“GMOs” Enriching Lives Around the World

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About ITIF

- Independent, nonpartisan research and education institute focusing on intersection of technological innovation and public policy, including:
  - Innovation and competitiveness
  - IT and data
  - Telecommunications
  - Trade and globalization
  - Life sciences, agricultural biotech, and energy
- Mission to formulate and promote policy solutions that accelerate innovation and boost productivity
- Ranked by University of Pennsylvania as top science and technology think tank in United States and number two in world
“A truly extraordinary variety of alternatives to the chemical control of insects is available. All have this in common: They are *biological* solutions, based on understanding of the living organisms they seek to control. ...Some of the most interesting of the recent work is concerned with ways of forging weapons from the insects’ own life processes.”

--Rachel Carson, *Silent Spring*, 1962

Chapter 17, para 3
What is a “GMO”?

“organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination”

UN WHO at http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/

Definition describes something that does not exist. (Sweet potatoes, monarch butterflies, every living thing)
¿Odias los cultivos genéticamente modificados? Recuerda que por milenios el ser humano ha modificado genéticamente la naturaleza.

Mediante cruce y selección el ser humano ha modificado a nivel genético y morfológico muchas especies vegetales y animales de interés, este mejoramiento genético tradicional es un proceso ciego y azaroso que puede conllevar efectos negativos. Actualmente la ingeniería genética nos permite mejorar cultivos y animales en un ambiente controlado de laboratorio, con modificaciones génicas mínimas y precisas, además de evitar el surgimiento de características negativas.
Corn/maize
¿SABÍAS QUE LA MARIPOSA MONARCA ES UN ORGANISMO TRANSGÉNICO NATURAL’?’

En su ADN tiene genes provenientes de una avispa, y 2 de los genes adquiridos podrían tener un papel protector frente a patógenos que afectan a la mariposa (Gasmi et al, 2015).
¿SABÍAS QUE LA INSULINA PARA LOS DIABÉTICOS ES PRODUCIDA EN ORGANISMOS TRANSGÉNICOS?

ANTES SE EXTRAÍA DE ANIMALES MUERTOS. GRACIAS A LA INGENIERÍA GENÉTICA AHORA SE PUEDE PRODUCIR DE UNA MANERA LIMPIA Y EFICIENTE.

INFORMATE EN NUESTRA PÁGINA WEB Y REDES SOCIALES
Reducing Food Allergy Risks

La tecnología GM podría ayudar a desactivar la proteína que causa el 90% de las alergias de maní!
Disease resistant fruit

Actualmente el 80% de la papaya de Hawaii es transgénica, ya que el virus casi extinguió la papaya convencional en los años 1990's.
Sugar from Sugar Beets: the Greenest Option

No source of sugar is more sustainable than GM sugar beets.
Bt Brinjal in Bangladesh

With traditional varieties, I would lose 40% of my crop to pest damage.

With Bt brinjal, I don’t need to use pesticide and the crop doesn’t get any pest damage.

I have given almost everything away because I am sharing with neighbors!
Bt cotton in India

"Before GM cotton, we sprayed our fields almost every alternate day with pesticides and still we could barely control the boll worms. Lucky for me, my farm became a testing ground for GM cotton in 2003."

Balwinder Kang, farmer, India
**Figure 12**

**Insecticide use in corn and cotton production, 1995-2010**

Cotton, pounds per planted acre

Corn, pounds per planted acre

Bt maize protects against Asian corn borer
Bt protects against African stem borer
Un agricultor hondureño sostiene dos mazorcas de maíz. El de arriba está genéticamente modificada para resistir una plaga local, mientras que el de abajo no.
Bt maize & pesticide use
Bt maize, aflatoxin, and cancer
"The fact that our nation’s more than 300,000 farmers have adopted GMO technology on more than 90 percent of their corn acres demonstrates the effectiveness they see in their fields every day."

NATIONAL CORN GROWERS ASSOCIATION
What has been the global experience?


18 MILLONES DE AGRICULTORES BENEFICIADOS
Se debe destacar que 90% de los mismos fueron agricultores pequeños de escasos recursos en países en vías de desarrollo.

LA SUPERFICIE DE CULTIVO AUMENTÓ 100 VECES
Se incrementó desde 1,7 millones de hectáreas en 1996 a 19,7 millones en 2015. Esto se debe a la preferencia de los agricultores por los beneficios de esta tecnología.

22% DE MAYOR RENDIMIENTO
Los rasgos de resistencia a insectos y enfermedades, y tolerancia a herbicidas, permitieron reducir las pérdidas por plagas y malezas y ahorrar en insumos agrícolas.

37% DE REDUCCIÓN EN USO DE PESTICIDAS
Los cultivos transgénicos resistentes a insectos y tolerantes a herbicidas permiten ahorrar fitosanitarios al resistir plagas y tener un mejor control de malezas.

68% DE MAYORES CANANCIAS
Al aumentar los rendimientos y ahorrar en insumos como pesticidas y combustibles, los agricultores tienen un mayor margen de ganancias y más tiempo para dedicar a nuevas actividades en el campo.

CONSERVACIÓN DE 152 MILLONES DE HECTÁREAS DE BIODIVERSIDAD
Al ser más productivos, los cultivos transgénicos permiten producir más alimentos usando menos tierras. Esto contribuye a salvar pastizales, bosques y selvas.

Consequences:

- farm level benefit in 2014 = $17.7 billion
- average increase in income ~$320/acre
- for 19y period (1996-2014), global farm income gain has been $150.3 billion (+7.2%)
- +158 million tonnes of soybeans; +322 MT corn; +25 MT cotton lint & 9.2 MT canola

http://www.tandfonline.com/doi/full/10.1080/21645698.2016.1176817
IN 2014 ALONE, CROP BIOTECHNOLOGY ALLOWED FARMERS TO GROW MORE ON LESS LAND

WHAT’S THE BENEFIT OF GENETICALLY MODIFIED CROPS?

WITHOUT BIOTECH, FARMERS WOULD HAVE NEEDED 44.7 MILLION MORE ACRES OF LAND TO PRODUCE THE SAME AMOUNT OF CROPS. THAT’S ALMOST EQUIVALENT TO ALL THE FARMLAND IN IOWA AND WISCONSIN.
• equivalent to removing 23 billion kg of carbon dioxide from the atmosphere

• equal to removing 10.2 million cars from the road for one year

• reduced pesticide spraying (1996-2011) by 9% = 474 million kg =

  A BILLION POUNDS+

Source: http://www.pgeconomics.co.uk/pdf/2013globalimpactstudyfinalreport.pdf
Adoption of genetically engineered crops in the United States, 2000-16

Data for each crop include seed varieties with herbicide tolerance, insect resistance, or both ("stacked") traits. Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, June Agricultural Survey.
SUPERFICIE MUNDIAL DE CULTIVOS BIOTECNOLÓGICOS/GM
Millones de hectáreas (1996-2014)

- Hectáreas totales
- Industrializados
- En desarrollo
- 28 países con cultivos biotecnológicos/GM

Un récord de 19 millones de agricultores, en 28 países, cultivaron 161,5 millones de hectáreas (448 millón de acres) en 2014, un incremento sostenido del 3-4% a 6,5 millones de hectáreas (16 millones de acres) más que en 2013.

Source: Clive James, 2014.
Global Area of Biotech Crops, 1996 to 2017: Industrial and Developing Countries (Million Hectares, Million Acres)
Global Area of Biotech Crops, 1996 to 2017: By Trait (Million Hectares, Million Acres)
Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares, Million Acres), 2017

- **80% Cotton**
- **77% Soybean**
- **32% Maize**
- **30% Canola**

**Conventional** | **Biotech**
---|---

ISAAA, 2017
Global Area of Biotech Crops, 1996 to 2017: By Crop (Million Hectares, Million Acres)
Biotech Crop Countries and Mega-Countries*, 2017

*18 biotech mega-countries growing 50,000 hectares or more of biotech crops.

ISAAA, 2017
Global Area of Biotech Crops, 2017: By Country (Million Hectares)

In 2017, global area of biotech crops was 189.8 million hectares, representing an increase of 3% from 2016, equivalent to 4.7 million hectares.

Top 5 Countries that Planted Biotech Crops in 2017
(Area and Adoption Rate)

- **USA**: 75.0 MHAs (94.5% adoption)
- **Brazil**: 50.2 MHAs (94% adoption)
- **Argentina**: 23.6 MHAs (~100% adoption)
- **Canada**: 13.1 MHAs (95% adoption)
- **India**: 11.4 MHAs (93% adoption)
STATUS OF APPROVED EVENTS FOR BIOTECH CROPS USED IN FOOD, FEED, PROCESSING, AND CULTIVATION

67 COUNTRIES ISSUED
4,133 REGULATORY APPROVALS
FOR 26 GM CROPS SINCE 1992
1,995 FOOD USE
1,338 FEED USE
800 CULTIVATION

JAPAN HAS MOST NUMBER OF APPROVALS
648 APPROVED EVENTS

MAIZE HAS LARGEST NUMBER OF APPROVED EVENTS
232 APPROVED EVENTS IN 30 COUNTRIES

HERBICIDE TOLERANT MAIZE EVENT HAS MOST APPROVALS
NK603 55 APPROVALS IN 25 COUNTRIES

Source: ISAAA, 2017
CONTRIBUTION OF BIOTECH CROPS TO FOOD SECURITY, SUSTAINABILITY, AND CLIMATE CHANGE

INCREASING CROP PRODUCTIVITY
US$186.1 BILLION
ARM INCOME GAIN IN 1996-2016
GENERATED GLOBALLY BY BIOTECH CROPS

CONSERVING BIODIVERSITY
IN 1996-2016, PRODUCTIVITY GAINED THROUGH BIOTECHNOLOGY SAVED
183 MILLION HECTARES OF LAND FROM PLOWING AND CULTIVATION

PROVIDING A BETTER ENVIRONMENT
LESS PESTICIDE APPLICATIONS
DECREASED ENVIRONMENTAL IMPACT FROM HERBICIDE & INSECTICIDE USE BY 18.4% IN 1996-2016

REDUCING CO2 EMISSIONS
SAVED 27.1 BILLION KGS CO2 EQUIVALENT TO REMOVING
16.7 MILLION CARS OFF THE ROAD FOR 1 YEAR

HELPING ALLEVIATE POVERTY & HUNGER
BIOTECH CROPS UPLIFTED THE LIVES OF
16-17 MILLION SMALL FARMERS AND THEIR FAMILIES TOTALING
>65 MILLION PEOPLE

Source: ISAAA, 2017
Figure 7
Farmers’ reasons for adopting genetically engineered crops

- **HT soybeans**: 60%
  - Increase yields: 15%
  - Decrease pesticide input cost: 20%
  - Save management time and make other practices easier: 5%
- **HT corn**: 71%
  - Increase yields: 13%
  - Decrease pesticide input cost: 7%
- **Bt corn**: 77%
  - Increase yields: 10%
  - Save management time and make other practices easier: 6%
- **Bt cotton**: 79%
  - Decrease pesticide input cost: 12%
  - Other: 6%
- **HT cotton**: 77%
  - Increase yields: 12%
  - Save management time and make other practices easier: 5%

Bt crops have insect resistant traits; HT crops have herbicide tolerance traits.
"I daresay the environmental movement has done more harm with its opposition to genetic engineering than with any other thing we've been wrong about... We've starved people, hindered science, hurt the natural environment and denied our own practitioners a crucial tool."

What Else Could We Do?

- Cure HIV
- Cure genetic diseases like CF, MD, Huntington's... (OMIM = 23,714)
- Cure cancer (restore p53-mediated tumor suppression)
- Improved N fixation; Nitrogen fixation in non legumes; enhanced photosynthesis (C3 plants to C4)
- Make mosquitoes immune to malaria/Dengue/Yellow Fever/Zika
- Drive mosquito species to extinction
- Rescue endangered species (Hawaiian honeycreepers; alala)
- Eradicate invasive species
- What else can you think of?
Questions?

- Safety/consensus
- Independent research confirms findings of industry research
- Only biotech crops are screened for allergenicity;
- Biotech crops may reduce allergenicity
- As safe or safer than any alternatives
There are so many misconceptions. The first is a fundamental one, that being that there is a debate [about safety] at all.

-- Kevin Folta @ http://randomrationality.com/2013/03/18/qa-the-lowdown-on-gmos-with-kevin-folta/
Food Safety

- We know what causes unsafe food
  - Microbial contamination (NB – organic over-represented)
  - Presence of allergens
  - Adulteration
  - Production process (e.g., plant breeding) is not on the list
Worldwide scientific consensus on “GMO” safety

- [http://realfoood.org.wordpress.com/2014/02/13/about-those-industry-funded-gmo-studies/](http://realfoood.org.wordpress.com/2014/02/13/about-those-industry-funded-gmo-studies/)
Worldwide scientific consensus on “GMO” safety


MÁS DE 275 ACADEMIAS CIENTÍFICAS Y ENTIDADES TÉCNICAS RECONOCEN LA SEGURIDAD DE LOS CULTIVOS TRANSGÉNICOS

INFÓRMATE CON LOS QUE SABEN

La mayor cantidad de estas instituciones científicas se encuentran en Europa.

Las Academias de Ciencias de EE.UU., Latinoamérica, África, China, India, Rusia y otros países también apoyan esta tecnología.

Fuente: https://goo.gl/Q5VCMO | Elaborado por ChileBio
¿¡¡TRANSGÉNICOS!!?

Alcohol: 3,3 millones de muertes/año

Tabaco: 6 millones de muertes/año

Obesidad: 3 millones de muertes/año

Transgénicos: 0 muertes/año

CUIDATE DE LO QUE REALMENTE TE HACE DAÑO
If you’re worried about food safety...

GENETIC MODIFICATION IS A PLANT BREEDING METHOD, NOT AN INGREDIENT!
Biotech improved crops are as safe/safer than other crops

- **European Union:** the use of more precise technology and the greater regulatory scrutiny probably make them even safer than conventional plants and foods... the benefits of these plants and products for human health and the environment become increasingly clear

  --European Commission, Press Release of 8 October 2001, announcing the release of 15 year study including 81 projects/70M euros, 400 teams (now 25+ years, 500 teams & 130 projects)
“it is absolutely true that there’s a scientific consensus on GMO safety.”

-- George Monbiot
What Do We Know About GM Food Safety?

- Substantial equivalence
  - This is a conclusion, not a presupposition
  - OECD: SE is a finding based on data & analysis

- Global Scientific Consensus
  - More than 275 scientific organizations
  - 11 US National Academy studies; 2000+ papers
  - Research by independent scientists & industry reaches the same conclusions
  - “There is no there there” (Gertrude Stein)
Further Reading

- Alessandro Nicolia, et al., *An overview of the last ten years of genetically engineered crop safety research*

- L. Val Giddings, *Gene Editing, GMOs, and Fear Based Marketing.*

- Jennifer Doudna, “*CRISPR systems in prokaryotic immunity*” and “*How CRISPR lets us edit our DNA.*”


Thank You!

Val Giddings  |  @PrometheusGreen
What proponents really want:

- http://www.geneticliteracyproject.org/2013/10/31/genetic-literacy-project-infographic-is-labeling-really-about-our-right-to-know/#.UwP6r_IdWS0
“Our purpose is not to be scientifically correct, that’s the corporation and robber-baron’s job. Our job is to move the needle and affect radical change.”

--Greenpeace organizer, responding to allegations that Greenpeace’s “science” continues to build on misrepresentations and blatant falsehoods.
GREENPEACE
Magazine
WINTER 2000

IT Came from the Grocery Store

The HORROR of Genetic Engineering
Do you know what's in the food you're buying?
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, “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.”

Joseph Mercola

ttp://vtdigger.org/2012/04/17/wanzek-genetically-modified-food-is-perfectly-healthy
“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.”
Ronnie Cummins.

https://www.commondreams.org/view/2012/08/02-0
So, our Institute designed and launched educational campaigns and worked in a coalition of other organizations to motivate consumers to protect their health by choosing non-GMO foods. We also made a Non-GMO Shopping Guide available to help people identify these healthier foods. Our goal was to generate a tipping point of consumer rejection in the U.S. and Canada to eliminate GMOs from the marketplace.

- See more at:

http://vitalitymagazine.com/article/the-market-for-gmos-is-about-to-tip-over/#sthash.13b3wzLq.dpuf
…If the newly announced non-GMO products start gaining sales and eroding the market share of their GMO competitor, then we anticipate a full clean out of GMO direct derivatives from the food industry soon after. If, however, non-GMO claims do not drive greater sales, then we risk stalling the tipping point trend. - See more at: http://vitalitymagazine.com/article/the-market-for-gmos-is-about-to-tip-over/#sthash.13b3wzLq.dpuf

Jeffery smith at

http://vitalitymagazine.com/article/the-market-for-gmos-is-about-to-tip-over/
This isn't about freedom of choice. It's about destroying biotechnology and getting it off the shelves.

-- Bruce Chassy, Assoc. Director, University of Illinois Biotechnology Center.
“Something’s just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty.”
Further Reading

- Alessandro Nicolia, et al., *An overview of the last ten years of genetically engineered crop safety research*
- L. Val Giddings, *Gene Editing, GMOs, and Fear Based Marketing.*
- Jennifer Doudna, “CRISPR systems in prokaryotic immunity” and “How CRISPR lets us edit our DNA.”