

Seeds of Hope: Past, Present, & Future of Agriculture

Bob Goldberg UCLA





G.M.O. Labels for Food Proliferate Even as a Battle Over Them Rages

Colorado, Oregon Reject GMO Labeling

L.A. council to weigh ban on growing genetically modified crops

Justices Back Monsanto on Biotech Seed Planting

What's a GMO?



What's a GMO?



A Genetically Engineered Bacteria Synthesizing Human Insulin Used as a Drug to Treat Diabetics?



A Genetically Engineered GloFish Used as a Pet?



A Genetically Engineered Person With a Gene That They Weren't Born With That "Cures" a Lethal Genetic Disease?

What's a GMO?







Crops That Are Grown For For Human & Animal Consumption?



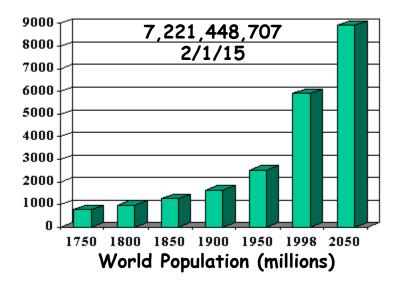








We Face Major Challenges in Agriculture





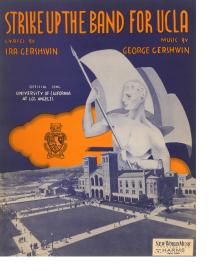
OVER THE NEXT 50 YEARS WE WILL NEED TO <u>PRODUCE</u> <u>MORE FOOD</u> THAN IN THE WHOLE OF HUMAN HISTORY AND DO IT WITH <u>FEWER INPUTS</u> ON LESS ARABLE LAND!!!! CROP **YIELDS** NEED TO BE INCREASED SIGNIFICANTLY!!

3,000 Acres/Day of Productive Farmland is Lost to Development Each Day in the United States



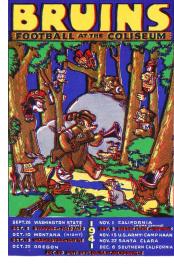


"Major Land Uses Overview." USDA, Economic Research Service, Web, April 3, 2013.



712 UNIVERSITY OF CALIFORNIA AT LOS ANGELES. CALIF.

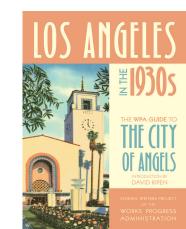




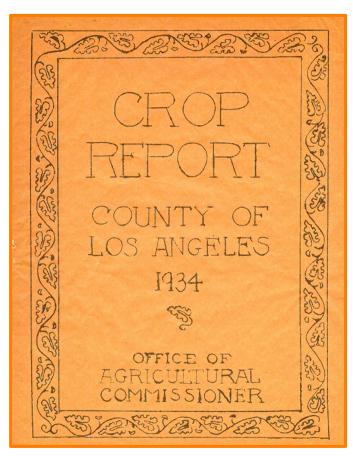
An Example From UCLA & Los Angeles History....







A Sample of LA County Agriculture in the 1930s



CITRUS FRUITS Cranges Lemons Grapefruit	44,566 11,134 <u>712</u> 56,412	9,211,900 2,063,000 190,800 41965 700	boxea "	\$ 17,786,100 5,923,000 <u>305,700</u> \$ 24,014,800
OTHER FRUITS & NUTS Apples Apricots Almonds Avocados** Figs Grapes-table Grapes-wine	441 944 1,008 2,191 772 1,919 2,550)	504,000 4,260,000	tons (green) lbs lbs tons	13,200 77,000 70,600 303,100 66,000 76,800 91,000
Grapes-raisin Olives Peaches-cling Peaches-free Pears Persinmons Plums Prunes Walnuts	324) 1,236 692 986 2,481 226 241 54 25,217	575 1,200 1,700 5,000 450 480 110 18,947,000	10 11 11 11 11	20,800 39,600 56,100 125,000 18,000 16,800 2,200 1,540,000

600,000 Acres ~30% of LA County Total Area!! Cash Value of \$2.8B in 2014 Dollars!!!

Crop Acreage Trends For LA County & Southern California, 1925-1954, Published by LA County Board of Supervisors, Compiled by LA County Chamber of Commerce UCLA Library OCLC21700378

Aerial Photograph of UCLA in 1929

There Were 18,000 Farms in Los Angeles County in 1930!!! From 1901 to 1950 Los Angeles County Was the Largest Agricultural Producing County in the USA!!!

Bel-Air

Sunset Blvd.

Westwood Blvd.

Original Agricultural College and Citrus/Avocado Orchard

Beverly

Hilgard Blvd.

Hills

Thelner Hoover 4/11/29

Los Angeles Population = 1,238,000

(Farms!!)

Original UCLA College of Agriculture-1930



UNIVERSITY OF CALIFORNIA BULLETIN



1939-40

DEPARTMENTS AT LOS ANGELES

For sale by the STUDENTS COÖPERATIVE BOOK STORE, LOS ANGELES PRICE, TWENTY-FIVE CENTS

COLLEGE OF AGRICULTURE

THE COLLEGE OF AGRICULTURE of the University of California offers at Los Angeles the Plant Science curriculum and the major in Subtropical Horticulture leading to the Bachelor of Science degree. Students electing other majors in this curriculum may spend the freshman and sophomore years at Los Angeles and then transfer to the campus where their major work is offered. Graduate work in agriculture is also offered which leads to the degrees of Master of Science and Doctor of Philosophy.

Students electing other curricula in the College of Agriculture—Animal Science, Agricultural Economics, Entomology and Parasitology, Forestry, Soil Science, Home Economics, and Agricultural Education—and those electing the curriculum in Agricultural Engineering, may spend the first two years at Los Angeles and then transfer to Berkeley or Davis without serious loss of time. Students who plan to major in Landscape Design are advised to transfer to Berkeley at the beginning of the sophomore year. Students who register at Los Angeles with the intention of later transferring to Berkeley or Davis to pursue other curricula or to obtain majors in the Plant Science curriculum other than Subtropical Horticulture are requested to consult the PEOSPECTUS OF THE COL-LEGE OF AGRICULTURE and the appropriate adviser in Agriculture at Los Angeles.

108. Fruit Physiology and Storage Problems. (2) I.

Mr. Biale

Lectures and discussions, two hours. Prerequisite: consent of the instructor.

Bipening processes of fruit on the tree; maturity standards and tests; ripening and respiration as affected by ethylene gas treatment; chemical and physiological changes at low temperatures; cold storage and refrigerated gas storage; role of volatile substances; differences in species and varietal responses.



Avocado Rootstock Progeny Nursery on the UCLA Campus in 1936



CA Schroeder, Cal. Avocado Society Year Book, 76, 77-83 (1992)

Origins of Avocado Research



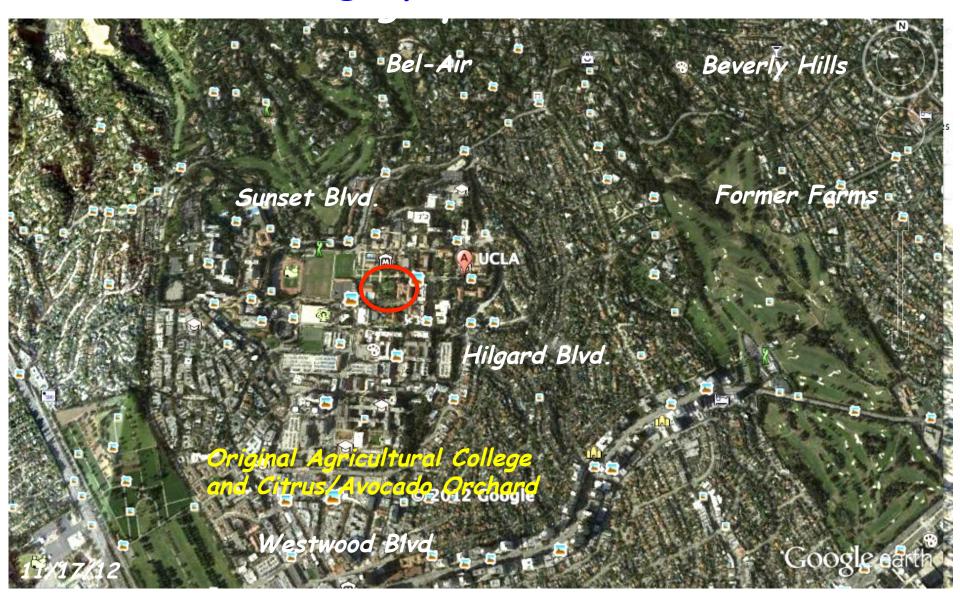








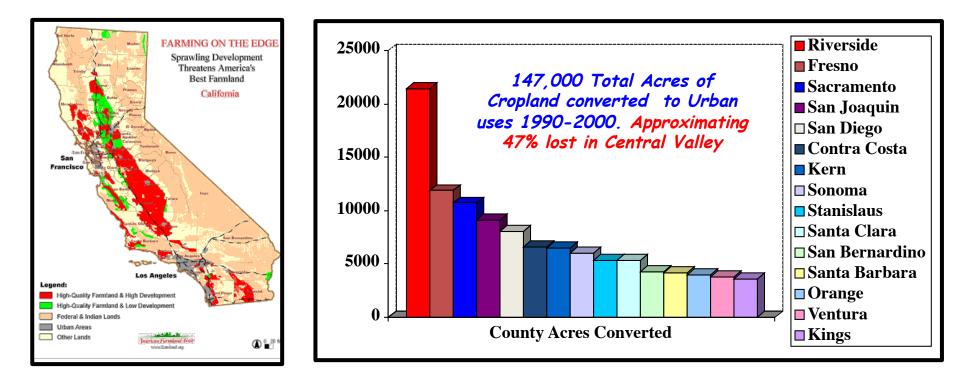
Aerial Photograph of UCLA in 2015



Note: Los of Crop Land!! Gone Forever!!

Los Angeles Population = 3,893,000

California Conversion of Cropland to Urban Uses is Occurring Statewide - <u>Crop Yields</u> <u>Need to Be Increased</u>!!



12,000,000 Total Acres of Cropland 15,000,000 Total Acres of Grazing Land

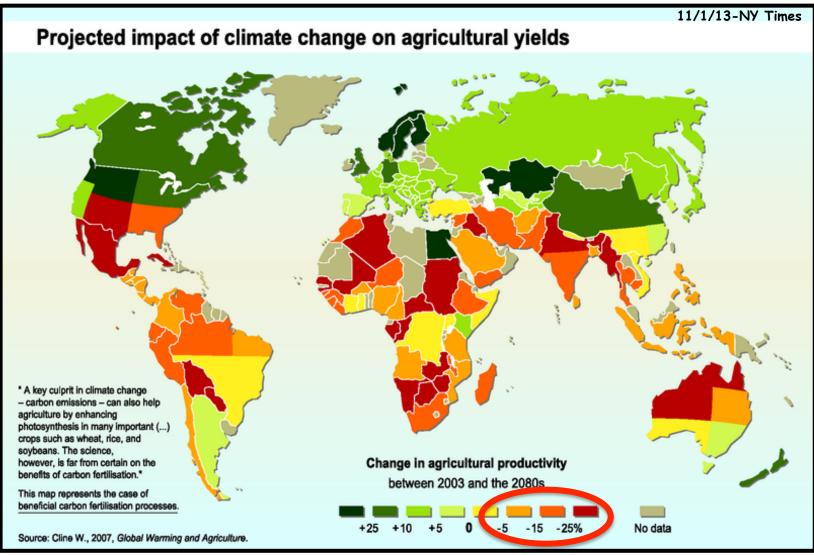
Los Angeles Times May 25, 2003





Climate Change Will Also Have a Major Impact on Crop Yields in the Future!

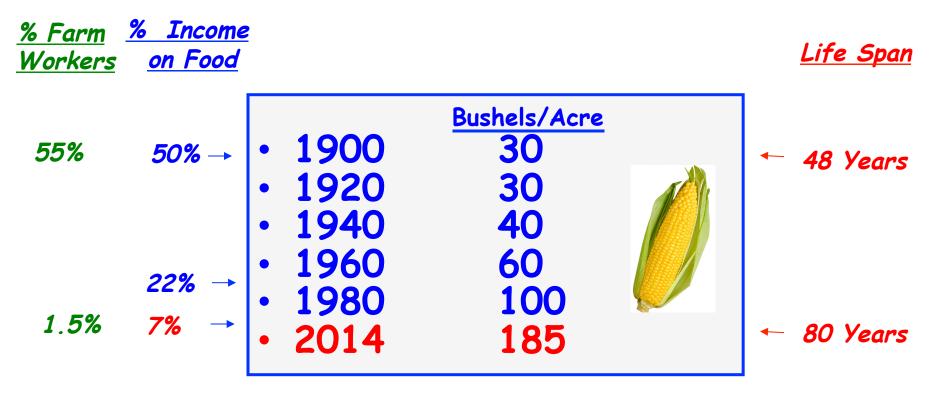
Climate Change Seen Posing Risk to Food Supplies



How Have Crop Yields Increased Over the Past 100 Years?

THE-ADMINISTRATIONS OMISES HAVE BEEN KEP Big Changes in the US Over The Past 100 Years "We've Come a Long Way Baby" 1900 2015 Life Expectancy 48 (women) 81 (women) \$8,000 \$50,000 Average Family Income (2015 Dollars) 1,100 gallons Gasoline Use Per Capita 34 gallons 99% Flush Toilets Per Housing 10% Unit High School Grads 13% 90% 1.5% Farm Workers 55%

CROP **YIELD** INCREASES HAVE "ROCKETED UPWARDS" OVER THE LAST 100 YEARS AND CONTRIBUTED TO A LONGER AND "BETTER" LIFE



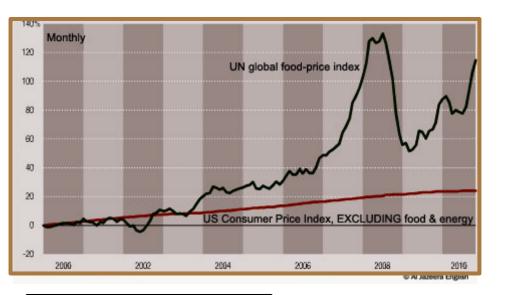
<u>1930:</u> 30 bushels/acre <u>1930:</u> 1 farmer fed 10 people

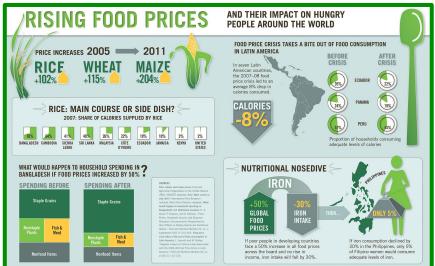
<u>2014</u>: 185 bushels/acre <u>2014:</u> 1 farmer feeds 200 people

<u>Conclusion</u>: Crop yields increased >500% over the past 100 years and <u>lead to a similar reduction in food costs!!!!!</u>



World Crop Production is Leveling Off on a Per Capita Basis-Higher Prices Ahead?





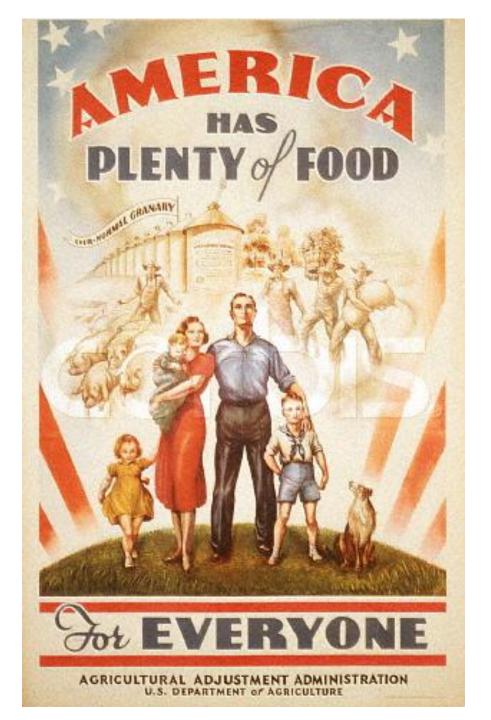
Food riots fear after rice price hits a high

Political Instability

Rising food prices: A global crisis

Action needed now to avert poverty and hunger

Yields Need to Increase to Produce More Food & Grow More on Less Land





How Was This Accomplished Over the Past 100 Years?

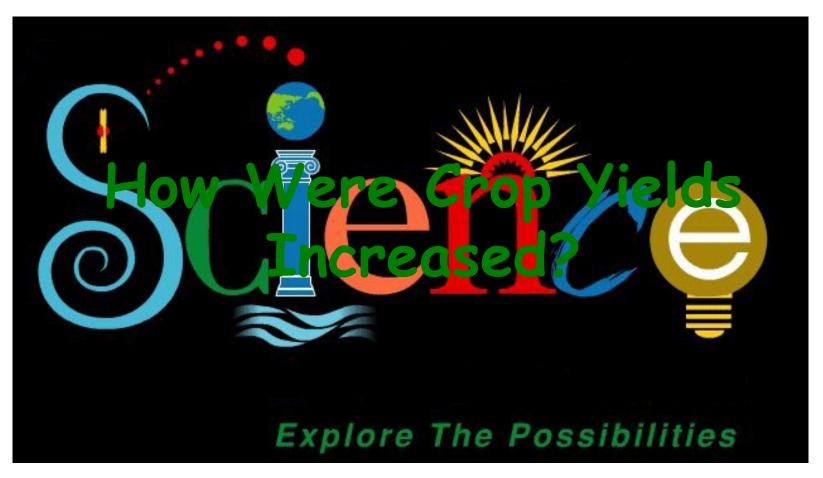
What Role Did Science & Technology Play in Increasing Crop Yields?

What About in the Future When There are 350 Million People in the USA and 9 Billion in the World?



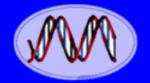








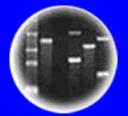




DNA Genetic Code of Life



Entire Genetic Code of a Bacteria



DNA Fingerprinting



Cloning: Ethical Issues and Future Consequences



Plants of Tomorrow

Science is NOT "Hocus Pocus" or Based on Opinions and Beliefs



•Science is Based on Observation, Hypothesis Testing, Rigorous Experimentation, and Verification

•Technology, or the Application of Scientific Knowledge, Has Transformed Dramatically Our Lives and How We Live

It's Not Politics or Talk Showology!!!

The Past 100 Years Has Produced a Revolution in Genetic Research and Knowledge Leading to **Remarkable Advances in Medicine and Agriculture**

1900: Rediscovery of Mendel's Work

of inheritance in the scientific world.



DeVries, Correns and Tschermak independently rediscover Mendel's work. Three botanists - Hugo DeVries, Carl Correns and Erich von Tschermak independently rediscovered Mendel's work in the same year, a generation after Mendel published his papers. They helped expand awareness of the Mendelian laws

The three Europeans, unknown to each other, were working on different plant hybrids when they each worked out the laws of inheritance. When they reviewed the literature before publishing their own results, they were startled to find

Mendel's old papers spelling out those laws in detail. Each man announced Mendel's discoveries and his own work as confirmation of them.

1909: The Word Gene Coined

Danish botanist Wilhelm Johannsen coined the word gene to describe the Mendelian units of heredity.

He also made the distinction between the outward appearance of an individual (phenotype) and its genetic traits (genotype).

Four years earlier, William Bateson, an early geneticist and a proponent of Mendel's ideas, had used the word genetics in a letter; he felt the need for a new term to describe the study of heredity and inherited variations. But the term didn't start spreading until Wilhelm Johannsen suggested that the Mendelian factors of inheritance be called genes.

The proposed word traced from the Greek word genos, meaning "birth". The word spawned others, like genome.

1911: Fruit Flies Illuminate the Chromosome Theory



Using fruit flies as a model organism, Thomas Hunt Morgan and his group at Columbia University showed that genes, strung on chromosomes, are the units of heredity.

Morgan and his students made many important contributions to genetics. His students, who included such important geneticists as Alfred Sturtevant, Hermann Muller and Calvin Bridges, studied the fruit fly Drosophila melanogaster. They showed that chromosomes carry genes, discovered genetic linkage - the fact that genes are arrayed on linear chromosomes - and described chromosome recombination.

In 1933, Morgan received the Nobel Prize in Physiology or Medicine for helping establish the chromosome theory of inheritance.



1973: Genetic Engineering is Invented

SAVE Biochemists working in California have developed a practical method of transplanting genes, the chemical units of heredity, from cells as complex as those of animals into the extremely simple, fast-multiplying cells known as bacteria. [END OF FIRST PARAGRAPH]





1983: First Genetically Engineered Plant





2004: Refined Analysis of Complete Human Genome Sequence



The finished sequence contains 2.85 billion nucleotides interrupted by only 341 gaps. It The finished sequence contains 2.85 sillion nucleosides interrupted by why 34 gass. If second a sequence of the techniques and possibly new technologies. The finished genome sequence can be freely accessed through public disbases and may be used by reactive structure structures.

20110: Era of Synthetic Biology Begins -Genome Synthesized From Chemicals



2013 : Genome Sequencing Explosion



2100??





WHAT TECHNOLOGIES CAUSED AN INCREASE IN CROP YIELDS OVER THE PAST 100 YEARS?

- PLANT BREEDING (New Hybrids-Green Revolution)
- · IRRIGATION
- · FERTILIZERS
- · PESTICIDES & HERBICIDES
- MECHANIZATION (e.g., Tractor)
- · GLOBAL POSITIONING AND SATELLITE IMAGING
- GENOMICS & GENETIC ENGINEERING (New Traits)

These technologies have resulted in a >300% increase in US crop productivity!



Need to sustain this yield increase by applying the best technology and agricultural practices!



Our Food is Derived From Fifteen Crops & Over Half Produce Seeds For Human and Animal Consumption Most of These Genomes Have Been Sequenced!



- Wheat
- · Rice
- Corn*
- Barley
- Sorghum
- Soybean*
- Common Bean
- Coconut
- Canola*

* Genetically Engineered

Non-Seed Crops

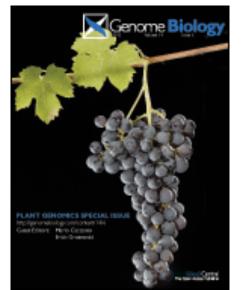
- Potato
- Sweet Potato
- Cassava
- Sugar Beet*
- Sugar Cane
- Banana

We Understand the Science of These Genomes - It's No Longer a "Black Box" as in the Pre-Genomics Era!!!!!

2015 - The Genomics Revolution Goes Green!!!



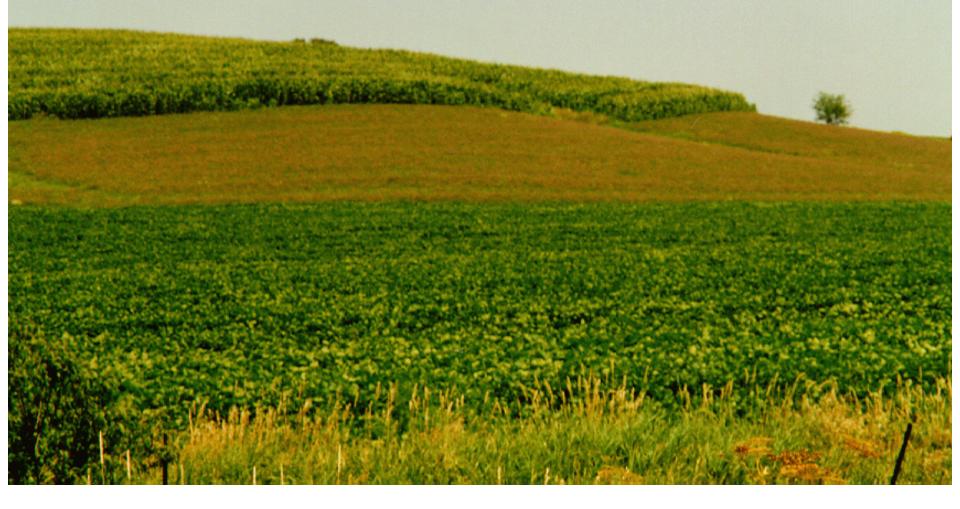
A Rich Harvest of Plant Genes & Basic Plant Processes!







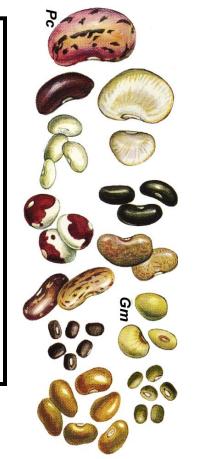
How Will Crop Yields Be Increased in the Future?



...By Using a Variety of Approaches to Identify Genes and Processes That Will Help Increase Crop Yields and Food Production Significantly in the 21st Century....

<u>Yield (Developmental Traits)</u>

- Seed Number
- Seed Size
- Growth Rate
- Organ Size (More Seeds)
- Plant Architecture
- Flowering Time
- Senescence
- Maturity
- Stature



<u> Yield (Stress Traits)</u>

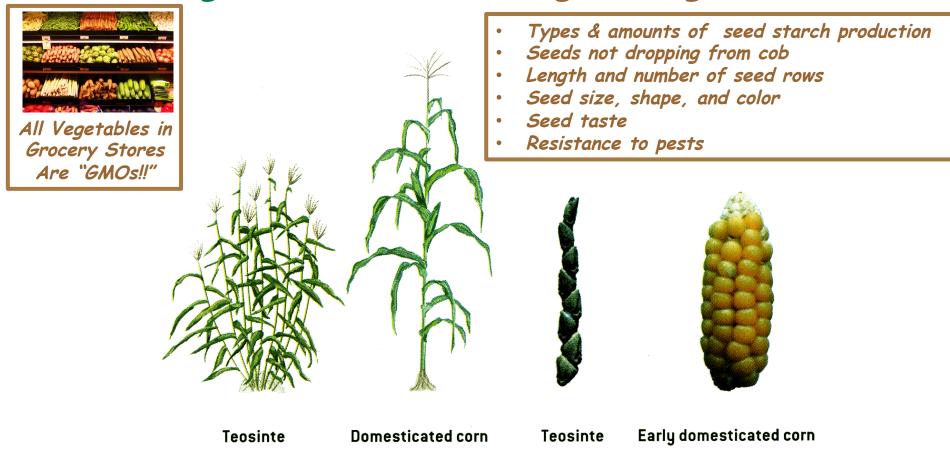
- Nutrient Uptake
- Drought Resistance
- Heat Resistance
- Cold Tolerance
- Salt Tolerance
- Shade Tolerance
- Disease Resistance





......And by Using Genomics, Breeding, and Genetic Engineering to Introduce These "Yield" Genes Into Crops (One thing we can be sure of-we can't predict what new technology will be the driver 10-25 years out!)

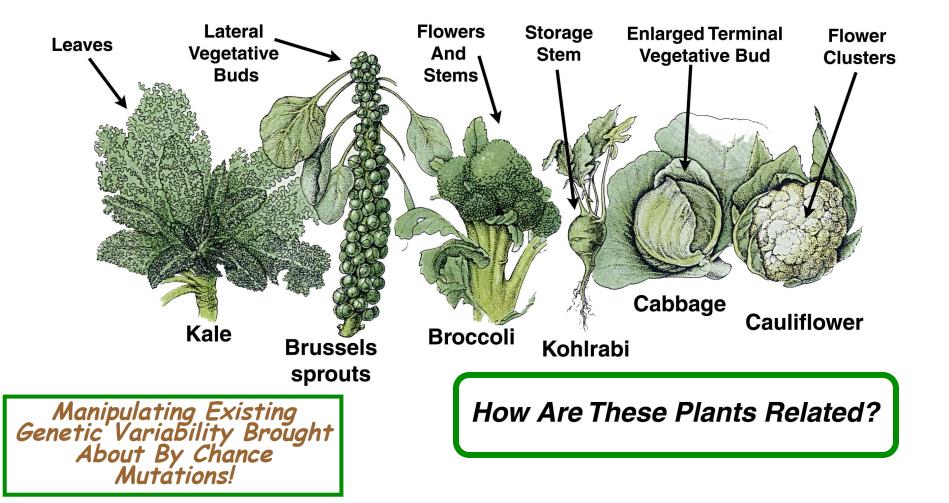
<u>All Crops Have Been Engineered</u> - Turning Wild Teosinte Into Domesticated Corn 10,000 Years Ago - Seed & Plant Engineering!!



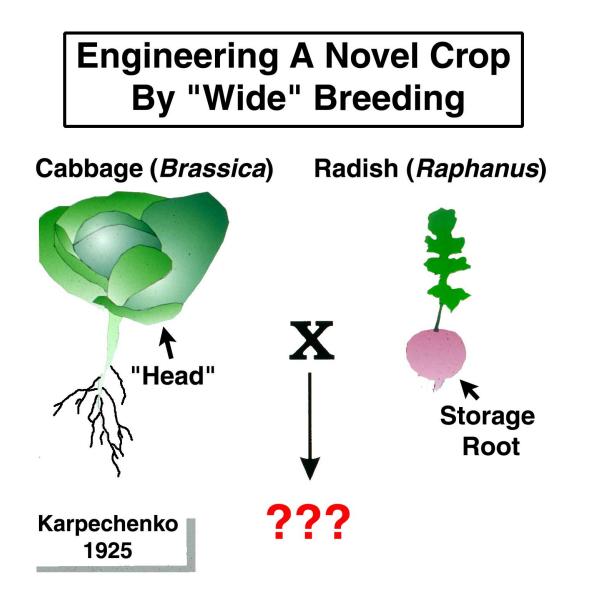
<u>Note:</u> Architecture and Fruit (cob) Size

Only Five Genes Cause These Plants to Differ & We Now Know What They Are

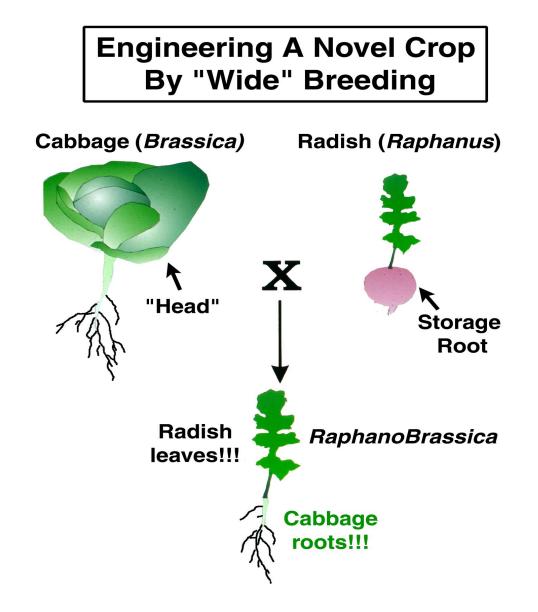
Engineering Vegetables With Different Plant Architectures



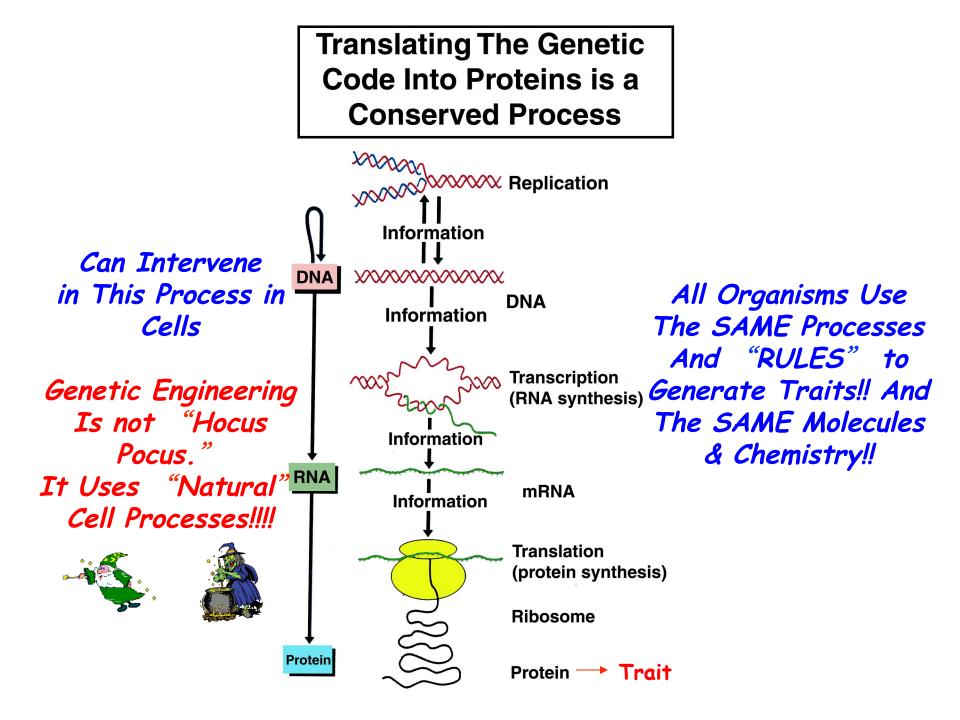
The Problem With Breeding the "Old Fashioned Way"





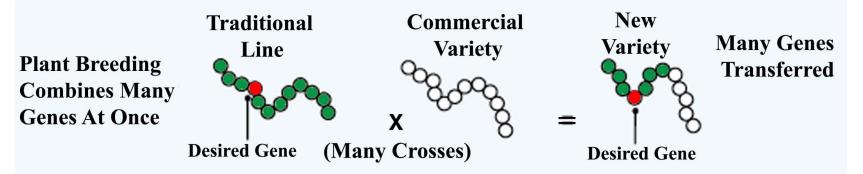


Results Show the Unpredictability of Classical Breeding Approaches!!

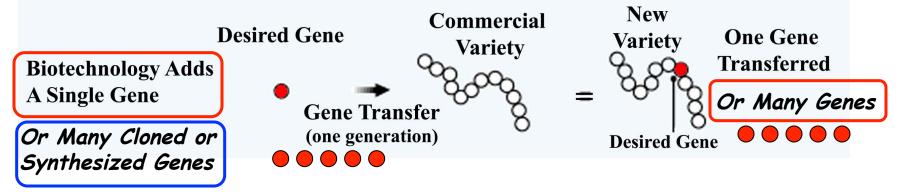


Classical vs. Molecular Genetic Engineering Techniques

TRADITIONAL PLANT BREEDING



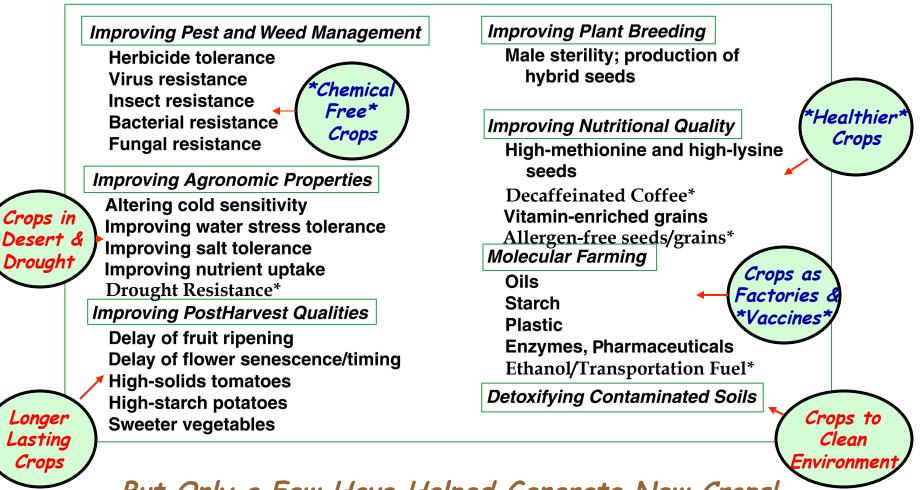
PLANT BIOTECHNOLOGY



Both Manipulate Genes - But in Different Ways!!

Plants Have Been Engineered For Large Numbers of Traits in <u>Laboratories</u> Around the World - And More Exciting Traits to Come! Tens of Thousands of Genetic Engineering Experiments!!





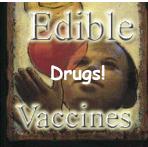
But Only a Few Have Helped Generate New Crops! The "Simple Ones With Economic Drivers"

Genetic Engineering Examples





Golden Rice Vitamin A Fortification





Nature, May, 1987

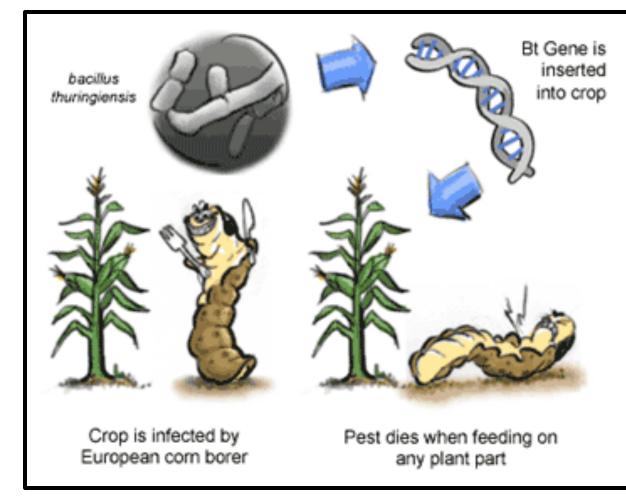
nature

Example: How to Make an Insect-Resistant Plant?









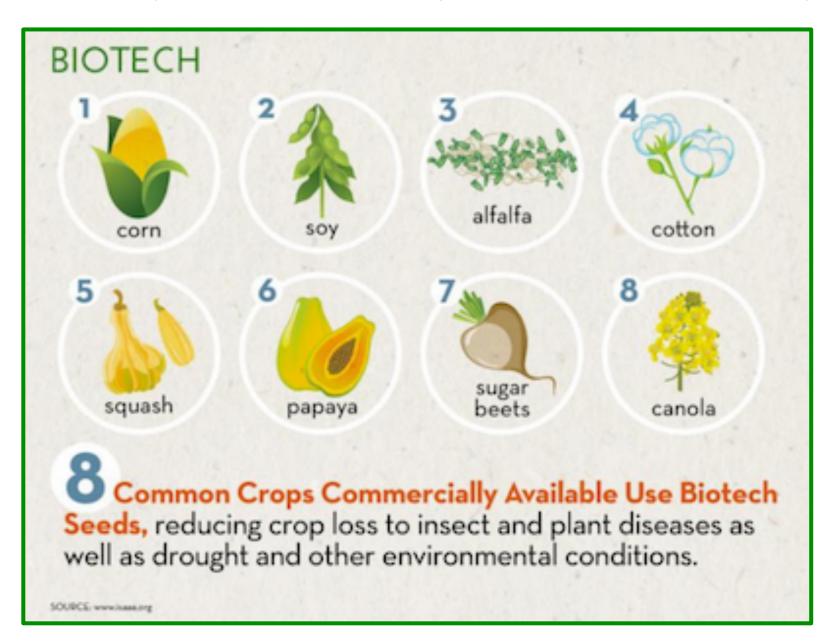


How to Use Bt Pesticide as an Organic Pest Control

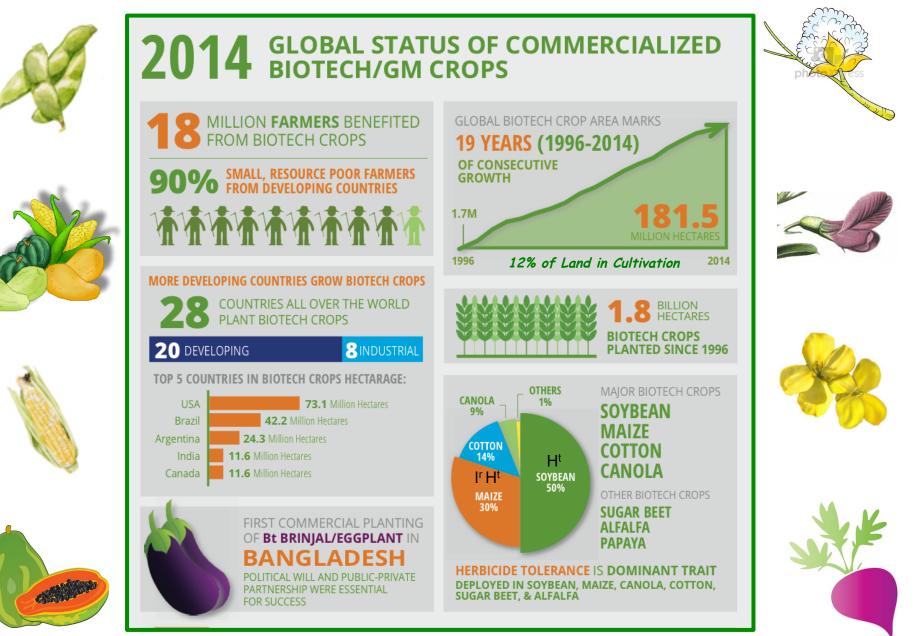
Learn how to use Bt pesticide to kill cabbage worms, tomato hornworms and other pests in your organic vegetable garden.



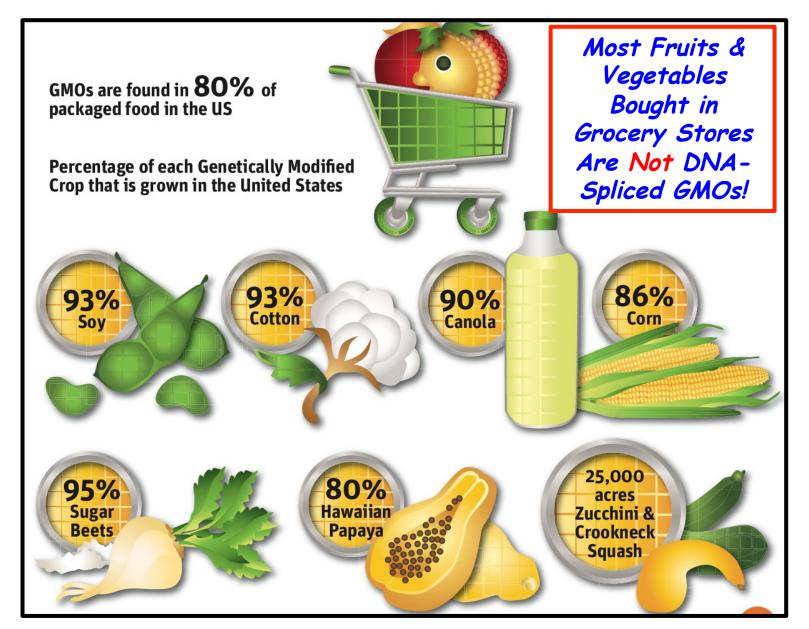
Genetically Engineered Crops in Cultivation Today



Genetic Engineering - Most Rapidly Adopted Technology in Agricultural History



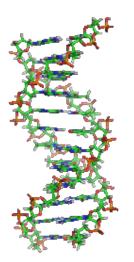
Most Genetically Engineered Crops Are Fed To Animals or in Processed Foods





WHAT ABOUT SAFETY? How Many Genes Did You Eat Today?





- One Lettuce Leaf Has Two Million Cells
- Each Lettuce Cell Has ~25,000 Genes
- \cdot One Lettuce Leaf Has Fifty Billion Genes
- A Small Salad Has 10 Lettuce Leaves Or Five Hundred Billion Genes!!!

What About the Carrots, Celery, Tomatoes, etc.?

What Happens to the Genes That You Eat?

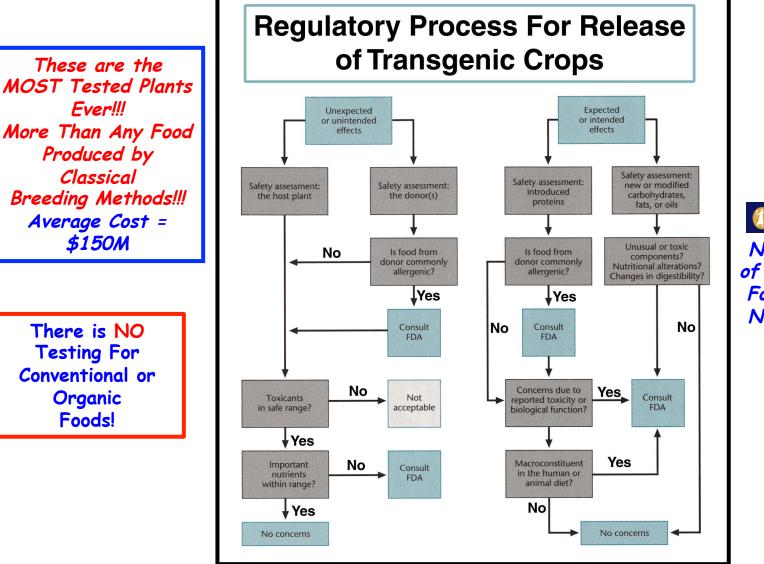


Protein Studied*	Noel**	Stable to Digestion?	Stable to Processing?
Cry1Ab	>4000	No (30s)	No
Cry1Ac	>5000	No (30s)	No
Cry/2Aa	>4011	No (30s)	No
Cry/2Ab	>1450	No (30s)	No
Cry3A	>5220	No (30s)	No
Cry3Bb	>3780	No (30s)	No
Cry/9C	>3760	+/- (30 min)	Partial
NPT II	>5000	No	No
CP4 EPSPS	>572	No	N.A.
GUS	>100	No	N.A.







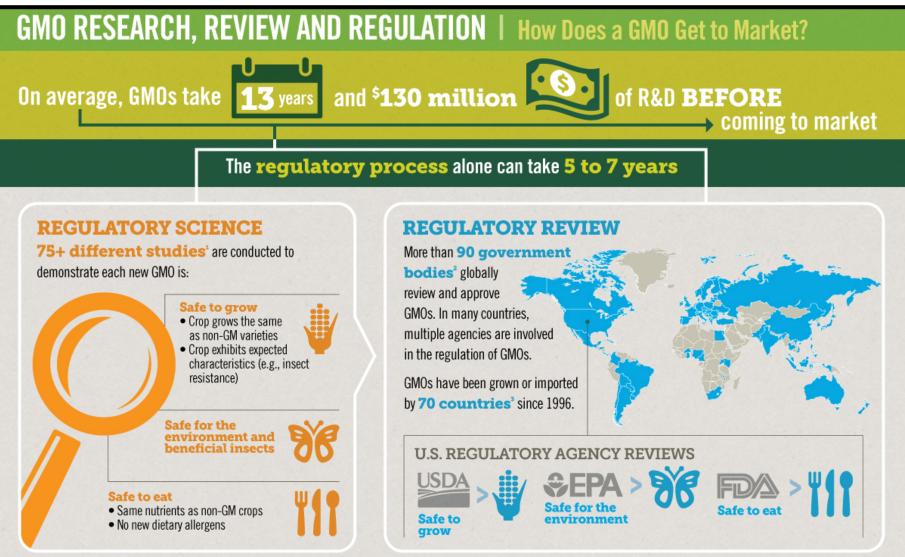


national academy of sciences

National Academy of Sciences Report: Focus on the Food Not the METHOD of Production!!!

Similar to Those Used For Antibiotics, Vaccines, and Drugs!!

Genetically Engineered Crops Are the Most Tested Crops in Agricultural History!



*Estimated numbers from DuPont Pioneer based on studies from recent biotech applications. 1 Pincludes agencies reviewing new biotechnology applications from 62 individual countries and 28 EU member countries. 1 *Country count cited from ISAAA.org

For more information, visit www.GMOAnswers.com

Which Food Would YOU Eat?

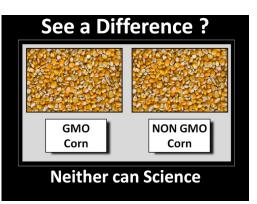


- No Testing
- No Regulatory Oversight
- Contains Known Allergen
- 200 People Die Each Year





- Extensive Testing (~10 years)
- FDA, USDA, & EPA Oversight
- Eaten By Billions of People
- No Documented Health Problems



Researchers Develop First Hypoallergenic Soybeans

Will These Ever Get To The Market? Safety Issues of Genetically Engineered Plants Have Been Investigated and Discussed For 30 Years - Thousands of Studies -Unanimous Conclusion - <u>GMOs are Safe For Human Consumption!</u>!



2004

2010

2011



"The AMA adopted policy supporting this science-based approach, recognizing that there currently is no evidence that there are material differences or safety concerns in available bioengineered foods."



"To date no adverse health effects attributed to genetic engineering have been documented in human populations."



"The scientific literature shows no compelling evidence to associate such crops, now cultivated worldwide for more than 15 years, with risks to the environment or with safety hazards for food."

Critical Reviews in Biotechnology

http://informahealthcare.com/bty ISSN: 0738-8551 (print), 1549-7801 (electronic)

Crit Rev Biotechnol, Early Online: 1–12 © 2013 Informa Healthcare USA, Inc. DOI: 10.3109/07388551.2013.823595



REVIEW ARTICLE

An overview of the last 10 years of genetically engineered crop safety research

Alessandro Nicolia¹*, Alberto Manzo², Fabio Veronesi¹, and Daniele Rosellini¹

¹Department of Applied Biology, Faculty of Agriculture, University of Perugia, Perugia, Italy and ²Ministry of Agriculture, Food and Forestry Policies (MiPAAF), Rome, Italy

Abstract

The technology to produce genetically engineered (GE) plants is celebrating its 30th anniversary and one of the major achievements has been the development of GE crops. The safety of GE crops is crucial for their adoption and has been the object of intense research work often ignored in the public debate. We have reviewed the scientific literature on GE crop safety during the last 10 years, built a classified and manageable list of scientific papers, and analyzed the distribution and composition of the published literature. We selected original research papers, reviews, relevant opinions and reports addressing all the major issues that emerged in the debate on GE crops, trying to catch the scientific consensus that has matured since GE plants became widely cultivated worldwide. The scientific research conducted so far has not detected any significant hazards directly connected with the use of GE crops; however, the debate is still intense. An improvement in the efficacy of scientific communication could have a significant impact on the future of agricultural GE. Our collection of scientific records is available to researchers, communicators and teachers at all levels to help create an informed, balanced public perception on the important issue of GE use in agriculture.

Keywords

Biodiversity, environment, feed, food, gene flow, –omics, substantial equivalence, traceability

History

Received 17 December 2012 Revised 24 June 2013 Accepted 24 June 2013 Published online 13 September 2013



Journal of Animal Science

The premier journal and leading source of new knowledge and perspective in animal science



Prevalence and impacts of genetically engineered feedstuffs on livestock populations A. L. Van Eenennaam and A. E. Young

J ANIM SCI 2014, 92:4255-4278. doi: 10.2527/jas.2014-8124 originally published online September 2, 2014

Conclusions

Commercial livestock populations are the largest consumers of GE crops, and globally, billions of animals have been eating GE feed for almost 2 decades. An extensive search of peer-reviewed literature and field observations of animals fed diets containing GE crop products have revealed no unexpected perturbations or disturbing trends in animal performance or health indicators. Likewise, it is not possible to distinguish any differences in the nutritional profile of animal products following consumption of GE feed. Animal agricul-

And a Lot, Lot, Lot More.....

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 is an international non-profit organization AAS serves some 261 affiliated societies and academies of science. "The science is quite clear: crop mprovement by the modern molecular techniques of biotechnology is safe."



The National Academy of Sciences is a non-profit organization in the United States. It is the premier scientific body

To date more than 98 million acres of genetically modified crops have been grown worldwide. No evidence of human health problems associated with the ingestion of these crops or resulting food products have been



The American Council on Science and lealth is a non-profit group of scientists dedicated to ensuring that important public policies related to health and the environment have a sound scientific

with the continuing accumulation of vidence of safety and efficiency, and he complete absence of any evidence of harm to the public of the environment, more and more consources are becoming as biotechnology as they are with medical biotechnology"



The ASM represents over 42,000 microbiologists worldwide.

"The ASM is not aware of any acceptable evidence that food produced with biotechnology and subject to FDA oversight constitutes high risk or is unsafe. We are sufficiently convinced to assure the public that plant varieties and products created with biotechnology have the potential of improved nutrition, better taste and longer





The premier body of physicians in the United States "There is no scientific justification for special labeling of genetically modified foods.

AMA

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."



England's top medical society, the Royal Society of Medicine is an independent educational organisation for doctors, dentists, scientists and others involved in medicine and health

"Foods derived from GM crops have been consumed by hundreds of millions of people across the world for inter than 15 years, with no reported ill effects (or legal cases related to human health), despite many of the consumers coming from that most litigious of countries, the USA."



The Academy of Nutrition and Dietetics is the world's largest organization of food and nutrition professionals.

We support biotechnology as a means for improving plant health, food safety, and sustainable growth in plant productivity.



American Society of Plant Sciences is a professional society devoted to the advancement of the plant sciences.

"The risks of unintended consequences of this type of gene transfer are comparable to the random musical breeding. The ASPB belleves strongly that, with continued responsible regulation and oversight, GE will bring many significant health and environmental benefits to the



The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. "No effects on human health have

"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.



EUROPEAN

The European Commission (EC) is the executive body of the European Unio "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a perio of more than 25 years of research, a involving more than 500 independe biotector and the second second biotector and the second second biotector of cover risky than e.g. conventional plant breeding



The American Society for Cell Biology is an international community of biologists dedicated to advancing scientific discovery, advocating sound research policies and improving ducation "Far from presenting a threat to the public health, GM crops in many

"Far from presenting a threat to the public health, GM crops in many cases improve it. The ASCB vigorously supports research and development of the area of genetically engineered organisms, including the development of genetically modified (GM) crop plants."



acilitate the international movement of seed, related know-how and technology:

"The safety of genetically modified plant varieties is ensured through most rigorous andcomprehensive s of regulatory and guality assuranc

The Science Source for Food, Agricultural, and Environmental Issuer

composed of scientific societies and many individual, student, company, nonprofit, and associate society

"over the last decade, 8.5 million farmers have grown transgenic varieties of crops on more than 1 billion acres of farmland in 17 countries. These crops have been consumed by humans and

Fransgenic crops on the market today are as safe to eat as their conventional counterparts, and likely more so given the greater regulatory



Representing the American Dairy Science Association, the American Society of Animal Science, and the Poultry Science Association members

Meat, milk and eggs from livestock and poultry consuming biotech feeds are safe for human

SOT Society of Toxicology

Creating a Safer and Healthier World by Advancing the Science of Toxicology

The Society of Toxicology is a rofessional and scholarly organization o scientists from academic institutions, government, and industry representing the great variety of scientists who practice toxicology.

Scientific analysis indicates that the process of GM food production is profixely to lead to paradis of a different nature than those already familiar to toxicologists. The level of safety of current GM foods to onsumers appears to be equivalent to that of traditional foods."



The Union of German Academies of Sciences and Humanities is an umbrella organisation for eight German academies of sciences and

"In consuming food derived from GM plants approved in the EU and in the USA, the risk is in no way higher than in the consumption of food from conventionally grown plants. On the contrary, in some cases food from GM plants appears to be superior in plants appears to be superior in

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.



There's NOT One Credible Study Showing That GM Foods Are Unsafe For Human & Animal Consumption

ksues Crop Science

SOCIETY OF AMERICA

The Grop Science Society of America (CSSA) is a prominent international scientific society dedicated to the conservation and wise use of natural sources to produce food, feed, and fiber ops while maintaining and improving the

The Crop Science Society of America supports education and research in all aspects of crop production, including the judicious application of biotechnology."



The SIVB has one the largest groups of rop geneticists and biotechnologists in

"All crop and animal products that result from biotechnology are demonstrated to be safe as non-engineered versions of that plant



Prepared by the Royal Society of London, the DS National Academy of Sciences, the Brazilian Academy of Sciences, the Indian National Science Academy, the Mexican Academy of Sciences and the Third World Academ

Produced through the use of GM technology that are more nutritious, stable in storage, and in rinciple health promoting —bringin benefits to consumers in both industrialized and developing



"GMOs on the market today, having uccessfully passed all the tests and procedures necessary to thorization, are to be considered, or he basis of current knowledge, it is afe for use human food and animal"

The international Council for Science (ICSU) is an international non-governmental organization devoted to international cooperation in the advancement of science. Its members are national scientific bodies and international scientific unions

"Currently available genetically modified crops – and foods derived rom them – have been judged safe to eat, and the methods used to test them have been deemed appropriate"



Here's the Irony..... The Engineered Protein in GMO Soybeans is a Protein that Occurs Naturally in All Plants and that You Eat Everyday in Organic and Non-GMO Vegetables!!!

and and a second			
	Bacteria		
	Corn	А	1
	Soybean	-MAQVSRVHNLAQSTQIFGHSSNSNKLKSVNSVSLRPRLWGASKSRIPMHKNGSFMGNFNVGKGNSGVFKVSASVAAAEKPS	81
	Cotton	MATQVGKIYNGTQKTCVLPNVSKTQNPKHVPFVSFKSNLNGKTSSWGLVVKNNGKFGSIKARSLKVSASTATAEKPS	
/ /	Bacteria	MIELTITPPDHPLSGKVEPPGSKSITNRALLLAGLAKGKSRLTGALKSDDTLYMAEALREMGVKVT-EPDATTFVVEGTG	
	Corn	GAEEIVLQPIKEISGTVKLPGSKSLSNRILLLAALSEGTTVVDNLLNSEDVHYMLGALRTLGLSVEADKAAKRAVVVGCGGK	
	Soybean	${\tt TSPEIVLEPIKDFSGTITLPGSKSLSNRILLLAALSEGTTVVDNLLYSEDIHYMLGALRTLGLRVEDDKTTKQAIVEGCGGL}$	
	Cotton	RASEIVLQPINEISGTVKLPGSKSLSNRILLLAALSEGTTVVENLLNSDDVHHMLVALGKLGLYVKHDSEKKQAIVEGCGGQ	159
~	Bacteria	VLOOPEKPLFLGNAGTATRFLTAAAALVDGAVIIDGDEHMRKRPIMPLVEALRSLGVEAEAPTGCPPVTVCGKG	153
	Corn	FPVEDAK-EEVQLFLGNAGTAMRPLTAAVTAAGGNATYVLDGVPRMRERPIGDLVVGLKQLGADVDCFLGTDCPPVRVNGIG	164
	Soybean	FPTSKESKDEINLFLGNAGTAMRPLTAAVVAAGGNASYVLDGVPRMRERPIGDLVAGLKQLGADVDCFLGTNCPPVRVNGKG	245
	Cotton	FPVGKGEGQEIELFLGNAGTAMRPLTAAITAAGGNSSYVLDGVPRMRERPIGDLVTGLKQLGADVDCILGTNCPPVRIEGKG	241
	Bacteria	TGFPKGSVTIDANLSSQYVSALLMAAACGDKPVDIVLKGEEIGAKGYIDLTTSAMEAFGAKIERVSNAIWRVHPTGYTA	222
	Corn	-GLPGGKVKLSGSISSQYLSALLMAAPLALGDVEIEIIDKLISIP-VVEMTLRLMERFGVKAEHSDSWDRFYIKGGQKYKSP	
	Soybean	-GLPGGKVKLSGSVSSQYLTALLMAAPLALGDVEIEIVDKLISVP-VVEMTLKLMERFGVSVEHSGNWDRFLVHGGOKYKSP	
	Cotton	-GLPGGKVKLSGSISSQYLTALLMAAPLALGDVEIEIIDKLISIP-YVEMTMKLMERFGVTVEHTDSWDRFFIRGGQKYMSP	
	Bacteria	TDFHIEPDASAATYLWGAELLTGGAIDIGTPADKFTQPDAKAYDVMAKFPHLPAEIDGP	
	Corn	KNAYVEGDASSASYFLAGAAITGGTVTVEGCGTTSLQGDVKFAEVLEMMGAKVTWTETSVTVTGPPREPFGRKHLKAIDVNM	
	Soybean	GNAFVEGDASSASYLLAGAAITGGTITVNGCGTSSLQGDVKFAEVLEKMGAKVTWSENSVTVSGPPRDFSGRKVLRGIDVNM	
	Cotton	GNAYVEGDASSASYFLAGAAVTGGTVTVEGCGTSSLQGDVKFAEVLEMMGAKVTWTENSVTVTGPPRNSSGRKHLRAIDVNM	403
	Bacteria	SQMQDAIPTIAVLAAFNETPVRFVGIANLRVKECDRIRAVSLGLNEIRNGLAHEEGDDLIVHADPALAGQTVKASIDTFADH	371
	Corn	NKMPDVAMTLAVVALFADGPTAIRDVASWRVKETERMVAIRTELTKLGASVEEGPDYCIITPPEKLNVTAIDTYDDH	
	Soybean	NKMPDVAMTLAVVALFANGPTAIRDVASWRVKETERMIAICTELRKLGATVEEGPDYCVITPPEKLNVTAIDTYDDH	484
Ser State	Cotton	NKMPDV <mark>AM</mark> TLAVVALYADGPTAIRDVASWRVKETERMIAICTELRKLGATVEEGPDYCVITPP <mark>EKL</mark> NVTAIDTYDDH	480
AT LEAN	Doctorio		
	Bacteria	RIAMSFALAALKIGGIAIQNPACVGKTYPGYWKALASLGVDYTEKESAAEPQH 425 RMAMAFSLAACAEVPVTIRDPGCTRKTFPDYFDVLSTFVKN 444	
	Corn		
	Soybean Cotton	RMAMAFSLAACGDVPVTIKDPGCTRKTFPDYFEVLERLTKH 525 RMAMAFSLAACAEVPVTIKDPGCTRKTFPDYFEVLDRVTKH 521	
	COTTON	RMARAF SLAACAEVFVIIRDPGCTRRTFPDIFEVLDRVTRH 521	



Some Benefits of Biotech Crops - Dispelling the Myths (1996-2014)

- Increased Crop Value by \$78B
- ~75% of Crop Added Value Went to Small Farmers
- Reduced Pesticide Use 10% or 200M Pounds!
- Reduced CO₂ Emissions by 40B Pounds or the Equivalent of Taking 9M Cars Off the Road
- Saved Billions of Tons of Topsoil by Using No-Till Farming (1B per year)
- Improved the Health of Farmers in Developing Countries (Reduced Pesticides)
- Contributed to Reduced Food Costs in the US and Elsewhere











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PLOS ONE

A Meta-Analysis of the Impacts of Genetically Modified

Crops Funded by German Federal Ministry of Development & European Union

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Abstract

Background: Despite the rapid adoption of genetically modified (GM) crops by farmers in many countries, controversies about this technology continue. Uncertainty about GM crop impacts is one reason for widespread public suspicion.

Objective: We carry out a meta-analysis of the agronomic and economic impacts of GM crops to consolidate the evidence.

Data Sources: Original studies for inclusion were identified through keyword searches in ISI Web of Knowledge, Google Scholar, EconLit, and AgEcon Search.

Study Eligibility Criteria: Studies were included when they build on primary data from farm surveys or field trials anywhere in the world, and when they report impacts of GM soybean, maize, or cotton on crop yields, pesticide use, and/or farmer profits. In total, 147 original studies were included.

Synthesis Methods: Analysis of mean impacts and meta-regressions to examine factors that influence outcomes.

Results: On average, GM technology adoption has reduced chemical pesticide use by 37%, increased crop yields by 22%, and increased farmer profits by 68%. Yield gains and pesticide reductions are larger for insect-resistant crops than for herbicide-tolerant crops. Yield and profit gains are higher in developing countries than in developed countries.

Limitations: Several of the original studies did not report sample sizes and measures of variance.

Conclusion: The meta-analysis reveals robust evidence of GM crop benefits for farmers in developed and developing countries. Such evidence may help to gradually increase public trust in this technology.

Citation: Klümper W, Qaim M (2014) A Meta-Analysis of the Impacts of Genetically Modified Crops. PLoS ONE 9(11): e111629. doi:10.1371/journal.pone.0111629

However... There's a Battle Raging to Get Bioengineered Crops Banned in Many Parts of the World



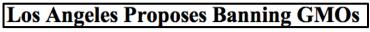


NO

GMOs

















- <u>Organic Growers/Markets</u> Gain Market Share (Follow the \$!!)
- Successful Well-Financed Anti-GMO "Propaganda" Campaign
- Bogus Science Studies Sensationalized by the Popular Media
- Ideology /Anti-Technology /Anti-Science/ Not "Natural"
- Pollen Flow & Transgene "Contamination" Native Species "Contamination" With GMO Transgenes
- Labeling Right to Know and Choose What is Eaten (CA-Proposition 37)
- No "Obvious" Consumer Benefit
- "Perceived" Negative Health Effects
- Mistrust of International/US Corporations (Monsanto!)/ Anti-Market
- Anti-Globalization Anti-Patent/Intellectual Property
- Ecological & Environmental Issues Lack of Confidence in Government No Strong USDA, FDA, or EPA Tradition in Europe (Protect Food Supply - Mad Cow - Dioxin)!
- Industrial-Oriented Conventional Farming That Uses GMOs
- Lack of Public Science Awareness

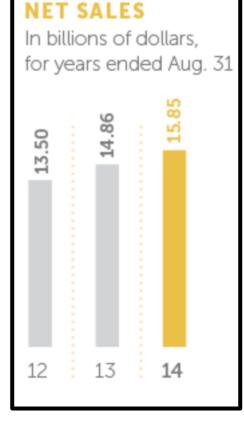
A Tale of Two Giants







Follow the Money **NET SALES** (IN BILLIONS) \$12.9 \$10.1 \$11.7 \$8.0 \$9.0 YEAR 2009 2010 2013 2011 2012



What Has Been Some of the Real Life Affects of the GMO Controversy?

AFRICAN COUNTRIES REJECT GM FOOD AID

Zimbabwe and Zambia have rejected genetically modified food donations intended to avert drought-induced food shortages. Wisdom Mdzungairi reports for Harare that participants to an international conference on genetic engineering and sustainable agriculture in Lusaka, Zambia commended the countries' decision to mill some of the donated food instead.

Dr. Luke Mumba, chairman of the Biosafety Council of Zambia and research of the University of Zambia, commented that while there was respect for the two countries' decision, there was need to adopt safe biotechnological advances, and that the use of GM technology could contribute to the complex problems of alleviating poverty and malnutrition. Meanwhile, Zambian Minister of Science and Technology Judith Kapijimpanga said the problem of food insecurity in Africa was a result of complex issues that required an integrated approach for sustainability.

See the article in http://allafrica.com/stories/200510110710.html.



Greenpeace's Crime Against Humanity 8 Million Children Dead AllowGoldenRiceNow.org







The End.... or The Beginning?





