

# GMO crops

What they are, how are they regulated,  
and should food get a GMO label?

*Steve Strauss*

*Oregon State University*

*Steve.Strauss@OregonState.Edu*

**OSU**  
Oregon State  
UNIVERSITY



# Pre-GMO: Crop domestication is the basis of agriculture, enabled civilization



# Radical changes in domesticated animals too: All dogs derived from the wolf by non-GMO breeding



# Non-GMO breeding continues and is accelerating in age of massive DNA sequencing



PLANT SELECTION

[GIFT CERTIFICATES](#)

[VISIT THE STORE](#)

[NEWSLETTER SIGNUP](#)

## New Products

[Home](#) / [All Products](#) / [New Products](#) / [Plant-Indigo Rose Tomato](#)

### Plant-Indigo Rose Tomato

[Like](#) 129 [Tweet](#) 3 [Pin it](#) 47 [+1](#) 0 [Share](#)

80 days. Unlike any tomato that we have seen! Indigo Rose is the first high-anthocyanin tomato commercially available anywhere in the world. The high amount of anthocyanin (a naturally occurring pigment that has been shown to fight disease in humans) creates quite a vibrant indigo, almost blue skin on the 2 inch, round fruit. The purple coloring occurs on the portion of the fruit that is exposed to light, while the shaded portion starts out green and turns deep red when mature. Inside, the flesh reveals the same rosy tone with a superbly balanced, multi-faceted tomatoey flavor. The indeterminate plants have an open habit and are very vigorous producers. Bred at Oregon State University.

Available only within the contiguous US.

[More Live Transplant Information](#)

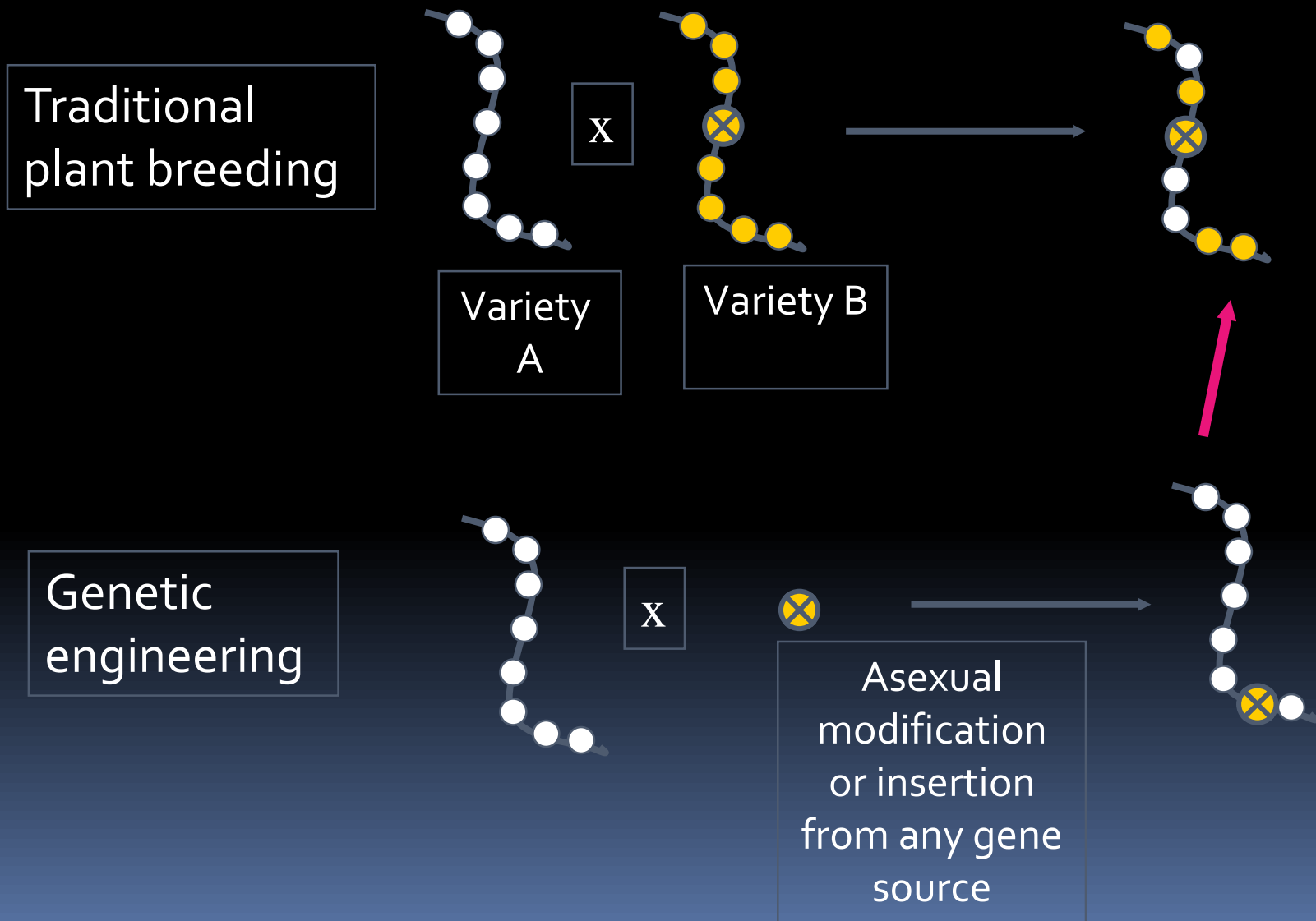
OP Open Pollinated



# Genetic admixture is ubiquitous in agriculture – with or without GMOs



# Genetic engineering defined



# The GMO acronyms

**GE (genetic engineering) = GM (genetic modification) = transgenic = asexual modification and/or insertion of DNA**

**GMO = genetically modified organism**

**GEO = genetically engineered organism**

**The terms “biotechnology” or “modern biotechnology” often used interchangeably with GE or GM**

# Regeneration of GE plants (poplar)





# Then propagated normally

Seeds or cuttings tested for health and new qualities, incorporated into breeding programs



Propagation of poplars in  
tissue culture



Growth in the field

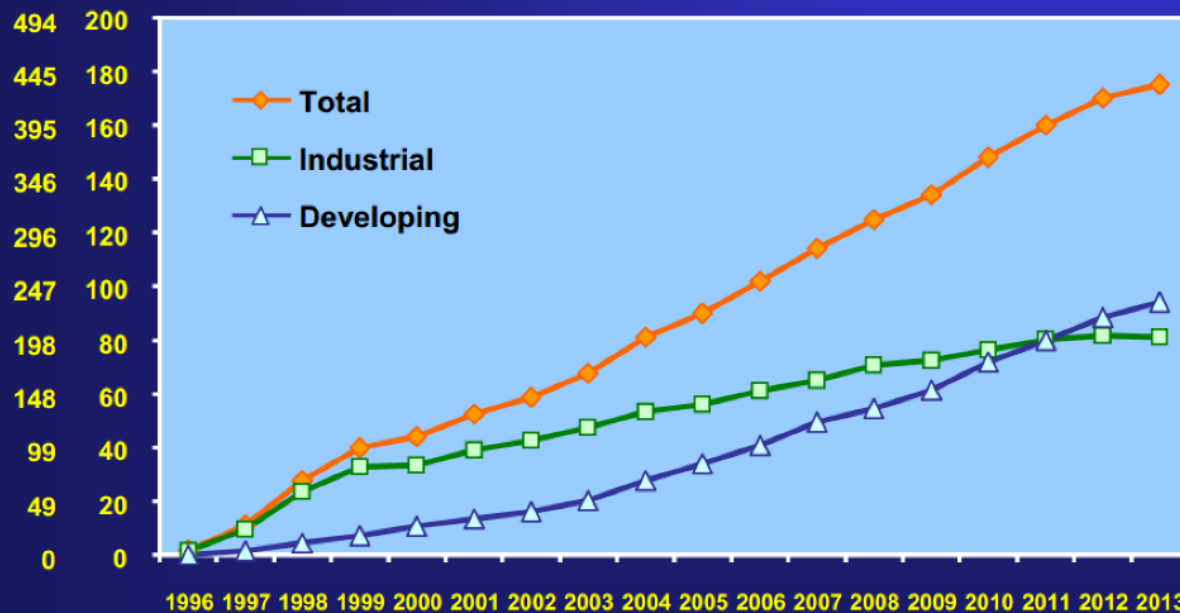
# GMO crops widespread, rapidly adopted

Grown on >10% arable land on planet, extensive uptake in developing world

Global Area of Biotech Crops, 1996 to 2013:  
Industrial and Developing Countries (M Has, M Acres)



M Acres

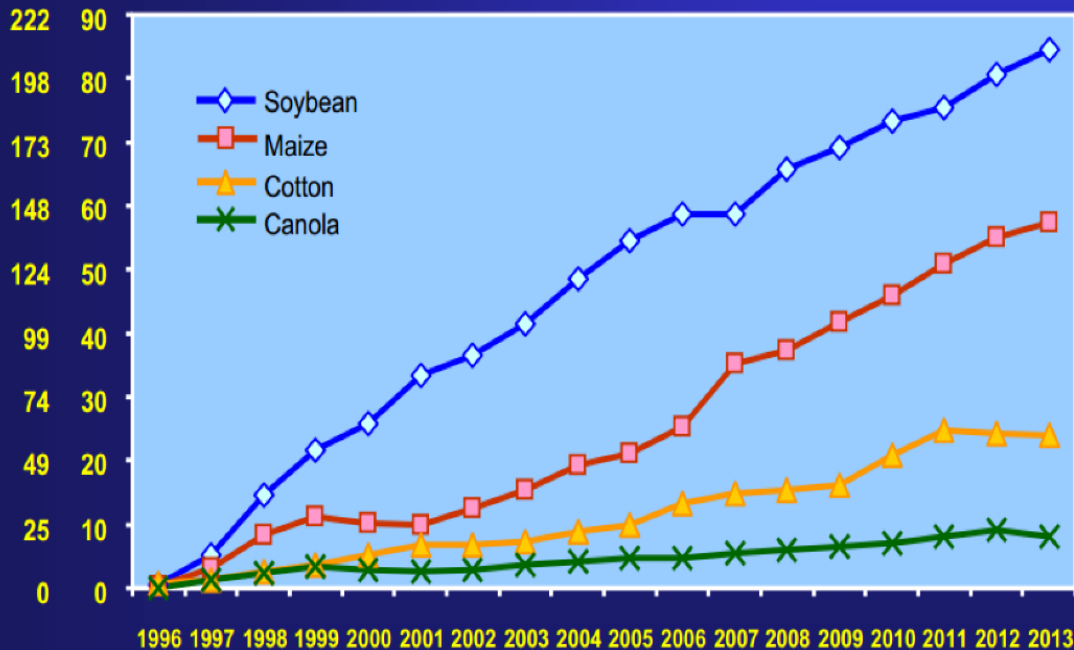


# Four crops dominate, 8 grown in USA

Global Area of Biotech Crops, 1996 to 2013:  
By Crop (Million Hectares, Million Acres)



M Acres



1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

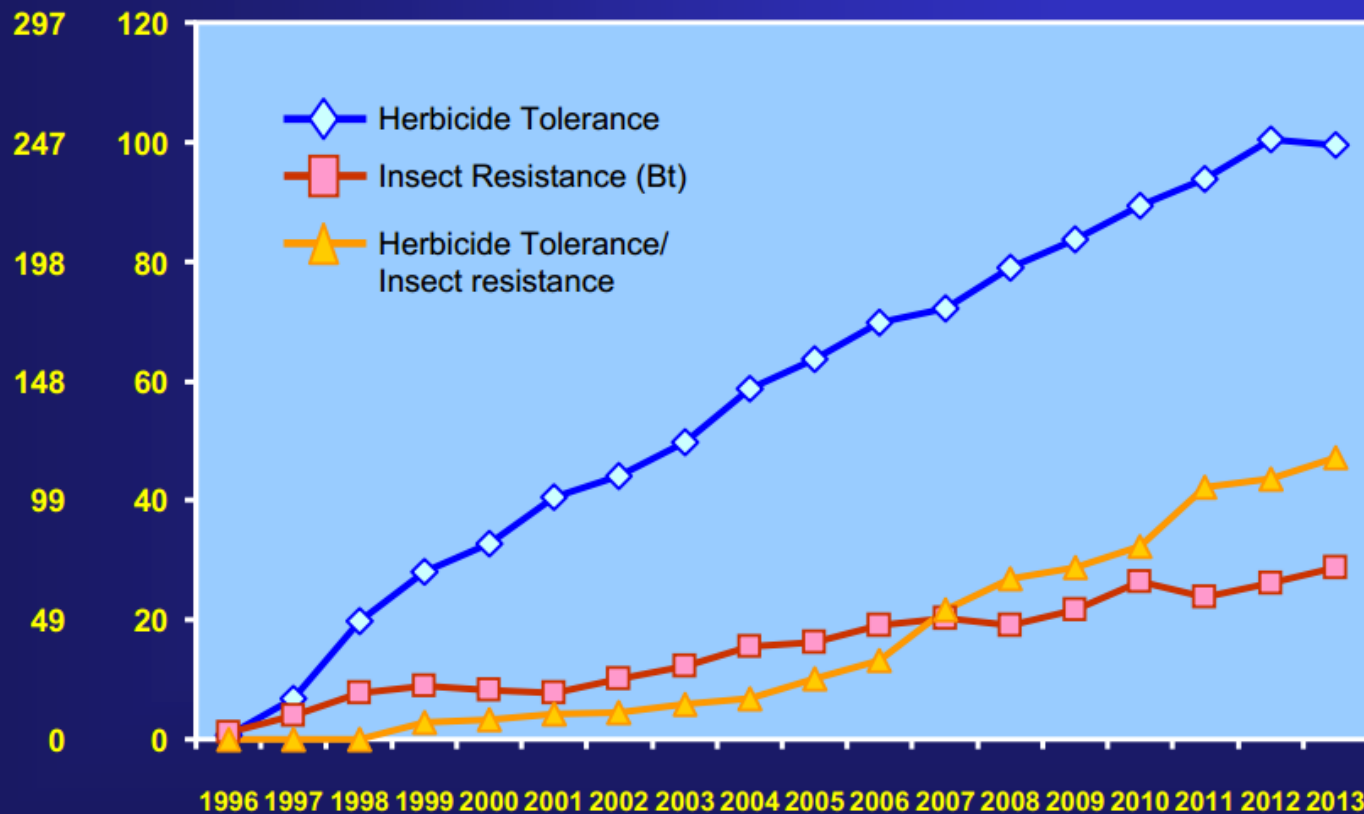


# Two traits dominate

## Global Area of Biotech Crops, 1996 to 2013: By Trait (Million Hectares, Million Acres)



M Acres



# Major reports on GMO crops show very large positive impacts on economics, sustainability, in USA

**THE NATIONAL**  
DIVISION ON EARTH AND LIFE STUDIES

**ACADEMIES**

**The Impact of Genetically Engineered Crops on Farm Sustainability in the United States**

Public Briefing  
NAS Lecture Room  
April 13, 2010

**THE NATIONAL ACADEMIES**  
*Adviser to the Nation on Science, Engineering, and Medicine*  
National Academy of Sciences  
National Academy of Engineering  
Institute of Medicine  
National Research Council

 Review in Advance first posted online on August 14, 2013. (Changes may still occur before final publication online and in print.)

**Agricultural Biotechnology: Economics, Environment, Ethics, and the Future**

Alan B. Bennett,<sup>1,2</sup> Cecilia Chi-Ham,<sup>2</sup> Geoffrey Barrows,<sup>3</sup> Steven Sexton,<sup>4</sup> and David Zilberman<sup>3</sup>

<sup>1</sup>Department of Plant Sciences, <sup>2</sup>Public Intellectual Property Resource for Agriculture, University of California, Davis, California 95616; email: [abbennet@ucdavis.edu](mailto:abbennet@ucdavis.edu), [cchiham@ucdavis.edu](mailto:cchiham@ucdavis.edu)

<sup>3</sup>Department of Agricultural and Resource Economics, University of California, Berkeley, California 94720; email: [gmb103@berkeley.edu](mailto:gmb103@berkeley.edu), [zilber11@berkeley.edu](mailto:zilber11@berkeley.edu)

<sup>4</sup>Department of Agricultural and Resource Economics, North Carolina State University, Raleigh, North Carolina 27607; email: [stevn.sexton@ncsu.edu](mailto:stevn.sexton@ncsu.edu)

**Keywords**  
genetic modification, genetic engineering, GMO, GM crops, food security

**Abstract**  
Agricultural biotechnology and, specifically, the development of genetically modified (GM) crops have been controversial for several reasons, including concerns about potential health and environmental impacts.

*Annu. Rev. Environ. Resour.* 2013. 38:19.1–19.31  
The *Annual Review of Environment and Resources* is online at <http://enviro.annualreviews.org>

This article's doi:  
10.1146/annurev-environ-050912-124612

Copyright © 2013 by Annual Reviews.  
All rights reserved.

# Herbicide tolerant plants promote conservation tillage – With many environmental benefits thereof

Conservation Technology Information Center

- Lowers greenhouse gas emissions
- Improves soil organic matter
- Reduces erosion and fertilizer runoff into water
- Often provides better wildlife habitat



**Global: In 2012 reduced CO<sub>2</sub> emissions by ~27 billion kg, equivalent to ~13 million cars off the road**

<http://www.isaaa.org/resources/publications/briefs/46/to/pfacts/default.asp>

# Benefits provided by biotech crops, on a global scale: 1996-2012

- Increased crop production valued at **US\$116.9 billion**
- Conserved biodiversity (indirectly) by saving 123 million hectares of land from 1996-2012
- **Helped alleviate poverty** for >16.5 million small farmers and their families totaling **>65 million people**, who are some of the poorest in the world

# There are legitimate science concerns that GMOs with pest management traits have not been managed well

## THE TROUBLE WITH GMOs

**AGAINST MY BETTER JUDGMENT**, I'm dipping my toe into the genetically modified organism debate.

These are rough waters. GMOs seem to polarize people more than almost anything else — especially in terms of whether they are safe to eat or to grow. I try to stay open-minded on the topic, but it's obvious that the use of GMOs in agriculture has created some big problems.

The problem facing GMOs isn't with the technology per se; it's with how they have been deployed. Despite promises of improved food security, increased yields, decreased chemical use and more nutritious crops, GMOs end up causing many disappointing failures.

To begin, while GMO efforts may have started with good intentions to improve food security, they ended up focusing on crops that are better at improving profits, such as feed corn (mostly for animal feed and ethanol), soybeans (mostly for animal feed), cotton and canola. While the technology might have "worked," it wasn't applied to crops that actually feed the world's poor.

Furthermore, GMOs have had uneven success in boosting yields. Instead of improving plant growth, they have mainly replaced

GMO crops, this was apparently more than offset by an increase in *herbicide* use on U.S. croplands, likely because weeds have become resistant to Roundup. Here there seems to have been a lack of systems thinking — which would have anticipated the "rebound" problems inherent in chemical weed control.

I also become skeptical when GMO approaches are pursued instead of simpler ways to address the same problem. For example, we hear a lot about biotech crops that are drought tolerant, fix their own nitrogen and so on, but they are a long way from being ready for the real world. Why not focus on agronomic approaches — such as using cover crops, mulching and organic-style techniques — instead, which could yield results *today*?

Similarly, instead of engineering better nutrition into crops to make GMOs such as golden rice, why not grow conventional nutrient-rich crops such as fruits and vegetables? Why focus on more technical solutions, where a simple approach might be as (or more) effective?

Finally, many GMO advocates bristle at efforts to require labeling of GMO food because they see "no substantial biological difference" between GMO and traditional crops. Maybe, but that's not the point. It's



thinking, where the focus is on technology and business models, and less on the social and environmental impacts.

I urge GMO advocates to take a step back and think *more holistically* about GMO technologies in the context of the larger systems connecting agriculture, food, culture, people and the environment. I encourage them to build more *interdisciplinary* research teams — with social scientists, ecologists, organic farmers and GMO critics. I suggest supporting more of their work with public funding, to help ensure that social and environmental benefits are put ahead of profits. And I would strongly urge *both sides* of the GMO debate

**GMOs have frequently failed to live up to their potential, not because they are inherently flawed, but because**

**GMOs have frequently failed to live up to their potential, not because they are inherently flawed, but because they have been poorly deployed into the complex social and environmental contexts of the real world.**

**ensia**  
SPRING 2014 | ENVIRONMENTAL SOLUTIONS IN ACTION



# Poor weed management has led to rapid development of herbicide-resistant weeds

nature  
biotechnology

nature.com » journal home » archive » issue » news » full text

NATURE BIOTECHNOLOGY | NEWS

## Glyphosate resistance threatens Roundup hegemony

Emily Waltz

Nature Biotechnology 28, 537–538 (2010) | doi:10.1038/nbt0610-537

Corrected online 13 October 2010

Corrigendum (October, 2010)

PDF Citation Reprints Rights & permissions Article metrics

Weeds are becoming increasingly resistant to glyphosate, a report from the US National Academy of Sciences (NAS) released in April has found. The driving force, according to the report, is farmers' dependence on the weed killer accompanied by the widespread adoption of genetically modified (GM) herbicide-tolerant crops. Seed makers are hoping to forestall the problem by developing GM crops with 'stacked' traits that tolerate multiple herbicides. But weed scientists warn that if farmers manage these new crops in the same way as they managed their glyphosate-tolerant predecessors, weeds will simply become resistant to the new technologies.



"The number of weed species evolving resistance to glyphosate

BILL BARKSDALE / AGSTOCKUSA /

## Confirmed Glyphosate Resistant Weeds in the U.S.



- Horseweed (Marestail)
- Common Ragweed
- Giant Ragweed
- Palmer Amaranth
- Common Waterhemp
- Hairy Fleabane

- Italian Ryegrass
- Rigid Ryegrass
- Johnsongrass

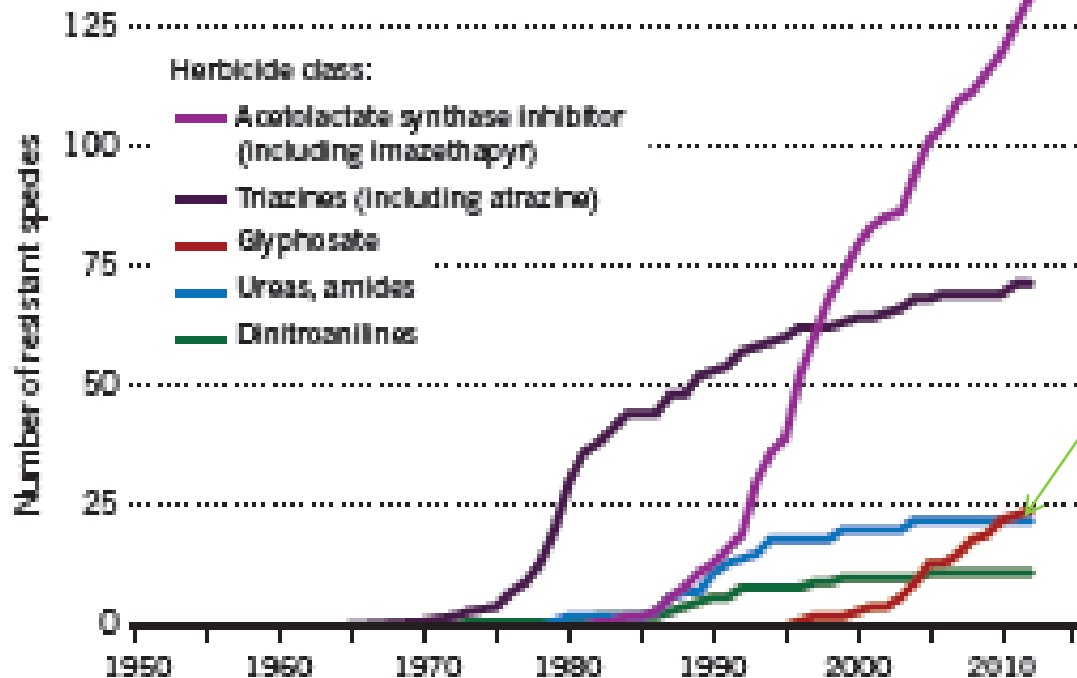
UW  
Extension

# Herbicide-resistant weeds are an old problem in agriculture, but exacerbated by GE herbicide tolerant crops

## THE RISE OF SUPERWEEDS

Weed species often become resistant to herbicides. Glyphosate resistance, once deemed unlikely, rose after genetically engineered crops were introduced in the mid-1990s.

SOURCE: INTERNATIONAL SURVEY OF HERBICIDE RESISTANT WEEDS WWW.EDSIRG.COM/RESISTANTWEEDS (2010).



Accelerated by  
GE Roundup-  
tolerant crops



**The method has diverse applications**

**Many other crops and traits starting to be used, or in the pipeline for near term use**

# Virus-resistant papaya saved the Hawaiian industry in the mid-1990s / ~80% of papaya today

- Nobel prize winning “immunization” in plants – stimulates natural defenses
- Great humanitarian potential in developing world

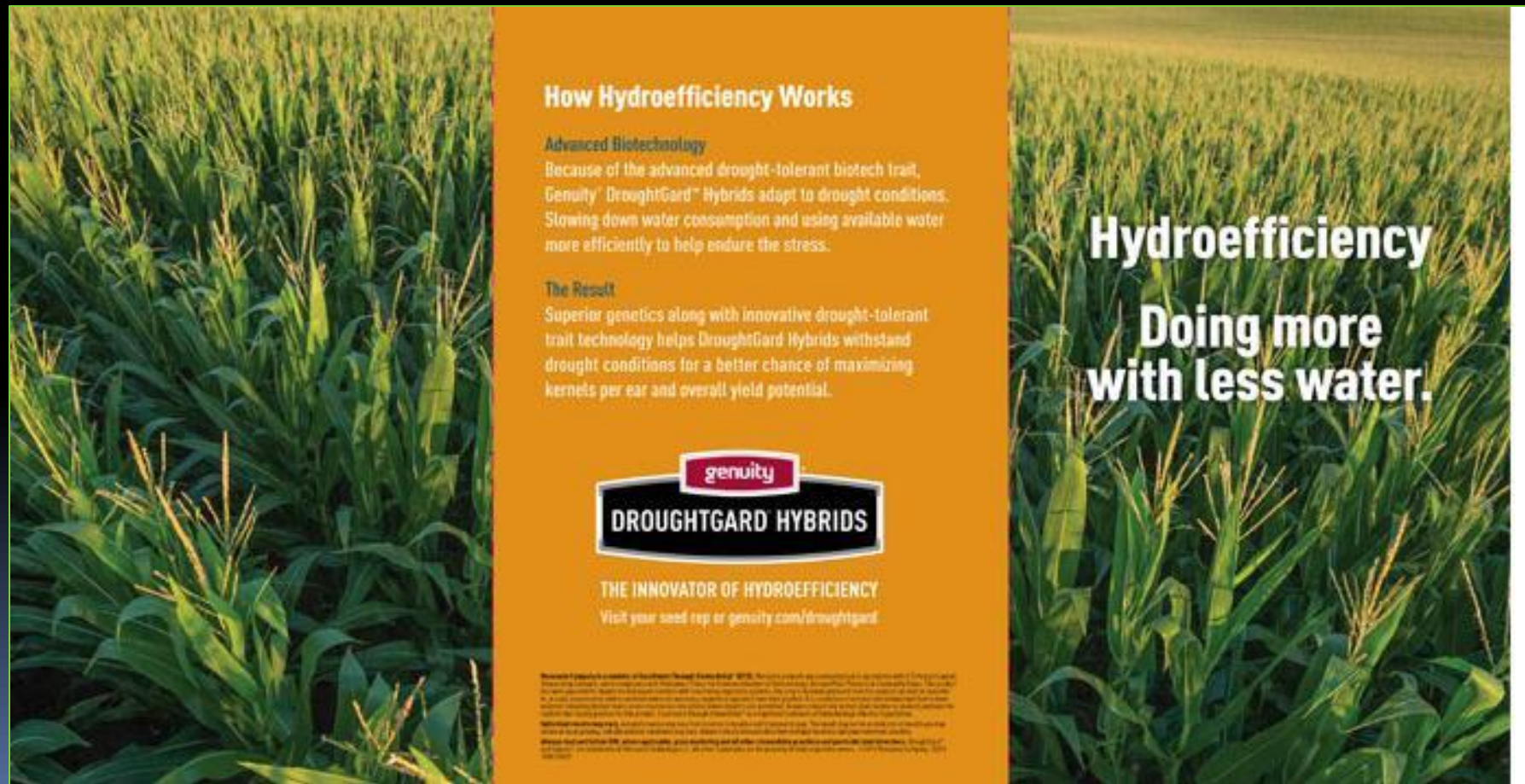


Courtesy of Denis Gonsalves, formerly of Cornell University

GMO, virus-resistant trees

# Drought-tolerant maize – Planted on ~150,000 acres – Also tested in Africa

Important tool given climate change, water shortages?



**How Hydroefficiency Works**

**Advanced Biotechnology**  
Because of the advanced drought-tolerant biotech trait, Genuity® DroughtGard™ Hybrids adapt to drought conditions. Slowing down water consumption and using available water more efficiently to help endure the stress.

**The Result**  
Superior genetics along with innovative drought-tolerant trait technology helps DroughtGard Hybrids withstand drought conditions for a better chance of maximizing kernels per ear and overall yield potential.

**genuity**  
**DROUGHTGARD HYBRIDS**

THE INNOVATOR OF HYDROEFFICIENCY  
Visit your seed rep or [genuity.com/droughtgard](http://genuity.com/droughtgard)

**Hydroefficiency**  
**Doing more with less water.**

© 2012 Genuity. All rights reserved. DroughtGard is a registered trademark of Genuity. DroughtGard Hybrids are a registered trademark of Genuity. Genuity is a registered trademark of Genuity. All other trademarks are the property of their respective owners. This advertisement is for informational purposes only and does not constitute an offer of any product. Please contact your local seed representative for more information.

# Purple GM tomatoes with increased antioxidants and rot resistance

Current Biology 23, 1094–1100, June 17, 2013 ©2013 Elsevier Ltd All rights reserved <http://dx.doi.org/10.1016/j.cub.2013.05.007>

## Anthocyanins Double the Shelf Life of Tomatoes by Delaying Overripening and Reducing Susceptibility to Gray Mold

Yang Zhang,<sup>1</sup> Eugenio Butelli,<sup>1</sup> Rosalba De Stefano,<sup>2</sup> Henk-Jan Schoonbeek,<sup>1</sup> Andreas Magusin,<sup>1</sup> Chiara Pagliarini,<sup>3</sup> Nikolaus Wellner,<sup>4</sup> Lionel Hill,<sup>1</sup> Diego Orzaez,<sup>5</sup> Antonio Graneli,<sup>3</sup> Jonathan D.G. Jones,<sup>6</sup> and Cathie Martin<sup>1,\*</sup>

<sup>1</sup>John Innes Centre, Norwich Research Park, Norwich, NR4 7UH, UK

They are produced by plants that disperse anthocyanin pigments [9]. Anthocyanin production is induced under stress conditions [11]. Besides physiological functions, anthocyanins are associated with protection against [12], cardiovascular diseases [13], and other disorders [13].




# Healthier soy oils: High oleic acid and omega-3

HOME PAGE TODAY'S PAPER VIDEO MOST POPULAR U.S. Edition ▼

**The New York Times** **Business Day**

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION AI

## In a Bean, a Boon to Biotech



DuPont Pioneer

DuPont Pioneer's oil compared with soybean oils with partly hydrogenated oils, the source of trans fats.

By ANDREW POLLACK  
Published: November 15, 2013

A new federal push to purge artery-clogging trans fats from foods could be just what the doctor ordered — not only for public health but for the unpopular biotechnology industry, specifically, two developers of genetically modified crops.

FACEBOOK  
TWITTER  
GOOGLE+  
SAVE

“It almost mirrors olive oil in terms of the composition of fatty acids.”

# Healthier potato – reduced browning and acrylamide (↓waste, ↑safety)

## Trait #1 - Silenced PPO (Enzyme)

- Non-browning when cut
- Reduced black spot bruise

## Trait #2 - Reduced Asparagine (Amino Acid)

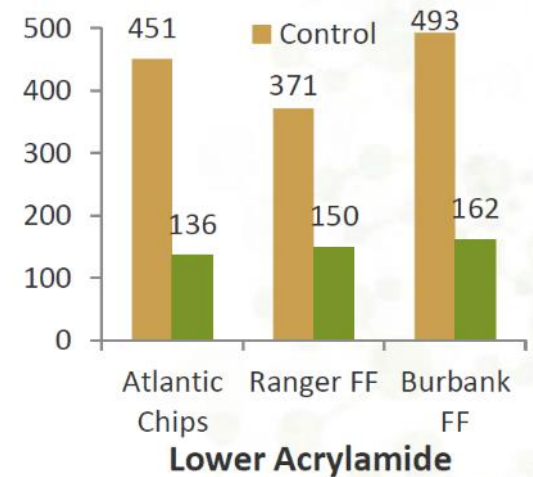
- Yields a 50-80% reduction in acrylamide when baked or fried
- Meets Prop 65 in California

## Four Improved Varieties

- Russet Burbank, Ranger Russet, Atlantic, Snowden
- No effect on taste, texture, or performance
- USDA approval expected in 2014



Non-Browning





# Helping forests under threat by exotic pests

Sign In | Register  0

**SCIENTIFIC AMERICAN™**

Search ScientificAmerican.com 

[Subscribe](#) [News & Features](#) [Topics](#) [Blogs](#) [Videos & Podcasts](#) [Education](#) [C](#)

Energy & Sustainability » Scientific American Volume 310, Issue 3 2 [Email](#) [Print](#)

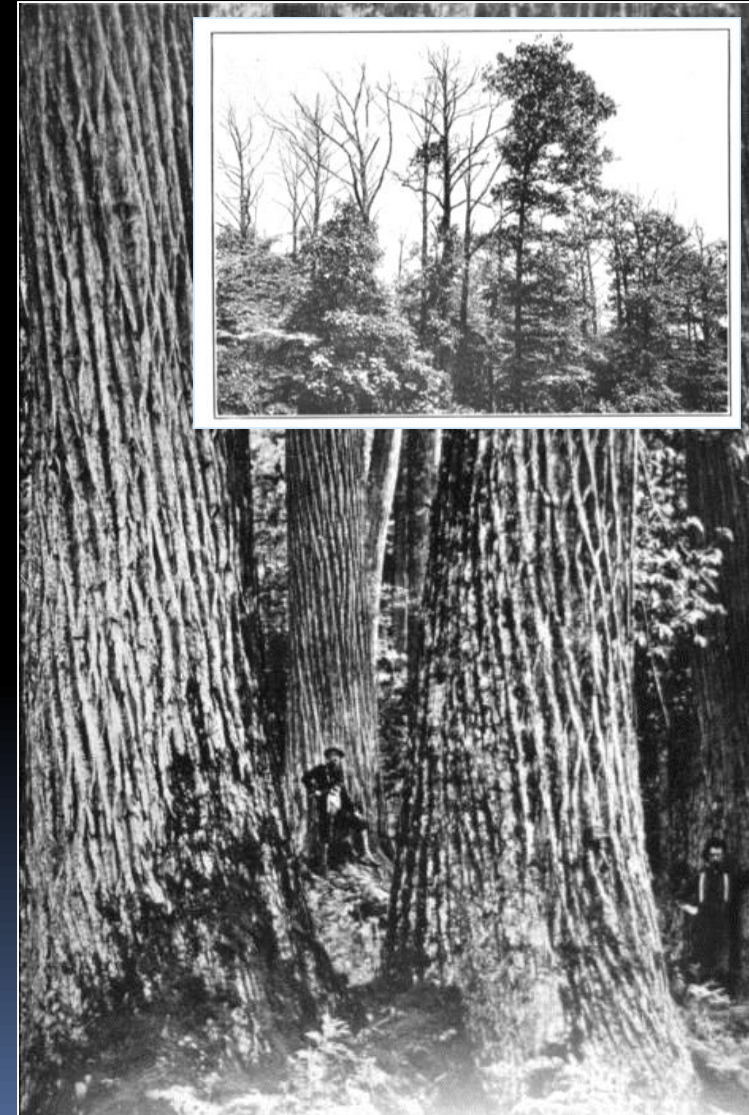
 **The American Chestnut's Genetic Rebirth**  
A foreign fungus nearly wiped out North America's once vast chestnut forests. Genetic engineering can revive them  
By William Powell

In 1876 Samuel B. Parsons received a shipment of chestnut seeds from Japan and decided to grow and sell the trees to orchards. Unbeknownst to him, his shipment likely harbored a stowaway that caused one of the greatest ecological disasters ever to befall eastern North America. The trees probably concealed spores of a pathogenic fungus, *Cryphonectria parasitica*, to which Asian chestnut trees—but not their American cousins—had evolved resistance. *C. parasitica* effectively strangles

**More In This Article**

 **A New Generation of American Chestnut Trees May Redefine America's Forests**

March 2014 issue - Scientific American



# Vitamin enrichment for the poor – to help billions that are malnourished

## DuPont reports breakthrough in introducing beta carotene in Sorghum



In Africa, up to half a million children become blind from Vitamin A Deficiency (VAD) with increased risk of cognitive impairment, disease and death from severe infections. Furthermore, nearly 600,000 women die from c..

20 Feb 2014

**IOWA, USA:** Dupont has achieved a breakthrough in introducing pro-vitamin (beta carotene) into sorghum, a staple food in Africa which is naturally deficient in key nutrients.

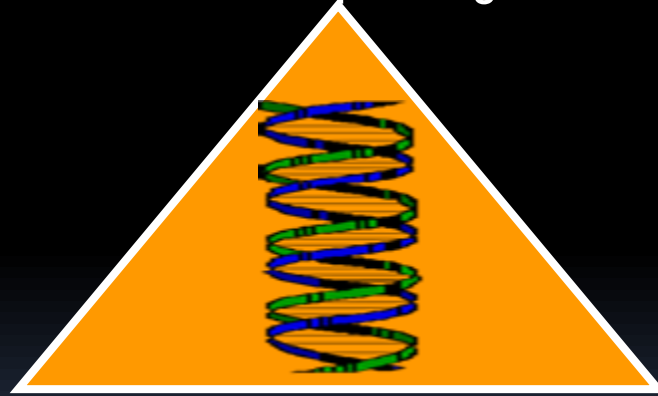
This is expected to help improve nutrition for nearly 300 mn people in Africa dependent on Sorghum. DuPont said that the ability to achieve 100 % of the recommended daily allowance of vitamin A in children from Sorghum has never been achieved before.

In Africa, up to half a million children become blind from Vitamin A Deficiency (VAD) with increased risk of cognitive impairment, disease and death from severe infections. Furthermore, nearly 600,000 women die from childbirth-related causes, many from complications that could be reduced through more vitamin A in their diet.

# Regulated at the federal level in the USA – three agencies based on the trait and prior laws



USDA – US Dept of Agriculture



EPA - Environmental Protection Agency



FDA - Food & Drug Administration

# By far the most carefully studied crops for safety – no question

- Of 129 GE crops commercialized in the US and 129 have had FDA consultation
  - EPA and/or USDA also do evaluations for most types of crops
- Foreign regulatory bodies repeat and verify most safety assessments
  - Health Canada, FSANZ, EFSA, Korea FDA, EFSA, Chinese Ministry of Agriculture, Japan Food Safety Commission

# Components of pre-market safety assessment

- Characterization of inserted DNA and insertion sites
- Characterization and toxicology of newly introduced proteins
- Detailed composition analysis
- Optional whole food animal studies
- Search for unintended adverse effects such as introduction of toxins, anti-nutrients, introduction of an allergen or changes in allergenicity

# Mainstream science strongly supports safety for humans

**Is GM food safe?**  
 if an overwhelming majority of experts say something is true, then any sensible non-expert should assume that they are probably right

The American Association for the Advancement of Science (AAAS) is the premier body of scientists in the United States. It is the largest scientific organization in the world. AAAS serves some 261 affiliated societies and academies of science. "The science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe."

The American Medical Association (AMA) is the premier body of physicians in the United States. It is the largest medical organization in the world. AMA serves some 261 affiliated societies and academies of medicine. "There is no scientific justification for special labeling of genetically modified foods. For the general population in the countries where they have been approved, the effects on human health have been shown to be no different from those of conventional crops."

The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. "No effects on human health have been shown as a result of the consumption of GM foods by the general population in the countries where they have been approved."

The European Commission (EC) is the executive body of the European Union. "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are no more risky than e.g. conventional plant breeding technologies."

The Royal Society of Medicine (RSM) is England's top medical society. "The safety of genetically modified foods derived from GM crops has been reported and/or substantiated in the peer-reviewed literature."

The Crop Science Society of America (CSSA) is the premier scientific body in the United States. "All crop and animal products that are derived from GM crops are safe for human consumption."

The International Council for Science (ICSU) is an international organization devoted to international cooperation in science. "The scientific consensus around the safety of genetically modified foods is as strong as the scientific consensus around climate change. These foods are subjected to more testing than any other, and everything tells us that they're safe."



**Is GM food safe?**  
 if an overwhelming majority of experts say something is true, then any sensible non-expert should assume that they are probably right

The American Association for the Advancement of Science (AAAS) is the premier body of scientists in the United States. It is the largest scientific organization in the world. AAAS serves some 261 affiliated societies and academies of science. "The science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe."

The American Medical Association (AMA) is the premier body of physicians in the United States. It is the largest medical organization in the world. AMA serves some 261 affiliated societies and academies of medicine. "There is no scientific justification for special labeling of genetically modified foods. For the general population in the countries where they have been approved, the effects on human health have been shown to be no different from those of conventional crops."

The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. "No effects on human health have been shown as a result of the consumption of GM foods by the general population in the countries where they have been approved."

The European Commission (EC) is the executive body of the European Union. "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are no more risky than e.g. conventional plant breeding technologies."

The Royal Society of Medicine (RSM) is England's top medical society. "The safety of genetically modified foods derived from GM crops has been reported and/or substantiated in the peer-reviewed literature."

The Crop Science Society of America (CSSA) is the premier scientific body in the United States. "All crop and animal products that are derived from GM crops are safe for human consumption."

The International Council for Science (ICSU) is an international organization devoted to international cooperation in science. "The scientific consensus around the safety of genetically modified foods is as strong as the scientific consensus around climate change. These foods are subjected to more testing than any other, and everything tells us that they're safe."

<http://www.axismundionline.com/blog/the-new-is-gm-food-safe-meme/>

# Vermont labeling law passed – but in legal limbo amidst lawsuits

The New York Times



DEALBOOK  
Sotheby's and Loeb End  
Fight Over Board



Europe Expects Its  
Economy to Grow 1.6%  
This Year

China Tightens Rules for Foreign-Made  
Milk Powders

Pfizer Profit Tumbles 1

## BUSINESS DAY

# *Vermont Will Require Labeling of Genetically Altered Foods*

By STEPHANIE STROM APRIL 23, 2014

✉ EMAIL

f FACEBOOK

🐦 TWITTER

📁 SAVE

➦ MORE

Going further than any state so far, Vermont on Wednesday [passed a law](#) requiring the labeling of foods that contain genetically engineered ingredients.

Though the move came in a tiny state far from the nation's population centers, proponents of such labeling immediately hailed the legislative approval as a significant victory. Labeling efforts are underway in some 20 other states, and the biotech and food industries have been pushing for [federal legislation](#) that would pre-empt such action.

**BELLE**  
NOW PLAYING  
GET TICKETS

# Recently passed Oregon bill motivated by anti-GMO activism at county level

77th OREGON LEGISLATIVE ASSEMBLY--2013 Special Session

## Enrolled Senate Bill 863

Sponsored by JOINT COMMITTEE ON SPECIAL SESSION

CHAPTER .....

AN ACT

Relating to preemption of the local regulation of agriculture; and declaring an emergency.

Be It Enacted by the People of the State of Oregon:

**SECTION 1.** Sections 2 and 3 of this 2013 special session Act are added to and made a part of ORS 633.511 to 633.750.

**SECTION 2.** (1) As used in this section, "nursery seed" means any propagant of nursery stock as defined in ORS 571.005.

(2) The Legislative Assembly finds and declares that:

(a) The production and use of agricultural seed, flower seed, nursery seed and vegetable seed and products of agricultural seed, flower seed, nursery seed and vegetable seed are of substantial economic benefit to this state;

(b) The economic benefits resulting from agricultural seed, flower seed, nursery seed and vegetable seed and seed product industries in this state make the protection, preservation and promotion of those industries a matter of statewide interest that warrants reserving

~~exclusive regulatory power over agricultural seed, flower seed, nursery seed and vegetable~~

(c) The agricultural seed, flower seed, nursery seed and vegetable seed and seed product industries in this state will be adversely affected if those industries are subject to a patchwork of local regulations.

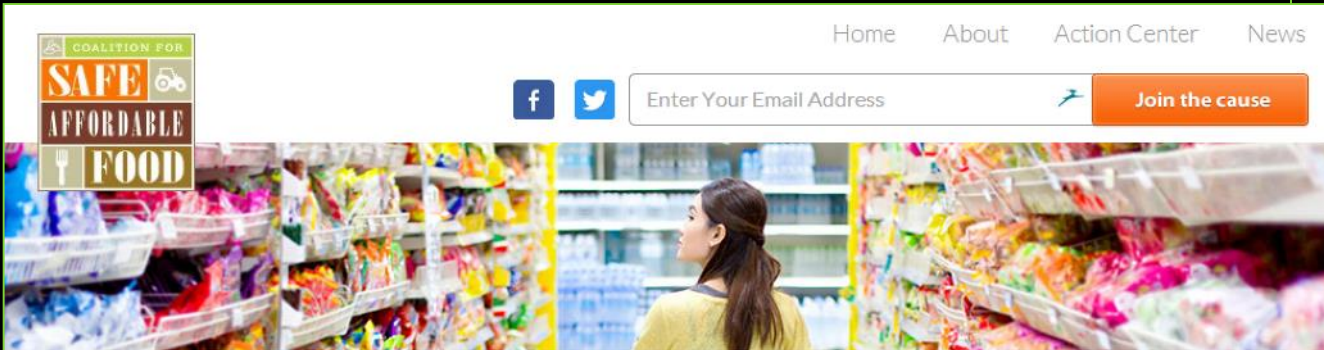
~~SECTION 3. (1) The following provisions shall not apply to any agricultural seed, flower seed, nursery seed and vegetable~~



# Effort underway to standardize and prohibit “Balkanization” of GE label regulations throughout USA”””

- American Bakers Association
- American Beverage Association
- American Farm Bureau Federation
- American Feed Industry Association
- American Frozen Food Institute
- American Seed Trade Association
- American Soybean Association
- American Sugarbeet Growers.....

AND 20 MORE



## Broad-Based Coalition Launched to Advocate for Congressional Action on a Federal GMO Labeling Solution

February 5, 2014

### Broad-Based Coalition Launched to Advocate for Congressional Action on a Federal GMO Labeling Solution

*Legislation Needed to Protect Consumers by Eliminating Confusion and Advancing Food Safety*

(Washington, D.C.) American farmers and representatives from a diverse group of almost thirty industry and non-governmental organizations today announced the formation of the Coalition for Safe Affordable Food ([www.CFSAF.org](http://www.CFSAF.org)) and urged Congress to quickly seek a federal solution that would establish standards for the safety and labeling of food and beverage products made with genetically modified ingredients (GMOs).

# Should GMO-crop derived food have a mandatory label, vs. the common voluntary non-GMO labels (organic, non-GMO)?

**BE IT ENACTED BY THE PEOPLE OF THE STATE OF OREGON:  
AN ACT REQUIRING THE LABELING OF GENETICALLY ENGINEERED RAW  
AND PACKAGED FOOD**

**Section 1. Findings and Declarations**

- (1) Oregon consumers have the right to know whether the foods they purchase were produced with genetic engineering so they can make informed purchasing decisions. Labeling is necessary to ensure that Oregon consumers are fully and reliably informed about the products they purchase and consume. Labels provide informed consent and prevent consumer deception. Polls consistently show that the vast majority of the public wants to know if its food was produced with genetic engineering, for a variety of reasons.
- (2) For multiple health, personal, economic, environmental, religious, and cultural reasons, the State of Oregon finds that food produced with genetic engineering should be labeled as such, as evidenced by the following.
- (3) In the United States, there is currently no federal or Oregon State requirement that genetically engineered foods be labeled. In contrast, sixty-four countries, including Japan, South Korea, China, Australia, Russia, India, the European Union member states, and other key U.S. trading partners, already have laws mandating disclosure of genetically engineered foods on food labels. In 2011, Codex Alimentarius, the food standards organization of the United Nations, stated that governments are free to decide on whether and how to label foods produced with genetic engineering.
- (4) The U.S. Food and Drug Administration (FDA) does not require or conduct safety studies of genetically engineered foods. Instead, any safety consultations are voluntary, and genetically engineered food developers may decide what information to provide to the agency. Market



# Pros vs. cons of mandatory GMO labels

- Pro viewpoints

- Right to know
- Tool to track problems
- Ethics (keep animal DNA out of food of vegetarians)
- Many other countries are doing it
- Restrict - stigmatize – increase costs of using GMOs

# Pros vs. cons of mandatory GMO labels

## • Con viewpoints

- Already intensively regulated/scrutinized already by US government, far more than conventionally bred crops
- We have a labeling law already in place (FDA) for changes that matter (“material” changes to nutrition, safety, whether positive or negative)
- Organic already GMO-free and widely available to consumers who wish to choose non-GMO for any reason

# Pros vs. cons of mandatory GMO labels

## • Con viewpoints

- A prominent and mandatory label has been shown in scientific studies to mislead/scare/stigmatize consumers (viewed as warning label)
- Labeling increases cost of food for all consumers (estimates vary, but some estimates are very high). This is unethical because it hits the poor hardest
- Reduces choice by loss of GMO products, as has been observed in Europe (food system cannot infrastructure cannot support GMO and non-GMO options for most foods, and companies often avoid stigma to their brand label so don't use GMO)

# Those who fund and write labeling ballot measures are interested in removing GMO technology

## IS LABELING REALLY ABOUT OUR "RIGHT TO KNOW" ?

"We are going to force them to label this food. If we have it labeled, then we can organize people not to buy it."

—Andrew Kimbrell, Executive Director, Center for Food Safety

"Personally, I believe GM foods must be banned entirely, but labeling is the most efficient way to achieve this. Since 85% of the public will refuse to buy foods they know to be genetically modified, this will effectively eliminate them from the market just the way it was done in Europe."

—Dr. Joseph Mercola, Mercola.com

**IS LABELING REALLY ABOUT OUR "RIGHT TO KNOW" ?**

"We are going to force them to label this food. If we have it labeled, then we can organize people not to buy it."

—Andrew Kimbrell, Executive Director, Center for Food Safety

"Personally, I believe GM foods must be banned entirely, but labeling is the most efficient way to achieve this. Since 85% of the public will refuse to buy foods they know to be genetically modified, this will effectively eliminate them from the market just the way it was done in Europe."

—Dr. Joseph Mercola, Mercola.com

"By avoiding GMOs, you contribute to the tipping point of consumer rejection, forcing them out of our food supply."

—Jeffrey Smith, Founder, Institute for Responsible Technology

"With labeling it (GMOs) will become 0%... For you the label issues is vital, if you get labeling then GMOs are dead-end."

—Vandana Shiva, environmental activist

"The burning question for us all then becomes 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."

—Rennie Cummins, Director, Organic Consumers Association

# The largest organization of scientists in the USA and the world – AAAS – does not support labels

“Legally mandating such a label can only serve to mislead and falsely alarm consumers”

## Statement by the AAAS Board of Directors On Labeling of Genetically Modified Foods

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE  
20 October 2012

There are several current efforts to require labeling of foods containing products derived from genetically modified crop plants, commonly known as GM crops or GMOs. These efforts are not driven by evidence that GM foods are actually dangerous. Indeed, the science is quite clear: crop improvement by the modern molecular techniques of biotechnology is safe. Rather, these initiatives are driven by a variety

conclusion: consuming foods containing ingredients derived from GM crops is no riskier than consuming the same foods containing ingredients from crop plants modified by conventional plant improvement techniques.

Civilization rests on people's ability to modify plants to make them more suitable as food, feed and fiber plants and all of these modifica-

added, the protein must be shown to be neither toxic nor allergenic. As a result and contrary to popular misconceptions, GM crops are the most extensively tested crops ever added to our food supply. There are occasional claims that feeding GM foods to animals causes aberrations ranging from digestive disorders, to sterility, tumors and premature death. Although such claims are often sensationalized and receive a

Approved by the AAAS Board of  
Directors on 20 October 2012



# The Oregonian editorial board, and those of most other mainstream news organizations, have not supported labeling measures

A8 | Saturday, July 5, 2014 | The Oregonian

## OPINION

Contact Editorial: 503-221-8150 • [commentary@oregonian.com](mailto:commentary@oregonian.com) • [letters@oregonian.com](mailto:letters@oregonian.com)



The Oregonian OREGONLIVE  
OREGONIAN MEDIA GROUP

Founded December 4, 1850.  
Established as a daily February 4, 1861.  
The Sunday Oregonian established  
December 4, 1881. Incorporating the  
Oregon Journal since 1962.

**N. Christian Anderson III**  
President and Publisher

**Erik Lukens**  
Editorial and Commentary Editor

**Hallie Janssen** Vice President/  
Marketing

**Barbara Swanson** Vice President/  
Sales

**Therese Bottomly**, Director of State Content  
**Jerry Casey**, Director of Digital Operations  
**Susan Gage**, Director of Local Content  
**Pete Lesage**, Director of Publications

**Kevin Denny**, General Manager,  
Advance Central Services Oregon

## GMO food-labeling mandate would only sow confusion

Backers claim labels on GMO products will prevent consumer confusion, but the exact opposite is likely to be true

Backers of an initiative that would require labels for food produced using genetic engineering turned in more than 155,000 signatures this week, virtually guaranteeing a spot on the November ballot. Similar initiatives having failed in California in 2012 and in Washington in 2013, it's now Oregon's turn on the label-it movement's West Coast swing. With any luck, voters here will do justice to the state animal, the beaver, commonly known as nature's engineer.

**Editorial**





# What is a GMO at an LA farmers market

- <http://www.youtube.com/watch?v=EzEr23XJwFY>



# Arguments for measure 92

## **GMOs are increasing use of toxic pesticides**

- Herbicide-resistant weeds have increased due to use of herbicide tolerant GMO crops  
**BUT**
- Total herbicide toxicity appears to have decreased or remained the same
- Low- and no-till agriculture has increased due to these GMO crops, with many environmental benefits
  - Reduced greenhouse gas release and soil erosion; increased soil carbon and wildlife habitat

# Arguments against measure 92

## **Its about method, not content of food**

- It stigmatizes one method of genetic modification among many – when there is clear scientific consensus that its “product not process” that matters
  - USA National Academy of Sciences: “There is no evidence that unique hazards exist either in the use of rDNA techniques or in the movement of genes between unrelated organisms.”
- Clearly safer products, such as more healthy corn and potato, will be “warning labeled” too

# Arguments against measure 92

## **It is of no value for making health decisions**

- It does not account for different types or amounts or activities of GMO materials in food
- It requires labels on GMO gene & protein-free materials – like oils and sugars
- Much of the food we eat is exempted from any sort of labeling (e.g., restaurants, cafeterias, meats)

# Arguments against measure 92

## We have reliable, standardized, national GMO-free choices



- Organic food is now common and cannot be made with GMO ingredients
- The GMO-free label is rapidly growing, and is more rigorous for those with concerns (e.g., meats from GMO-fed animals are excluded)
- The costs are not imposed on others, they are borne by those with strong concerns



# Arguments against measure 92

## **The cost of food will be increased, disproportionately hurting the poor**

- Main costs are segregation, tracking, and compliance inspection, not printing
- Recent studies from Cornell University and the Washington Academy of Sciences suggest it may be hundreds-\$\$ per family
  - Oregon administrative cost alone in millions/yr
- The stigma of the prominent label is likely to prompt many producers to use higher priced, non-GMO ingredients – raising food prices
  - Ben and Jerry's now trying – 5-20% (Wall St. Journal)
  - Reduced choice? Companies likely to discontinue many products just for Oregon

# Arguments against measure 92

## Investments in consumer education by labeling should start with issues of highest consumer and health concern

### Food Safety Concerns

- Disease/contamination and handling/prep are still the most mentioned food safety concerns, although to a lesser degree than previous years.

Food safety concerns	Total 2014 (A) n=1000	Total 2012 (B) n=751	Total 2010 (C) n=750	Total 2008 (D) n=1000
Disease/contamination	18%	29% A	29% A	38% ABC
Handling/preparation	18%	21%	23% AD	17%
Preservatives/Chemicals	12% D	13% CD	8% D	6%
Agricultural production	10% CD	7%	7%	5%
Packaging/labeling	9% BCD	5% D	4%	2%
Health/nutrition	7% D	8% D	6%	4%
Biotech	7% BCD	2%	2%	1%
Food sources	6%	7%	8%	9% A
Processed foods	3% BCD	1%	1%	1%
Other	3% CD	1%	1%	<1%

A/B/C/D Indicate statistical significance between years

Q12. What, if anything, are you concerned about when it comes to food safety? [OPEN END]





# Arguments against measure 92

## **The stigma and cost will impede future biotechnology innovations, against American's interests**

- Regardless of benefits, it will be risky for companies to produce products with a marketplace stigma and added cost
- Investment in R & D will decline
- New crops in the commercial pipeline with clear benefits may be abandoned, and new innovations left on the shelf

# Poll: A majority of Americans wish to purchase products of biotechnology

## Likelihood to Purchase Plant Biotech Foods

- Consumers show high interest in nutrition & health-related benefits of food biotechnology.
- Nearly three-quarters of Americans say they are likely to purchase foods made with oils modified to provide more healthful fats, such as Omega-3s.

Total 2014 (n=1000)	Not Likely	Likely
Food product made with oils modified by biotechnology to <u>provide more healthful fats</u> , like Omega-3, in the food	28%	72%
Variety of produce modified by biotechnology to <u>reduce the potential for carcinogens</u> (n=501)	31%	69%
Variety of produce modified by biotechnology to be <u>protected from insect damage and required fewer pesticide applications</u>	31%	69%
Bread, crackers, cookies, cereals, or pasta made with flour modified to <u>use less land, water, and/or pesticides</u>	31%	69%
Bread, crackers, cookies, cereals, or pasta made with flour modified to <u>enhance nutritional benefits</u>	33%	67%
Food product made with oils modified by biotechnology to <u>eliminate the trans fat</u> content in the food*	33%	67%
Variety of produce modified by biotechnology to <u>improve vitamin content</u> (n=499)	35%	65%
Variety of produce modified by biotechnology to <u>taste better or fresher</u>	42%	58%

\*Note: Wording change from 2012 - "reduce the saturated fat content"

A/B indicate statistical significance between years

PB5, Q25 Q22 Q23. All other things being equal, how likely would you be to buy...

