GMO Facts
http://www.nongmoproject.org/gmo-facts/

What is a GMO? A GMO, or genetically modified organism, is a plant, animal, microorganism or other organism whose genetic makeup has been modified using recombinant DNA methods (also called gene splicing), gene modification or transgenic technology. This relatively new science creates unstable combinations of plant, animal, bacterial and viral genes that do not occur in nature or through traditional crossbreeding methods. Visit the What is GMO page for more information and a list of high-risk crops.

Are GMOs safe? Most developed nations do not consider GMOs to be safe and have significant restrictions or outright bans on the production and sale of GMOs. The U.S. and Canadian governments, though, have approved GMOs based on studies conducted by the same corporations that created them and profit from their sale.

Are GMOs labelled? Sixty-four countries around the world, including Australia, Japan, and all of the countries in the European Union, require genetically modified foods to be labelled
1. While a 2015 ABC News survey found that 93% of Americans believe genetically modified foods should be labelled, GMOs are not required to be labelled in the U.S. and Canada
2. In the absence of mandatory labeling, the Non-GMO Project was created to give consumers the informed choice they deserve.

Which foods might contain GMOs? Most packaged foods contain ingredients derived from corn, soy, canola, and sugar beet — and the vast majority of those crops grown in North America are genetically modified
3. To see a list of high-risk crops, visit the What is GMO page.

How do GMOs affect farmers? Because GMOs are novel life forms, biotechnology companies have been able to obtain patents with which to restrict their use. As a result, the companies that make GMOs now have the power to sue farmers whose fields are contaminated with GMOs, even when it is the result of inevitable drift from neighboring fields
4. GMOs therefore pose a serious threat to farmer sovereignty and to the national food security of any country where they are grown, including the United States and Canada.

What are the impacts of GMOs on the environment? More than 80% of all GMOs grown worldwide are engineered for herbicide tolerance 5. As a result, use of toxic herbicides like Roundup has increased 16 times since GMOs were introduced 6. GM crops are also responsible for the emergence of herbicide resistant "super weeds" and "super bugs," which can only be killed with more toxic poisons like 2,4-D (a major ingredient in Agent Orange) 7,8. GMOs are a direct extension of chemical agriculture and are developed and sold by the world's biggest chemical companies. The long-term impacts of GMOs are unknown, and once released into the environment, these novel organisms cannot be recalled.

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2 Langer, Gary. "Poll: Skepticism of Genetically Modified Foods." *ABC News*. ABC News

Network, 19 June 2015. Web.
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4 Leader, Jessica. "Monsanto Wins Lawsuit Filed By U.S. Organic Farmers Worried About Seed Contamination." *The Huffington Post*. TheHuffingtonPost.com, 10 June 2013. Web.
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6 Kustin, Mary Ellen. "Glyphosate Is Spreading Like a Cancer Across the U.S." *EWG*. Environmental Working Group, 07 Apr. 2015. Web.
7 Mortensen DA, Egan JF, Maxwell BD, Ryan MR, Smith RG. "Navigating a critical juncture for sustainable weed management." *BioScience*. 2012;62(1):75-84.
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High-Risk Crops & Inputs

One of the elements that sets the Non-GMO Project Standard apart from other non-GMO claims is the requirement to test high-risk ingredients for GMO contamination.

An ingredient can be classified as high risk if it is derived from, contains derivatives of, or is produced through a process involving organisms that are known to be genetically modified and commercially produced. The following inputs are considered high risk:

Classification	Ingredient
Crops	Alfalfa, Canola, Corn, Cotton, Papaya, Soy, Sugar beet, Zucchini/
Animal Derivatives	Eggs, Gelatin, Hides and skin, Honey and other apiculture produc
Animal Production Inputs	rBGH, rBST, Semen, Vaccines, Veterinary medicines
Microbes and Microbial Products	Enzymes, including chymosin, Cultures and starters including yea

To meet the Non-GMO Project Standard, an ingredient derived from a high-risk organism will need test results from the raw source material to prove that it is non-GMO. For example, in order to prove that soy lecithin meets the standard, the raw soy must be tested before it is processed into lecithin.

Animal products such as milk, meat, eggs, and honey are considered high-risk inputs due the prevalence of GMOs in animal feed. As such, animal products are evaluated by looking at the feed and testing high-risk inputs in the feed. Cloned animals and their progeny are also considered GMOs under the standard.

http://www.nongmoproject.org/gmo-facts/high-risk/

Corn

Corn, also called maize, is native to Mexico and has become one of the most widely grown crops in the world. There are 142 different events (types) of genetically modified corn, the most of any plant species. Almost 90% of the corn grown in the United States goes into animal feed and biofuels, while the remainder is processed down into various ingredients such as high-fructose corn syrup and corn starch, or used as the source material to make ingredients such as alcohol and citric acid.123

Herbicide Tolerant	Insect resistant	Di

Newer varieties of genetically modified corn have developed for the following applications: drought stress tolerance, improved ethanol production, and increased lysine content.

Cultivation United States (92% of corn acreage in 2014)4

Canada (81% of corn acreage in 2014)5

Brazil Argentina

8 "USDA ERS – Corn." *USDA ERS – Corn*. United States Department of Agriculture Economic Research Service, n.d. Web.
9 "U.S. Domestic Corn Use." USDA Economic Research Service, Nov. 2015. Web

10 "U.S. Domestic Corn Use Table." USDA Economic Research Service, n.d. Web.
11 *Acreage*. Washington: U.S. Dept. of Agriculture, Statistical Reporting Service, Crop Reporting Board, 2015. 25. USDA, National Agricultural Statistics Service, June 2015. Web.
Mchughen, Alan. "Where in the World Are GM Crops and Foods?" *GM Crops & Food* 4.3 (2013): 17. *GMO Inquiry 2015*. Canadian Biotechnology Action Network (CBAN), 30 Mar. 2015. Web.

Cotton

Cotton is the primary crop for producing textiles around the world. As such, it was targeted early on by biotech companies and there are now 56 events (types) of genetically modified cotton, the second most behind corn (maize)1. Though cotton fiber is not common in consumer packaged goods, cottonseed oil is becoming more so as prices drop.

Herbicide Tolerant Insect resistant Di

Cultivation

United States (94% of cotton acreage in 2014)2
Brazil
Argentina
India
China
Paraguay
South Africa
Pakistan
Australia
Burkina Faso
Myanmar
Mexico
Columbia
Sudan

1. "GM Approval Database: Cotton." *GM Approval Database*. International Service for the Acquisition Of Agri-biotech Applications (ISAAA), n.d. Web.
2. *Acreage*. Washington: U.S. Dept. of Agriculture, Statistical Reporting Service, Crop Reporting Board, 2015. 26. USDA, National Agricultural Statistics Service, June 2015. Web.

http://www.nongmoproject.org/high-risk/cotton/

Soy

Soybean, also called soya bean, is the number one genetically modified crop in the world, representing half of all worldwide biotech crop acreage with an 82% adoption rate among soy farmers12. Due to its high oil and protein content, soy is cultivated for a variety of food purposes. Besides being the foundation of soy sauce and tofu, soy oil is a common vegetable oil, soybean meal is a regular part of animal feed, and soy protein is added to breads and packaged goods.

Herbicide Tolerant Insect resistant Di

Some genetically modified varieties of soy have been altered specifically for oil production and produce three times as much oleic acid as conventional varieties3.
Cultivation United States (94% of soy acreage in 2014)4 Canada (62% of soy acreage in 2014)5
Brazil Argentina Paraguay South Africa Uruguay Bolivia Mexico Chile Costa Rica

1. James, Clive. 2014. *Global Status of Commercialized Biotech/GM Crops: 2014*. ISAAA Brief No. 49. ISAAA: Ithaca, NY. 72. Print.
2. "Biotech Crop Annual Update: Soybean." (n.d.): n. pag. International Service for the Acquisition Of Agri-biotech Applications (ISAAA). Web.
3. "Soybean." *Soybean*. International Service for the Acquisition Of Agri-biotech Applications (ISAAA), 2006. Web.
4. *Acreage*. Washington: U.S. Dept. of Agriculture, Statistical Reporting Service, Crop Reporting

Board, 2015. 27. USDA, National Agricultural Statistics Service, June 2015. Web.
5. Mchughen, Alan. "Where in the World Are GM Crops and Foods?" *GM Crops & Food* 4.3 (2013): 18. *GMO Inquiry 2015*. Canadian Biotechnology Action Network (CBAN), 30 Mar. 2015. Web.
http://www.nongmoproject.org/high-risk/soy/

GMO Myths and Truths

An evidence-based examination of the claims made for the safety and efficacy of genetically modified crops and foods

John Fagan, PhD
Michael Antoniou, PhD
Claire Robinson, MPhil

2nd edition

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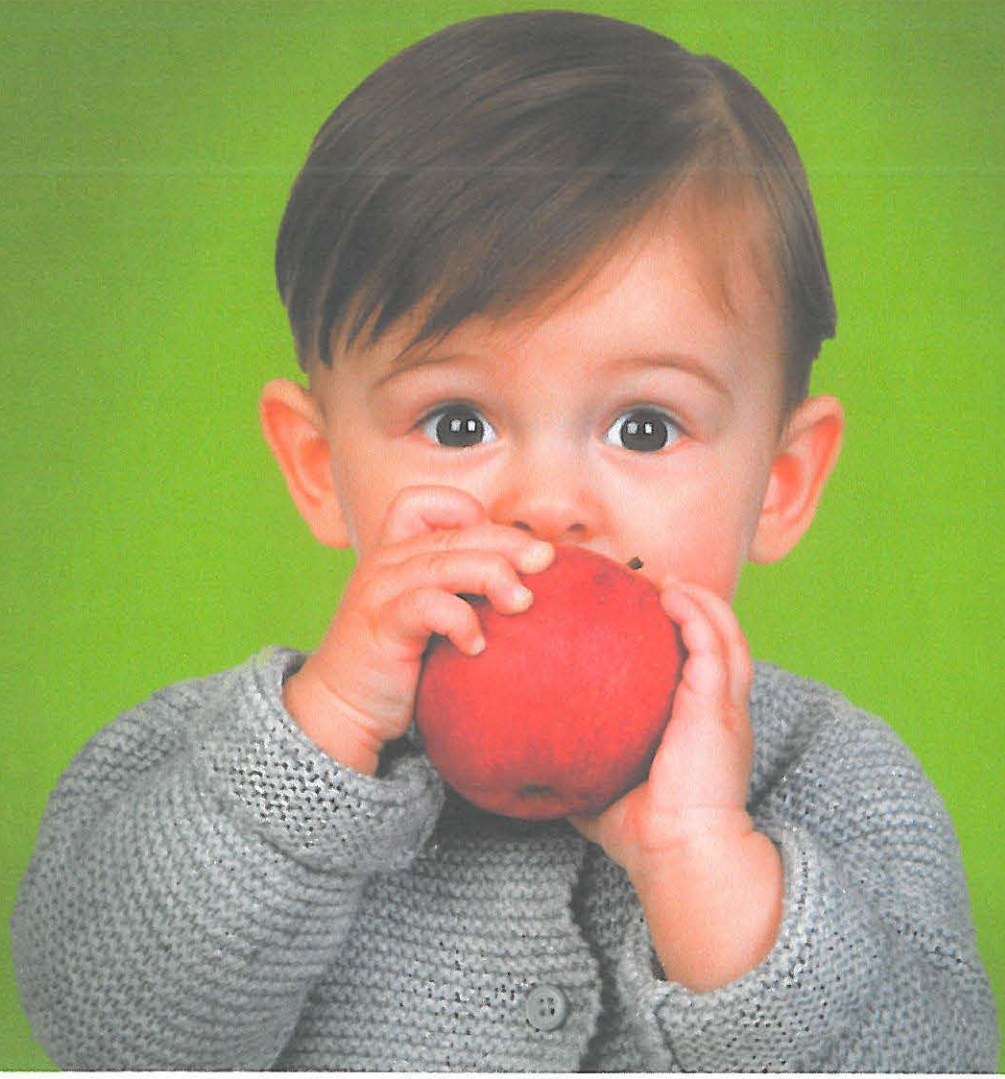

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Contents

Introduction

We began work on GMO Myths and Truths in 2010, prompted by frequent claims that the case against genetically modifying our food supply had no science behind it. As we had followed the scientific debate and evidence on genetically modified (GM) crops and foods since the early 1990s, we knew that this was untrue.

Another driving factor was the inflated claims that were being made for GM crops. The public was being told that they would make agriculture more sustainable, provide higher yields to feed the world's growing population, reduce pesticide use, help meet the challenges of climate change, provide more nutritious foods, and make farming easier and more profitable.

We knew that these claims were at best questionable and at worst false. GM had not provided a single crop that had sustainably delivered these benefits. On the contrary, a considerable and growing body of scientific evidence pointed not only to potential hazards but also to actual harm from GMOs (genetically modified organisms) to animal and human health and the environment. But this evidence was not reaching the public, campaigners, policy-makers, or even the majority of scientists.

We decided to produce a document explaining the evidence in simple language. Initially we planned a short 10-page document. But it grew – and grew. We finally published the first edition of GMO Myths and Truths as a free download on the Earth Open Source website in June 2012, with more than 120 pages and over 600 references, 280 of them to peer-reviewed papers.

Unexpectedly for such a dry, technical publication, GMO Myths and Truths appeared to hit a nerve. Its publication coincided with a big push for GMO labelling in the United States and campaigners in many states made good use of it. Requests for press interviews flooded in from North America. Well-wishers mailed thousands of copies to the US for those campaigning for GMO food labelling to use and send to their Congressmen and women. Within weeks, GMO Myths and Truths had been translated into Mandarin and published on a Chinese blog. Spanish speakers translated parts for dissemination in South America. In India, where citizens and farmers were smarting from a series of scandals and disasters involving GM Bt cotton, a publishing company asked for our permission to print a few thousand copies under their imprint. They sold them as cheaply as they could manage, given that their target readership was poor villagers and farmers. We were invited to speak in countries all over the world by citizen, government, and industry organizations.

The critics

Not everyone appreciated GMO Myths and Truths. GMO lobbyists launched attacks against it in online forums. These people are online 24/7, defending GMOs. They criticize GMO Myths and Truths every time someone cites it in an article, blog, or online post. While we may be able to manage a couple of comments in response before we have to do our work or otherwise live our lives, the GMO lobbyists seem to have nothing else to do than defend

Conclusion

The introduction of GM crops and foods represents an unprecedented development in the history of agriculture. Never before has the nature of the food supply and the manner in which crops are grown been so fundamentally altered in such a short period of time. This change will affect the lives of all people on earth for many years to come.

Advances in agriculture are to be welcomed if they can contribute to a more sustainable, secure and fair production system and help solve the problem of world hunger and malnutrition. GM crops and foods have been consistently promoted as a way to produce higher yields with less inputs, reduce pesticide use, make farming easier and more profitable, produce more nutritious foods, and meet the challenges of climate change.

But the evidence that has emerged since their introduction in 1996 paints a very different picture. Scientific research and real-world farming experience shows that GM crops have not delivered on the promises above. They have not increased yields or sustainably reduced toxic chemical inputs. They have presented farmers with the new challenges of controlling herbicide-resistant superweeds and Bt toxin-resistant super-pests. GM crops are no less dependent on artificial fertilizers than any other chemically grown crop. They are not as safe to eat as conventionally bred crop varieties. They provide no solution to the major challenges of our time: climate change, the energy crisis, and world hunger.

Why has GM failed to deliver on its promises?

The GM approach treats genes as isolated units of information with predictable outcomes. But this approach is flawed. Gene organization within the DNA of any organism is not random and gene function is a complex, interconnected, and coordinated network, consisting of layer upon layer of molecular systems.

GM is based on an outdated understanding of genetics and is destined to fail. It is beyond the ability of GM to deliver anything but the simplest of properties such as single-gene herbicide tolerance. GM is simply not up to the task of delivering safe, productive, and resilient food production systems.

Our modern understanding of genetics tells us that we need to take a holistic "systems biology" approach in crop development that preserves gene organization and regulation, rather than disrupting it, as GM does. The way to safely and effectively generate crops with complex desirable properties such as higher yield, drought tolerance, and disease resistance is through natural breeding, augmented where useful by marker assisted selection.

Given the fundamental technical and conceptual flaws of the GM approach to crop and food development, we should not be surprised to find that it has failed to deliver on any of its promises and has delivered foods that are not safe to eat.

Why do farmers plant GM crops?

The GMO lobby's trump card in responding to these arguments is to ask: If GMOs are as unimpressive and problematic as we suggest, why do so many farmers in so many countries plant them?

The simple answer is that while some farmers do plant GM crops, the vast majority do not. Non-GM farming is by far the dominant model. Industry figures from 2013 show that 18 million farmers grow GM crops in 27 countries worldwide: that's less than 1% of the farming population. Around 92% of all GMOs are grown in just six countries, and these countries mainly grow just four GM crops: soy, maize, oilseed rape (canola) and cotton. Eighty-eight percent of arable land across the globe remains GM-free.[1]

What is more, in 2014, industry figures revealed that GM crop planting had fallen in industrialized countries for the first time since the technology was commercialized in 1996. Clive James, head of the industry group ISAAA, admitted that the industry now sees the developing world as the target for GMO industry expansion.[2]

As the evidence and case studies presented in this report make clear, it is irresponsible to use farmers in the developing world as guinea pigs for experimental GM crops that the majority of people do not want to eat.

Time to move on

For two decades, GM proponents have dominated the political and media discussion on food and agriculture. Many of our agricultural research institutes and universities accept GMO industry funding and obligingly pursue a narrow GM-focused agenda, at the expense of proven effective agroecological solutions that focus on improving soil quality and maintaining crop diversity and health. Pro-GMO propaganda has even made its way into school and college curricula.

Yet the public, the vast majority of whom do not want to eat GM foods, is unconvinced. It has become common for pro-GMO lobbyists to try to shut down resistance to GM food and agriculture by saying that the debate is over, that science has shown that GMOs are safe and beneficial, and that it is time to move on and accept them.

We agree with only one aspect of this argument. It is indeed time to move on, but in the opposite direction to the one promoted by the GMO proponents. The scientific evidence presented in this report shows that the hypothetical benefits of GM crops and foods are not worth the known risks.

It is time to face up to what the evidence tells us about GMOs and stop pretending that GMOs can do anything that non-GM agriculture and good farming can't do far better, at a fraction of the cost, and without the restrictions attached to patent ownership. In fact, patents represent the single area in which GM crops and foods outstrip non-GM. If it ever becomes as easy to patent a non-GM crop as it is to patent a GM crop, it is likely that GM

About the authors

John Fagan, PhD was an early voice in the scientific debate on genetically engineered food. Today, as a director at Earth Open Source, Dr Fagan conducts research on biosafety and sustainable agriculture and works to advance environmental sustainability and social responsibility in the food system. Dr Fagan's expertise is sought by industry, government and the scientific community, and he has given hundreds of lectures around the world in the last two decades. Dr Fagan pioneered genetic testing methods for GMOs, and founded, built, and later sold a leading company in this field, Global ID Group. Earlier, he researched molecular mechanisms of carcinogenesis at the US National Institutes of Health and in academia. He earned a PhD in biochemistry, molecular biology, and cell biology from Cornell University.

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