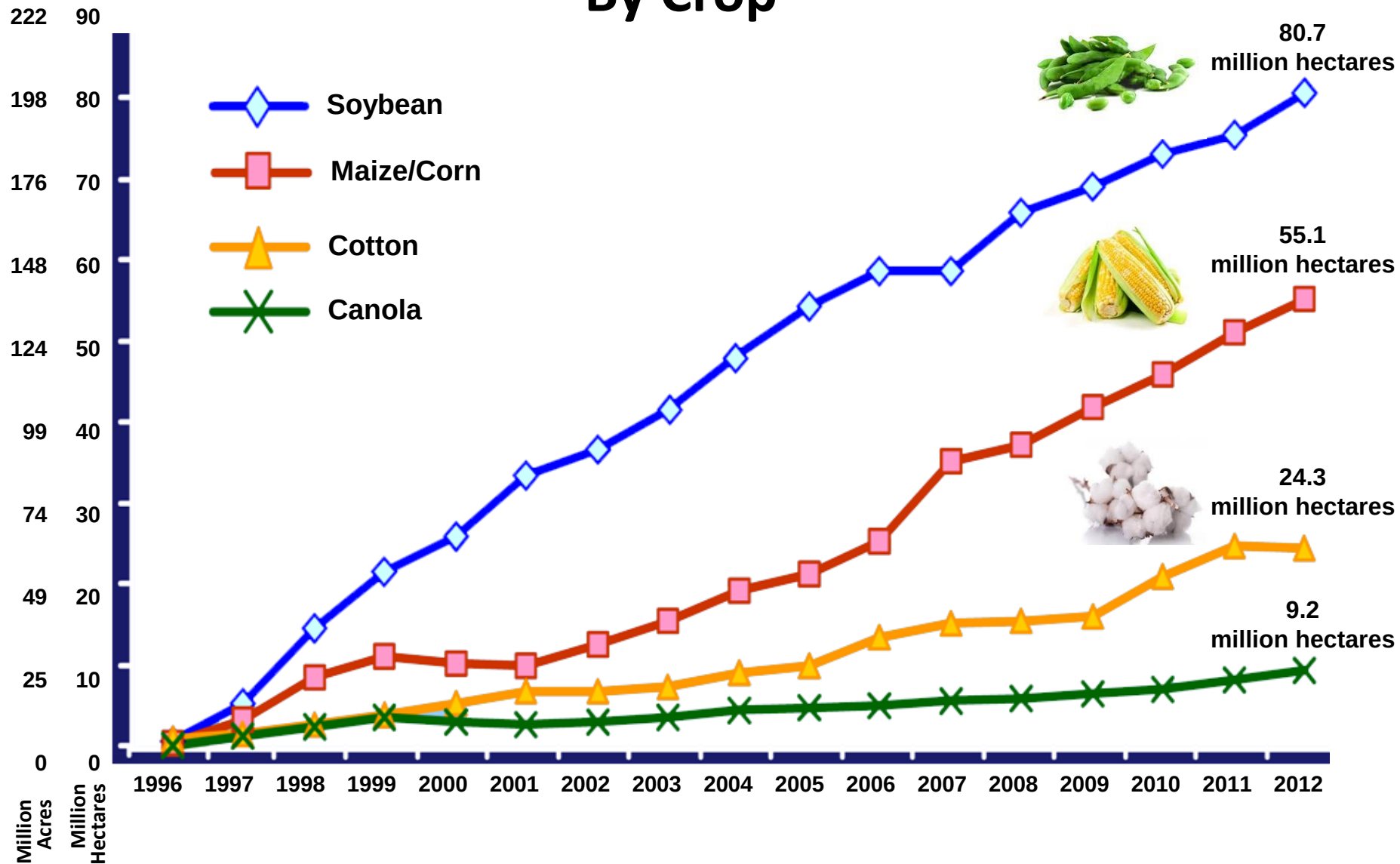


When are the yield benefits that have been derived from adoption of GE crops?

GE technology has added 110 million tonnes of soybeans and 195 million tonnes of maize to global production of these crops since the introduction of GE crops in the mid-1990s.

Brookes G, Barfoot P: **The global income and production effects of genetically modified (GM) crops 1996–2011.** *GM Crops and Food: Biotechnology in Agriculture and the Food Chain* 2013, **4**:74–83.

Global Area of Genetically Engineered (GE) Crops 1996 – 2012 By Crop





Share of global crop trade accounted for by GE crops 2011/12 (million tonnes)

	Soybeans	Maize (Corn)	Cotton	Canola
Global production	238	883.5	27.0	61.6
Global trade (exports)	90.4	103.4	10.0	13.0
Share of global trade from GE producers	88.6 (98%)	70.0 (67.7%)	7.15 (71.5%)	9.9 (76%)
Share of global trade that may be GE	96.7%	67.7%	71.5%	76%

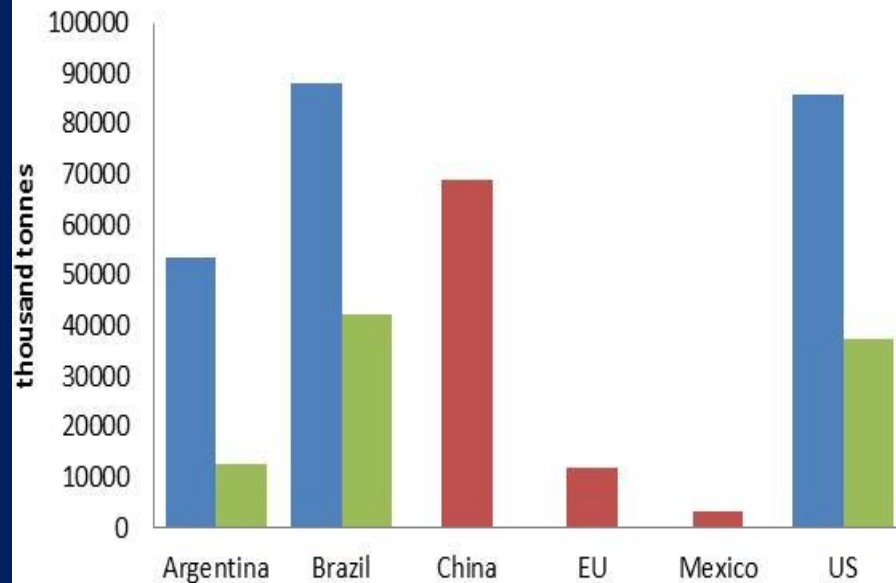
Brookes G, Barfoot P: 2013 GM crops: global socio-economic and environmental impacts 1996–2011. PG Economics Ltd: UK; www.pgeconomicscouk/pdf/2013globalimpactstudyfinalreportpdf.

China and the EU are large importers of GE soybeans

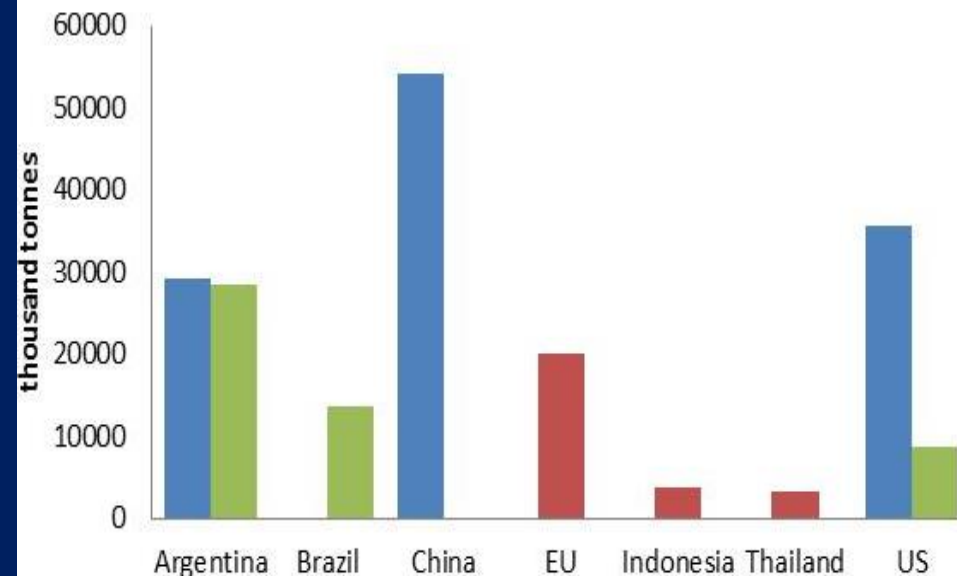
Three top producers, importers and exporters of soybeans and soybean meal (thousand tonnes)

■ Production ■ Imports ■ Exports

Soybeans - 2013



Soybean Meal - 2013



Oilseeds world market and trade. September 2013 <http://www.fas.usda.gov/oilseeds/Current>



German poultry sector ends avoidance of GMO soy in feed

No Comments Posted Feb. 18th, 2014 by Reuters News Service



HAMBURG, Feb 18 (Reuters) – German poultry producers have given up a promise to consumers to avoid feeding birds with soy containing genetically-modified organisms (GMOs) because of lower supplies of non-GMO soybeans, poultry producers association BBH said on Tuesday.

Brazil, the main bulk supplier of GMO-free soybeans, was likely to cut its supplies of GMO-free soybeans by 50 percent this year partly because of cross-pollination with conventional beans, the association said.

The danger of cross-contamination between GMO and conventional crops during transport has also risen, it said.

“Feeding for chicken and turkey production in Germany without use of genetic technology can no longer be undertaken,” the association said. “Specialist feed factories for production of poultry feed requires a seamless supply chain with impeccable GMO-free soybeans, but supplies can no longer be guaranteed in the required volumes.”

The association said Germany was not alone with such problems and some British and Danish poultry producers had in the past year also given up commitments not to use GMO soybeans. <http://www.producer.com/daily/german-poultry-sector-ends-avoidance-of-gmo-soy-in-feed/>





Top Ten Myths about GE food and feeding GE crops to livestock

- 
1. There is scientific uncertainty/lack of consensus about safety of GE
 2. There have been no independent safety studies on GE crops
 3. There have been no long term studies on the effects of GE crops
 4. GE feed is making livestock populations sick (e.g. pigs with enlarged uteruses, infertility, tumors, mortality)
 5. Meat, milk and eggs from animals that have eaten GE crops is unsafe/different
 6. Food from animals that have eaten GE feed needs to carry a mandatory label to give consumers choice
 7. Mandatory labeling will have no impact the price of food
 8. GE crops have no benefit to farmers or the environment and have resulted in a huge increase in the use of pesticides
 9. The world does not need GE feed for its livestock populations
 10. All scientists that speak about this topic are industry shills; except those who speak negatively about it - they are brave martyrs



Not all scientists are industry shills
Shill: an accomplice of a hawker, gambler, or swindler who acts as an enthusiastic customer to entice or encourage others.



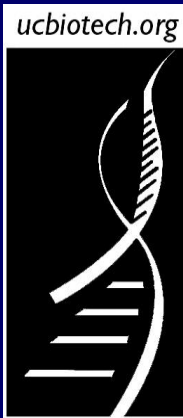


Summary

- Overwhelming consensus of data shows safety of GE feed and food
- No difference in milk, meat, or eggs from animals that have eaten GE feed – and no way to detect it (i.e. no “trace”) in animal products
- Labeling of products from animals that have (or have not) eaten GE feed – how much, how often, never ever will be very complicated – and prone to cheaters as no way to verify with a test
- Non-GE feed for animals will be more expensive



Want to ask questions?
Follow these easy steps in Biotech information section of <http://ucbiotech.org>



ucbiotech.org - Science-Based Information and Resources on Agriculture, Food and Technology

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know GMOS

This website provides educational resources focused broadly on issues related to agriculture, crops, animals, foods and the technologies used to improve them. Science-based information related to these issues is available, as well as educational tools and information, which can be used to promote informed participation in discussions about these topics.

FEATURED PRESENTATION

How Much Did You Pay for Your Lunch Today?

Center for Practical and Professional Ethics
California State University, Sacramento
February 7, 2012

BIOTECHNOLOGY INFORMATION

ANNUAL REVIEWS

Review articles:
Focused on food, environmental and socioeconomic issues of GE crops and foods.
[Part 1](#) | [Part 2](#)

RESOURCES FOR OUTREACH & EXTENSION, RESEARCHERS & TEACHERS

DNA for Dinner 4-H curriculum:
For grades 5-8, covers topics from plant diversity to genetic engineering. Each of the five lessons has 3 to 5 activities.

DNA FOR DINNER?

New Game: Who's In Your Family?
A free educational game to teach participants about the diversity of fruits and vegetables, and how they are related.

Slide Archive:
Extensive collection of PP slides on agriculture & biotechnology.

Available on loan:

Teaching Aids: Handouts and cards available, in both English and Spanish.

Educational displays: "Genetics and Foods" and "Genetic Diversity and Genomics" available with companion educational cards and teacher resources.

HELPFUL SITES

Academics Review
[Academics Review website](#)
Testing popular claims against peer-reviewed science.

BIOFORTIFIED
Provides factual information to foster discussion about agriculture, especially plant genetics and genetic engineering.

Biofortified website
Provides factual information to foster discussion about agriculture, especially plant genetics and genetic engineering.

Animal Genomics & Biotechnology Cooperative Extension Program, UC Davis
Provides education on use of animal genomics & biotechnology in livestock production.

HOW MUCH DNA DO YOU EAT?*

It is estimated that, with a normal diet, humans consume between 0.1-1 gram DNA/day

HAMBURGER
(60mg)



ONION RINGS
(10mg)



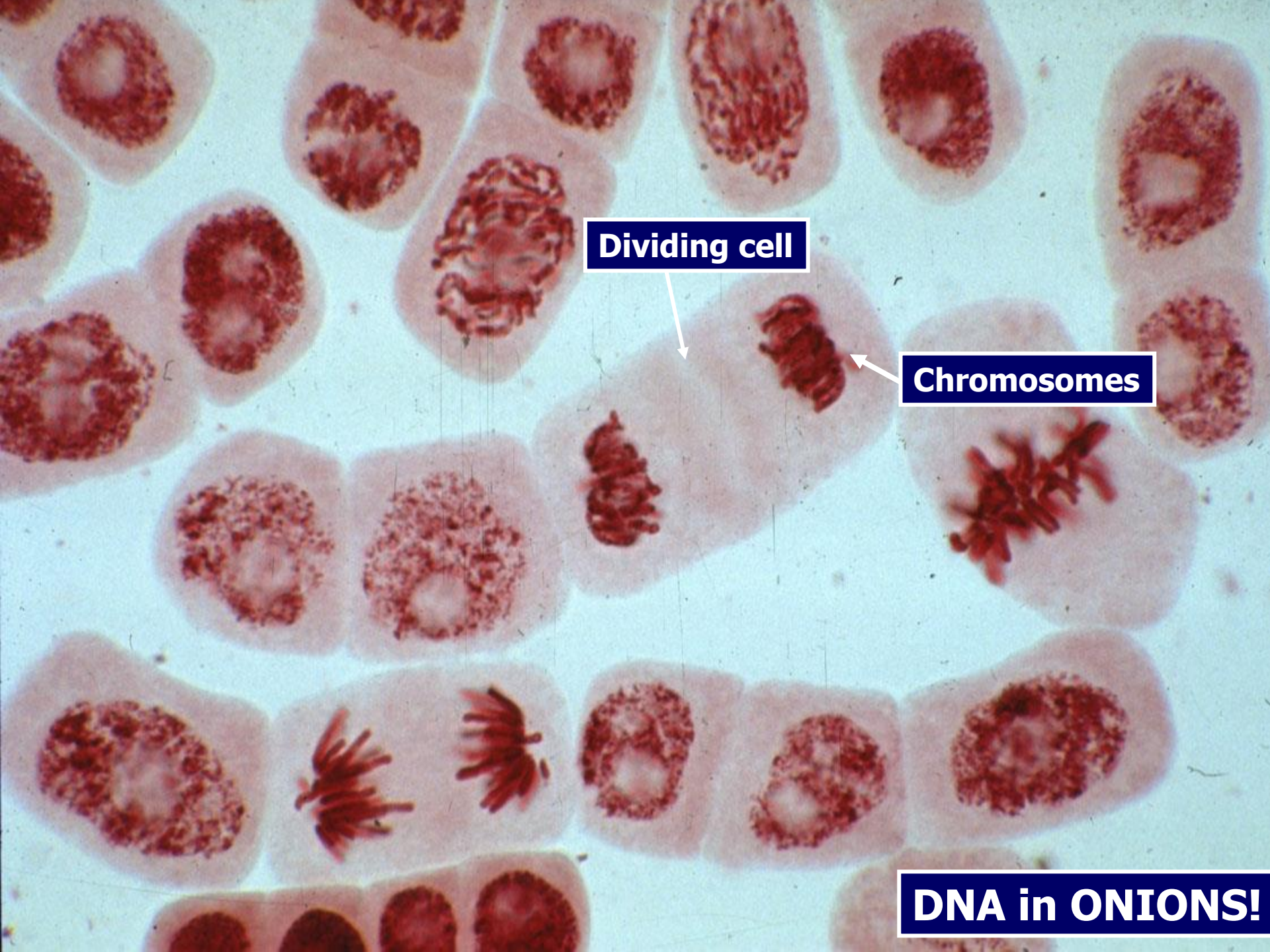
WHOLE TOMATO
(7mg)



WHOLE BANANA
(50mg)



All living things have DNA, the chemical that contains all information responsible for the way it looks and how it works. That chemical, a string approximately 5 feet long, can be isolated. The isolated DNA in each food is seen in the tube on the right.



Dividing cell

Chromosomes

DNA in ONIONS!



Questions

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<http://animalscience.ucdavis.edu/animalbiotech>