

# GMO Fact Sheet Sources

## Hyperlinks to GMO Citations for Easy Research

Note to Readers: Please send us feedback via [info@smallplanet.org](mailto:info@smallplanet.org) on these sources and suggest more authoritative and/or more recent sources. Thank you!

### Introduction:

*In the 1990s, GMOs took off in the US without public debate, and soon this country became the world's biggest producer and consumer of GM crops. Today, 70% of our processed food is derived from GMO crops. (CA Food and Ag, Food Research Int'l, 2010) As the debate over GMOs intensifies, we invite you to weigh seven points. Throughout, you'll find sources in brief. Complete citations: [www.smallplanet.org/content/small-planet-institute-fact-sheets](http://www.smallplanet.org/content/small-planet-institute-fact-sheets). We're eager for your feedback.*

### World's biggest GMO producer:

International Service for the Acquisition of Agri-Biotech Applications. "ISAA Brief 44-2012." Accessed September 26, 2013. <http://www.isaaa.org/resources/publications/briefs/44/highlights/default.asp>.

#### Source Says:

"The US continued to be the lead country with 69.5 million hectares, with an average 90% adoption across all crops."

### 70% of our processed food is derived from GMOS:

Joana Costa, Isabel Mafra, Joana S. Amaral, M.B.P.P. Oliveira. "Monitoring Genetically Modified Soybean Along the Industrial Soybean Oil Extraction and Refining Processes by Polymerase Chain Reaction Techniques." *Food Research International* 43:1 (2010) 301-306. Accessed September 10, 2014. doi: 10.1016/j.foodres.2009.10.003. <http://www.sciencedirect.com/science/article/pii/S0963996909003202>.

**Also see:** California Department of Food and Agriculture. "A Food Foresight Analysis of Agricultural Biotechnology: A Report to the Legislature," January 1, 2003. Accessed September 26, 2013. [http://www.cdfa.ca.gov/files/pdf/ag\\_biotech\\_report\\_03.pdf](http://www.cdfa.ca.gov/files/pdf/ag_biotech_report_03.pdf).

#### Source Says:

"In the United States, approximately 70 percent of processed foods in grocery stores contain bioengineered ingredients, making them ubiquitous in the food supply here."

### FACT#1:

***In a 2013 public statement, 297 scientists, academics and others knowledgeable about GMOs emphasize that there is "no scientific consensus" on GMO safety and call for "further independent scientific inquiry." (ENSSER, 2013)***

*In the US, GMOs producing their own pesticide must be approved by the Environmental Protection Agency — but with less stringent testing than required for chemical pesticides. (Union of Concerned Scientists, 2012) The review process for new GMO plant foods by the Food and Drug Administration— relying on the biotech industry's own safety assessments— is voluntary. (NY Times, 2014; Biotech. Genetic Eng. Rev., 2004) Tests of GMOs prepared as people actually eat them are lacking entirely, although recommended in internationally accepted standards. (CODEX) Post-release monitoring of environmental and health impacts of GMOs is also lacking. (Env. Int'l, 2012)*

Roni Caryn Rabin, "The Consumer: Information Not on the Label," New York Times, May 26, 2014.

<http://well.blogs.nytimes.com/2014/05/26/information-not-on-the-label/>.

#### Source Says:

"The F.D.A. decided that the difference between fresh peas and frozen peas was a 'material' difference to the consumer," said Jean Halloran, director of food policy initiatives at Consumers Union, which supports labeling of genetically modified foods. "This stuff is as different as frozen peas and nonfrozen peas, if not more so." Agency scientists have expressed concerns about new genetically engineered plant products, wondering whether the new plants have the same levels of important nutrients as non-engineered varieties, for instance, and whether they might contain toxins, new allergens or unapproved food additives. But unlike the approval process required for new drugs and even many food additives like artificial sweeteners, the review process for new G.M.O. plant foods is voluntary. Producers are asked only to consult with the F.D.A. The agency "does not conduct a comprehensive scientific review of data generated by the developer," according to F.D.A. documents. Officials rely on producers to do their own safety and nutritional assessments, and they review summaries of those assessments.

"We recognize and appreciate the interest that some consumers have expressed in knowing whether a food was produced using genetic engineering," said Theresa Eisenman, an F.D.A. spokeswoman. "Food from genetically engineered plants must meet the same requirements, including safety requirements, as foods from traditionally bred plants."

#### **2012 public statement:**

European Network of Scientists for Social and Environmental Responsibility. "Statement: No Scientific Consensus on GMO Safety." Last Modified Oct. 21, 2013. Accessed Oct. 23, 2013. <http://www.ensser.org/increasing-public-information/no-scientific-consensus-on-gmo-safety/>.

#### Source Says:

"As scientists, physicians, academics, and experts from disciplines relevant to the scientific, legal, social and safety assessment aspects of genetically modified organisms (GMOs),[1] we strongly reject claims by GM seed developers and some scientists, commentators, and journalists that there is a 'scientific consensus' on GMO safety[2] [3] [4] and that the debate on this topic is 'over'.[5]

We feel compelled to issue this statement because the claimed consensus on GMO safety does not exist. The claim that it does exist is misleading and misrepresents the currently available scientific evidence and the broad diversity of opinion among scientists on this issue. Moreover, the claim encourages a climate of complacency that could lead to a lack of regulatory and scientific rigour and appropriate caution, potentially endangering the health of humans, animals, and the environment.

Science and society do not proceed on the basis of a constructed consensus, as current knowledge is always open to well-founded challenge and disagreement. We endorse the need for further independent scientific inquiry and informed public discussion on GM product safety and urge GM proponents to do the same."

"On 21 October 2013 we released the statement 'No scientific consensus on GMO safety'. It was signed [by an] international group of more than 90 scientists, academics and physicians and is now open for further signatories."

Independent Science news. "Serralini and Science: an Open Letter." Last Modified Oct. 2, 2012. Accessed Oct. 2, 2013. <http://www.independentsciencenews.org/health/seralini-and-science-nk603-rat-study-roundup/page/3/>.

#### Source Says:

"In the end, it is a major problem for science and society when current regulatory protocols approve GMO crops based on little to no useful data upon which to assess safety."

#### **Role of Environmental Protection Agency (EPA) in GMO regulation:**

Gurian-Sherman, Doug, senior scientist. "A Contrary Perspective on the AAAS Board Statement Against Labeling of Engineering Foods." *The Equation*, Blog by Union of Concerned Scientists, November 2, 2012. Accessed September 26, 2013. <http://blog.ucsusa.org/a-contrary-perspective-on-the-aaas-board-statement-against-labeling-of-engineered-foods>.

#### Source Says:

"And there is also the question of whether the approval process for pesticidal GE crops at EPA can legitimately be called rigorous. Compared to the testing required for chemical pesticides, the answer is unequivocally 'no.' There are extensive testing guidelines for chemical pesticides required by U.S. EPA, for example, that include long-term animal testing, mutation testing, carcinogenicity testing and so on. Even these tests are imperfect. For GE foods, EPA requires only short term animal testing, for about a month, with a single high dose of the engineered substance, and some allergenicity testing. There are no long-term tests required, no mutation testing, and so on. Some would question whether these more thorough tests are needed, but trying to pass off testing of GE in the U.S. as rigorous is dubious."

#### **Role of Food and Drug Administration (FDA) in GMO regulation:**

Gurian-Sherman, Doug. "Holes in the Biotech Safety Net: FDA Policy Does Assure the Safety of Genetically Engineered Foods." Center for Science in the Public Interest, 2009. Accessed September 26, 2013. [http://www.cspinet.org/new/pdf/fda\\_report\\_final.pdf](http://www.cspinet.org/new/pdf/fda_report_final.pdf).

#### Source Says:

"Therefore, like their conventional counterparts, they are considered "Generally Recognized as Safe" (GRAS) under of the Federal Food, Drug, and Cosmetic Act (FFDCA) and no pre-market approval is necessary." (pg 1-2)

"In its policy statement about biotech crops, FDA established a voluntary consultation process so it could review the developer's determination of 'substantial equivalence' before a biotech crop was marketed. Under the voluntary consultation process, the developer contacts FDA to discuss how it might establish substantial equivalence in a specific product. FDA provides guidance to help GE-food developers assess the safety of their GE crops. That guidance recommends that developers consider issues such as toxicity and allergenicity of the gene product and plant. 'Decision trees' explaining general properties to consider in conducting the assessment are provided, but recommendations for testing and detailed testing procedures are not included." (pg2)

**Also see:** Freese, William and David Schubert. "Safety Testing and Regulation of Genetically Engineered Foods." *Biotechnology Genetic Engineering Review* 21 (2004): 299-324. Accessed September 26, 2013. [http://www.centerforfoodsafety.com/files/freese\\_safetytestingandregulationofgeneticallyengineeredfoods\\_nov212004\\_62269.pdf](http://www.centerforfoodsafety.com/files/freese_safetytestingandregulationofgeneticallyengineeredfoods_nov212004_62269.pdf).

**Source Says:**

"The review process outlined above makes it clear that, contrary to popular belief, the FDA has not formally approved a single GE crop as safe for human consumption." (pg 6)

"The FDA has left it up to the biotech industry to decide whether or not a transgenic protein is GRAS, and so exempt from testing (FDA Policy, 1992). The FDA has yet to revoke an industry GRAS determination and require food additive testing of any transgenic crop." (pg 5)

"Under voluntary consultation, the GE crop developer is encouraged, but not required, to consult with the FDA. The company submits data summaries of research it has conducted, but not the full studies." (pg 5)

**And:** Johan Diels et al., "Association of financial or professional conflict of interest to research outcomes on health risks or nutritional assessment studies of genetically modified products," *Food Policy* 36, (2011): 197-203, [doi:10.1016/j.foodpol.2010.11.016](https://doi.org/10.1016/j.foodpol.2010.11.016).

**Source Says:**

"In a study involving 94 articles selected through objective criteria, it was found that the existence of either financial or professional conflict of interest was associated to study outcomes that cast genetically modified products in a favorable light ( $p = 0.005$ ). While financial conflict of interest alone did not correlate with research results ( $p = 0.631$ ), a strong association was found between author affiliation to industry (professional conflict of interest) and study outcome ( $p < 0.001$ ). We discuss these results by comparing them to similar studies on conflicts of interest in other areas, such as biomedical sciences, and hypothesize on dynamics that may help explain such connections." (pg 197) Also see Table 1 (pg 200).

#### **Lacking tests of GMOs prepared as people actually eat them:**

Joint FAO/WHO Standards Programme CODEX Alimentarius Commission. "Foods Derived from Modern Biotechnology." Second Edition. Accessed September 26, 2013. <http://www.fao.org/docrep/011/a1554e/a1554e00.htm>.

**Source Says:**

"The goal of each safety assessment is to provide assurance, in the light of the best available scientific knowledge, that the food does not cause harm when prepared, used and/or eaten according to its intended use. The expected end-point of such an assessment will be a conclusion regarding whether the new food is as safe as the conventional counterpart taking into account dietary impact of any changes in nutritional content or value. In essence, therefore, the outcome of the safety assessment process is to define the product under consideration in such a way as to enable risk managers to determine whether any measures are needed and, if so, to make well-informed and appropriate decisions" (pg 11)

"The potential effects of food processing, including home preparation, on foods derived from recombinant-DNA plants should also be considered. For example, alterations could occur in the heat stability of an endogenous toxicant or the bioavailability of an important nutrient after processing. Therefore, information should be provided, describing the processing conditions used in the production of a food ingredient from the plant. For example, in the case of vegetable oil, information should be provided on the extraction process and any subsequent refining steps." (pg16) (Note: Professor Jack Heinemann notes that CODEX, paragraph 47, specifies such testing. CODEX is an international body to harmonize food standards, coordinated by the FAO and WHO; See Prof. Heinemann's comments on Grist [here](#).)

**Also see:** Norwegian Environment Agency Biosafety Report, Georgina Catacora-Vargas, "Sustainability Assessment of Genetically Modified Herbicide Tolerant Crops: The case of Intacta Roundup Ready 2Pro Soybean Farming in Brazil in light of the Norwegian Gene Technology Act," Centre for Biosafety, Tromsø, Norway, November 2014, 84-85, accessed July 20, 2015, [http://genok.no/wp-content/uploads/2015/06/010615\\_GENOK-HTIntactaBrazil-FINAL\\_web.pdf](http://genok.no/wp-content/uploads/2015/06/010615_GENOK-HTIntactaBrazil-FINAL_web.pdf).

**Source Says:**

"According to the Brazilian Normative Act No. 02 passed on November 27, 2006, Intacta RR2 Pro is classified under Risk Class 1 (low individual risk and low collective risk) (CTNBio 2006). According to the applicant, this is because it contains genetic material from donor and receptor organisms that do not cause harm to human and animal health, and therefore it does not cause adverse effects in crops and the environment (Berger and Braga 2009). Contrary to this assertion, the literature provides indications of harmful and adverse effects to the environment and to health (both animal and human), as well as to socio-economic conditions, particularly over the medium- and long-term. The literature related to the biosafety of GM HT plants has a number of important limitations making a comprehensive analysis of GM plants' sustainability difficult...

"These, among other methodological limitations (i.e. inconsistent selection of control, see more in section 2.1.5 "Comparison with controlled plants"), are present in the dossier of Intacta RR2 Pro submitted to the Brazilian

authorities. These limitations partially explain the kinds of findings reported by the applicant: all of them showing no possible adverse effects in contrast to a significant body of literature...

"Given the limited research on stacked GM HT crops such as Intacta RR2 Pro, the biosafety regulatory framework faces the challenge of having to make decisions under conditions of incomplete knowledge. The findings in this report clearly reveal that more empirical research is still needed on the multiple dimensions of sustainability of GM HT plants, including independent research regarding possible adverse effects at ecological, socioeconomic and human health, particularly of multiple-trait GM varieties."

#### **Lack of post-release monitoring:**

Heinemann, Jack and O.A. El-Kawy. "Observational Science in the Environmental Risk Assessment and Management of GMOs." *Environment International* 45 (2012): 68-71.

*We apologize that open web access is not available for this academic journal article.*

**Also see:** Sheldon Krimsky, "An Illusory Consensus behind GMO Health Assessment," *Science, Technology, and Human Values* (2015).

*We apologize that open web access is not available for this academic journal article.*

#### **Source Says:**

From the abstract: "This article examines scientific reviews and papers on GMOs, compares the findings of professional societies, and discusses the treatment of scientists who have reported adverse effects in animal feeding experiments. This article concludes by exploring the role that politics and corporate interests have had in distorting an honest inquiry into the health effects of GMO crops." (pg 1)

**For further, in depth discussion** of a lack of consensus on GMOs and a case for an [agroecological](#) approach to farming, see:

European Environment Agency, "Late lessons from early warnings: science, precaution, innovation," January 23, 2013, <http://www.eea.europa.eu/publications/late-lessons-2>.

## **FACT #2:**

### **Some experiments feeding GMOs to animals have found evidence of harm.**

*In several peer-reviewed studies, mammals fed GMO corn and soy developed "liver and kidney problems" that could mark the "onset of chronic diseases." (Environmental Sciences Europe, 2011). In another, pigs on the GM diet were 2.6 times more likely to get severe stomach inflammation than control pigs. (J. of Organic Systems, 2013) GMO advocates dismiss such studies, claiming experimenters used inappropriate lab animals or feeding methods, even though the industry's own studies use the same, or similar, protocols. (Independent Science News, 2012) Even in GMO studies where significant harm is not indicated, scientists express concern, noting, for example, that "much more scientific effort and investigation is necessary" before the authors can be "satisfied" that GMOs cause no harm. (Nutrition and Health, 2003; Env. Int'l, 2011)*

### **Liver and kidney problems marking the onset of chronic diseases:**

Séralini, Giles-Eric, Robin Mesnage, Emilie Clair, Steeve Gress, Joël Spiroux de Vendômois, and Dominique Cellier. "Genetically Modified Crops Safety Assessments: Present Limits and Possible Improvements," *Environmental Sciences Europe* 23:10 (2011). Accessed September 26, 2013. doi:10.1186/2190-4715-23-10. <http://www.enveurope.com/content/23/1/10>.

#### **Source Says:**

"Purpose: We reviewed 19 studies of mammals fed with commercialized genetically modified soybean and maize which represent, per trait and plant, more than 80% of all environmental genetically modified organisms (GMOs) cultivated on a large scale, after they were modified to tolerate or produce a pesticide. We have also obtained the raw data of 90-day-long rat tests following court actions or official requests. The data obtained include biochemical blood and urine parameters of mammals eating GMOs with numerous organ weights and histopathology findings."

"Conclusions: The 90-day-long tests are insufficient to evaluate chronic toxicity, and the signs highlighted in the kidneys and livers could be the onset of chronic diseases. However, no minimal length for the tests is yet obligatory for any of the GMOs cultivated on a large scale, and this is socially unacceptable in terms of consumer health protection. We are suggesting that the studies should be improved and prolonged, as well as being made compulsory, and that the sexual hormones should be assessed too, and moreover, reproductive and multigenerational studies ought to be conducted too."

### **Pigs on GM diet with severe stomach inflammation:**

Carman, Judy A., Howard R. Vlieger, Larry J. Ver Steeg, Verlyn E. Sneller, Garth W. Robinson, Catherine A. Clinch-Jones, Julie I. Haynes, and John W. Edwards. "A Long-Term Toxicology Study on Pigs Fed a Combined Genetically Modified (GM) Soy and GM Maize Diet." *Journal of Organic Systems* 8 (2013): 38-54. Accessed September 26,

2013. <http://www.organic-systems.org/journal/81/8106.pdf>.

Source Says:

"For non-GM-fed pigs, stomach inflammation was concentrated in the mild and moderate range, whereas GM-fed pigs showed much more severe inflammation." "GM-fed pigs showed severe stomach inflammation at a rate of 2.6 times that of non-GM-fed pigs" (pg 9)

Note to Readers: Following its controversial retraction, a scientific study that identified serious health impacts on rats fed on 'Roundup ready' GMO maize has been republished in peer reviewed journal Environmental Sciences Europe. The study underwent a comprehensive peer review process and Seralini and his colleagues have been defended by many scientists. The journal contains data available to the public. [http://www.theecologist.org/News/news\\_analysis/2451921/seralini\\_republished\\_roundupready\\_gmo\\_maize\\_causes\\_serious\\_health\\_damage.html](http://www.theecologist.org/News/news_analysis/2451921/seralini_republished_roundupready_gmo_maize_causes_serious_health_damage.html)

#### **Independent and industry science use same lab testing protocol:**

Independent Science News. "Seralini and Science: An Open Letter." Last modified October 2,

2012. <http://www.independentsciencenews.org/health/seralini-and-science-nk603-rat-study-roundup/#more-1087>.

Source Says:

"*Misleading Media Reporting*. A key pattern with risk-finding studies is that the criticisms voiced in the media are often red herrings, misleading, or untruthful. Thus, the use of common methodologies was portrayed as indicative of shoddy science when used by Seralini et al. (2012) but not when used by industry (see refs above and Science Media Centre, 2012). The use of red herring arguments appears intended to sow doubt and confusion among non-experts. For example, Tom Sanders of Kings College, London was quoted as saying: 'This strain of rat is very prone to mammary tumors particularly when food intake is not restricted' (Hirschler and Kelland, 2012 ). He failed to point out, or was unaware, that most industry feeding studies have used Sprague-Dawley rats (e.g. Hammond et al., 1996, 2004, 2006; MacKenzie et al., 2007). In these and other industry studies (e.g. Malley et al. 2007), feed intake was unrestricted. Sanders' comments are important because they were widely quoted and because they were part of an orchestrated response to the Seralini study by the Science Media Centre of the British Royal Institution. The Science Media Centre has a long history of quelling GMO controversies and its funders include numerous companies that produce GMOs and pesticides."

#### **Scientists concerned more testing needed:**

Pryme, Ian F. and Rolf Lembcke. "In Vivo Studies on Possible Health Consequences of Genetically Modified Food and Feed—With Particular Regard to Ingredients Consisting of Genetically Modified Plant Materials." *Nutrition and Health* 17 (2003): 1-8. doi: 10.1177/026010600301700101.

Link to abstract: <http://nah.sagepub.com/content/17/1/1.abstract?patientinform-links=yes&legid=spnah;17/1/1>

Source Says:

"In conclusion we feel that much more scientific effort and investigation is necessary before we can be satisfied that eating foods containing GM material in the long term is not likely to provoke any form of health problems. It will be essential to adequately test in a transparent manner each individual GM product before its introduction into the market." (pg 7)

**Also see:** Domingo, José L. and Jordi Giné Bordonaba. "A Literature Review on the Safety Assessment of Genetically Modified Plants." *Environment International* 37:4 (2011): 734-42. doi: 10.1016/j.envint.2011.01.003.

Link to

Abstract:[http://www.researchgate.net/publication/49812743\\_A\\_literature\\_review\\_on\\_the\\_safety\\_assessment\\_of\\_genetically\\_modified\\_plants](http://www.researchgate.net/publication/49812743_A_literature_review_on_the_safety_assessment_of_genetically_modified_plants)

Source Says:

"In general terms, all these authors agree in remarking that more scientific efforts are clearly necessary in order to build confidence in the evaluation and acceptance of GM foods/plant by both the scientific community and the general public." (pg 8)

#### **Other relevant sources:**

Claire Robinson, "Emails reveal role of Monsanto in Seralini study retraction," GMWatch, July 20, 2016, accessed July 27, 2016, <http://www.gmwatch.org/news/latest-news/17121-emails-reveal-role-of-monsanto-in-seralini-study-retraction>.

Kilic, Aysun and M. Turan Akay. "A Three Generation Study with Genetically Modified Bt Corn in Rats: Biochemical and Histopathological Investigation." *Food and Chemical Toxicology* 46 (2008): 1164–1170. Accessed September 26, 2013. [http://science.naturalnews.com/2008/544047\\_A\\_three\\_generation\\_study\\_with\\_genetically\\_modified\\_Bt\\_corn\\_in.html](http://science.naturalnews.com/2008/544047_A_three_generation_study_with_genetically_modified_Bt_corn_in.html).

Heinemann, Jack A., Sarah Zanon Agapito-Tenfen, Judy A. Carman. "A Comparative Evaluation of the Regulation of GM Crops or Products Containing dsRNA and Suggested Improvements to Risk Assessments." *Environment International* 55 (2013): 43–55. <http://gmojudycarman.org/wp-content/uploads/2013/06/comparative-evaluation-of-the-regulation-of-GM-crops-or-products-containing-dsRNA-and-suggested-improvements-to-risk-assessments.pdf>.

Heinemann, Jack and O.A. El-Kawy. "Observational Science in the Environmental Risk Assessment and Management of GMOs." *Environment International* 45 (2012): 68-71.

*We apologize that open web access is not available for this academic journal article.*

### **FACT #3:**

#### ***The consequences of GMO technology are inherently unpredictable.***

*Inserting a gene into another organism can result in multiple, unintended DNA changes and mutations, note scientists: "Unintended effects," they report, "are common in all cases where GE [genetic engineering] techniques are used." (Biotechnology and Genetic Engineering Reviews, 2004) In addition, the release of GMOs into the environment can cause unintended environmental and commercial harm, including documented GMO genetic contamination of other plants. (Biotechnology and Genetic Engineering Reviews, 2004) Note, moreover, that as a class GMOs cannot be proven safe because each new GMO presents a new harm-benefit profile that requires adequate testing. In weighing our choices, it is also useful to recall that substances ranging from lead to tobacco to asbestos to DDT were in wide use for some time before proven dangerous.*

#### **Unintended effects of genetic engineering and documented genetic contamination:**

Freese, William and David Schubert. "Safety Testing and Regulation of Genetically Engineered Foods." *Biotechnology Genetic Engineering Review* 21 (2004): 299-324. Accessed September 26, 2013. [http://www.centerforfoodsafety.com/files/freese\\_safetytestingandregulationofgeneticallyengineeredfoods\\_nov212004\\_62269.pdf](http://www.centerforfoodsafety.com/files/freese_safetytestingandregulationofgeneticallyengineeredfoods_nov212004_62269.pdf).

#### **Source Says:**

"The artificial introduction of foreign genetic constructs into plant cells creates numerous opportunities for potentially hazardous, unintended effects. These include the over-production of native allergens or toxins, nutritional deficits, and, as discussed above, the creation of novel fusion proteins with unknown properties. Unintended effects are common in all cases where GE techniques are used. For example, engineering a human gene into human cells significantly increases or decreases the expression levels of 5% of the genes in the cell (see Schubert, 2002 for discussion). Excess lignin production in Bt corn (Saxena and Stotzky, 2001), reduced levels of certain phytoestrogens in glyphosate-tolerant soybeans (Lappe et al., 1998) and unpredicted changes in the small molecule metabolism of GE potatoes (Roessner et al., 2001) are three of many examples of unintended effects in GE crops (see also Kuiper et al., 2001, Haslberger, 2003)." (pg 8).

European Environment Agency. "Late lessons from early warnings: science, precaution, innovation." No. 1: 23 Jan (2013). <http://www.eea.europa.eu/publications/late-lessons-2>

### **FACT #4:**

#### ***GMO makers influence government policy and block transparency, thus heightening the risk of inadequate safety protections.***

*Acceding to biotech industry requests, in 1992 the FDA declared GMOs "substantially equivalent" to conventionally bred crops, thus avoiding independent, long-term testing and monitoring prior to release — despite strong doubts expressed by some of its own scientists, and with no period for public comment. (FDA documents) Although 64 countries require GMO labeling (Center for Food Safety) and 93 percent of Americans favor labeling (NY Times), the biotech industry has spent millions to successfully block mandatory labeling here. (The Guardian, 2012) After scientists publicly complained about denial of access to GM seeds for research in 2009 (NY Times), biotech companies developed research contracts with certain universities. However, notes Cornell Professor E. Shields, we still "can't work with seeds before they come on the market" (Grist, 2013).*

#### **1992 FDA declaration of GMOs as "substantially equivalent":**

Marden, Emily. "Risk and Regulation: U.S. Regulatory Policy on Genetically Modified Food and Agriculture." *Boston College Law Review* 44:3 No. 3 (2003). <http://lawdigitalcommons.bc.edu/bclr/vol44/iss3/2/>.

#### **Source Says:**

"The 1992 FDA Policy had two purposes. First, it outlined the agency's view that most GM products were presumed or likely to be GRAS, and therefore not subject to food additive review. In addition, it established a voluntary pre-market consultation process to reassure companies and the public that the food supply was being safeguarded." (pg 747)

"FDA reaffirmed the position that most GM foods were substantially equivalent to their conventional counterparts." (pg 761)

**Also see:** Relevant FDA documents from staff scientists: Alliance for Bio-Integrity. "Key FDA Documents Revealing Hazards of Genetically Engineered Foods and Flaws with How the Agency Made its Decisions." Accessed September 26, 2013. <http://www.biointegrity.org/list.html>.

**64 countries require GMO labeling:**

Center for Food Safety. "International Labeling Laws." Accessed September 26, 2013. <http://www.centerforfoodsafety.org/issues/976/ge-food-labeling/international-labeling-laws>.  
See website for list of all 64 countries.

**Americans favor labeling of GMO ingredients:**

Kopicki, Allison. "Strong Support for Labeling Modified Foods." *New York Times*, July 27, 2013. Accessed September 26, 2013. [http://www.nytimes.com/2013/07/28/science/strong-support-for-labeling-modified-foods.html?\\_r=1&](http://www.nytimes.com/2013/07/28/science/strong-support-for-labeling-modified-foods.html?_r=1&).

**Source Says:**

"Americans overwhelmingly support labeling foods that have been genetically modified or engineered, according to a New York Times poll conducted this year, with 93 percent of respondents saying that foods containing such ingredients should be identified."

**Biotech industry spends millions to block GMO labeling:**

Goldenberg, Suzanne. "Prop 37: Food Companies Spend \$45m to Defeat California GM Label Bill." *The Guardian*, November 5, 2012. Accessed September 26, 2012. <http://www.theguardian.com/environment/2012/nov/05/prop-37-food-gm-bill>.

**Source Says:**

"Monsanto and other agribusiness and food companies have spent more than \$45m (£28m) to defeat a California ballot measure that would require labelling of some GM foods."

**Scientists denied access to GM seeds for research; biotech contracts with universities:**

Pollack, Andrew. "Crop Scientists Say Biotechnology Seed Companies are Thwarting Research." *New York Times*, February 19, 2009. Accessed September 26, 2013. [http://www.nytimes.com/2009/02/20/business/20crop.html?\\_r=0](http://www.nytimes.com/2009/02/20/business/20crop.html?_r=0).

**Source Says:**

"Biotechnology companies are keeping university scientists from fully researching the effectiveness and environmental impact of the industry's genetically modified crops, according to an unusual complaint issued by a group of those scientists."

"'No truly independent research can be legally conducted on many critical questions,' the scientists wrote in a statement submitted to the Environmental Protection Agency."

"So while university scientists can freely buy pesticides or conventional seeds for their research, they cannot do that with genetically engineered seeds. Instead, they must seek permission from the seed companies. And sometimes that permission is denied or the company insists on reviewing any findings before they can be published, they say."

"Such agreements have long been a problem, the scientists said, but they are going public now because frustration has been building."

**Seeds not available for research until they are already on the market:**

Johnson, Nathanael. "Genetically Modified Seed Research: What's Locked and What Isn't." *Grist*, August 5, 2013. Accessed September 26, 2013. <http://grist.org/food/genetically-modified-seed-research-whats-locked-and-what-isnt/>.

**Source Says:**

(An interview with Professor Shields) "There was one problem still, he said: Scientists can't work with seeds before they come on the market. That hampers his ability to make recommendations about which seeds work best under different conditions, or to test for unwanted effects. Remember the study [PDF] that showed that Monarch butterflies might die if they ate too much insect-resistant GE corn pollen? That was technically an illegal study, he said."

**FACT #5:**

***Fairly evaluating GMOs is also made more difficult as some positive claims, even in respected publications, rely — with no disclosure — on sources linked to the GMO industry.***

*The 2013 book Can We Feed the World? by Scientific American editors, for example, includes an article from Nature. Its introduction reports without citation that "[a]dvocates say that they [GMOs] have increased agricultural production by more than US \$98 billion." The reader is not told that this figure comes from a 2013 study by the consulting firm PG Economics, whose clients include biotech companies. The authors thank Monsanto for funding their study. (GM Crops and Food, Landes Bioscience, 2013) The 2010 book Food Politics: What Everyone Needs to Know promotes*

GMOs, but includes no citations. Published by Oxford University Press, the book does not inform readers its author served as an advisor to the CEO of Monsanto. (Correspondence with Oxford University Press)

**Monsanto funded study:**

Brookes, Graham and Peter Barfoot. "The Global Income and Production Effects of Genetically Modified (GM) Crops 1996–2011." *GM Crops and Food: Biotechnology in Agriculture and the Food Chain* 4:1 (2013): 74-83. Accessed October 3, 2013. <https://www.landesbioscience.com/journals/gmcrops/2013GMC0001R.pdf>.

**Source Says:**

"At the global level, GM technology has had a significant positive impact on farm income, with in 2011, the direct global farm income benefit being \$19.8 billion. This is equivalent to having added 6.2% to the value of global production of the four main crops of soybeans, maize, canola and cotton. Since 1996, farm incomes have increased by \$98.2 billion." (pg 77)

**Suspect scholarly standards in relation to GMO literature:**

Please see correspondence with Oxford University Press at <http://scholarlystandardsatrisk.org/>.

**FACT #6:**

***GMOs reinforce a model of agriculture that keeps farmers and consumers dependent on climate-disrupting fossil fuels and on corporations with monopoly power.***

*In only 12 years (1996-2008), three chemical corporations acquired more than two hundred seed companies (Sustainability, 2009), achieving control over half of the commercial seed market worldwide. (Center for Food Safety, 2013) One is Monsanto, whose patented genes are in 90 percent of all US soybean and 80 percent of all US corn acres. (Hubbard, 2009) Patented seeds, including GMOs — along with fossil-fuel based synthetic pesticides and fertilizers — must be purchased each season, and can thus worsen poor farmers' indebtedness and vulnerability to price increases. (World Bank) The cost per acre of soybean and corn seed, most of which is GM, has tripled in the US since 1996. (USDA) Imagine the impact on small farmers in poor countries who are the majority of the world's hungry people. (UNCTAD)*

**Consolidation of seed companies:**

Howard, Philip H. "Visualizing Consolidation in the Global Seed Industry: 1996–2008." *Sustainability* 1:4 (2009): 1266-1287. Accessed September 26, 2013. doi: 10.3390/su1041266.

Link to abstract which has access to free pdf full-text: <http://www.mdpi.com/2071-1050/1/4/1266>

**Source Says:**

"During the study period the firms that eventually became the largest acquired or created joint ventures with more than two hundred firms." (pg 1273)

**Three companies control over half of commercial seed market worldwide:**

"Seeds Giants vs. U.S. Farmers." Center for Food Safety and Save Our Seeds, 2013. Accessed September 26, 2013. [http://www.centerforfoodsafety.org/files/seed-giants\\_final\\_04424.pdf](http://www.centerforfoodsafety.org/files/seed-giants_final_04424.pdf).

**Source Says:**

"In the last few decades, the U.S. has led a radical shift toward commercialization, consolidation, and control of seed ownership. Three agrichemical firms—Monsanto, DuPont, and Syngenta—now control 53 percent of the global commercial seed market." (pg 2)

**Monsanto patented gene in 95 percent U.S. soy; 80 percent US corn:**

CBS News. "AP: Monsanto Strongarms Seed Industry." January 4, 2011. Accessed September 29, 2013. [http://www.cbsnews.com/2100-500395\\_162-5978152.html](http://www.cbsnews.com/2100-500395_162-5978152.html).

**Source Says:**

"With Monsanto's patented genes being inserted into roughly 95 percent of all soybeans and 80 percent of all corn grown in the U.S., the company also is using its wide reach to control the ability of new biotech firms to get wide distribution for their products, according to a review of several Monsanto licensing agreements and dozens of interviews with seed industry participants, agriculture and legal experts."

**Farmer indebtedness and vulnerability to seed price increases:**

Kumar, T. Vijay, D. V. Raidu, Jayaram Killi, Madhavi Pillai, Parmesh Shah, Vijaysekar Kalavadonda and Smriti Lakhey. "Ecologically Sound, Economically Viable: Community Managed Sustainable Agriculture in Andhra Pradesh, India." Society for Elimination of Rural Poverty and The World Bank, 2009. Accessed September 26, 2013. [http://www-wds.worldbank.org/external/default/WDSContentServer/WDS/IB/2013/03/13/000333037\\_20130313114055/Rendered/PDF/759610WP0P118800agriculture0AP02009.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDS/IB/2013/03/13/000333037_20130313114055/Rendered/PDF/759610WP0P118800agriculture0AP02009.pdf).

#### Source Says:

"The Green Revolution increased agricultural production for many farmers in India and achieved significant gains in terms of food security. However, many of the small-farm holders in rain-fed and resource poor areas did not benefit much from Green Revolution technology and credit. Of the small-farm holders who have been using chemical fertilizers and pesticides, many are caught in the debt trap due to the high cost of those fertilizers, lack of credit, poor access to markets, and lack of investible surplus. This has resulted in low profitability agriculture, and many smallholders have dropped out of the sector. The spate of suicides among farmers in recent years has been an unfortunate consequence." (pg 5)

(Also see pie chart on pg 7)

#### **Cost of soy and corn seeds more than doubling per acre in US:**

*We used the USDA data base to search for seed prices in the US in 1996 and 2012 (corn); and 1997 and 2012 (soy). Below, please find instructions on how to replicate our search and view the raw data we used to calculate change in cost over each time period:*

(1) Go to <http://www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx>

*For Corn:*

(2) In the field labeled "data" please select "recent costs and returns: corn"

(3) Download the spreadsheet titled "U.S.: 1996-2000, 2001-04, 2005-09, 2010-12"

(4) Note, the USDA ERS data is reported in nominal terms; we adjust for inflation in calculations below)

*For Soy:*

(2) In the field labeled "data" please select "recent costs and returns: soybeans"

(3) Download the spreadsheet titled "U.S.: 1997-2001, 2002-05, 2006-12"

(4) Note, the USDA ERS data is reported in nominal terms; we adjust for inflation in calculations below)

We Found:

**Corn Operating Costs:**

Cost of seed per acre in 1996: \$26.65 -- (adjusted to 2012 buying power, this is \$39.00, which we use in the percent change calculation)

Cost of seed per acre in 2012: \$89.88

Percent change from 1996 to 2012: 130.7%

**Soy Operating Costs:**

Cost of seed per acre in 1997: \$19.72 -- (adjusted to 2012 buying power, this is \$28.21, which we use in the percent change calculation)

Cost of seed per acre in 2012: \$62.68

Percent change from 1997 to 2012: 122.2%

#### **Impact on small farmers in poor countries:**

*Wake Up Before It Is Too Late*, UN Conference on Trade and Development, 2013. Accessed September 26, 2013. [http://unctad.org/en/PublicationsLibrary/ditcted2012d3\\_en.pdf](http://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf).

#### **FACT #7:**

##### ***GMOs are not needed, so why take on their risks — however big or small?***

*Today the world produces plenty of food—2,800 calories for every person every day. And that's only counting what's left over after half the world's grain goes to livestock feed, fuel and other purposes. (FAO) As to future needs? Non-GMO, sustainable farming practices are increasing yields, in many cases dramatically (De Schutter, 2010); and applied worldwide, they could enlarge our food supply as much as 50 percent. (Renewable Agriculture and Food Systems, 2007) At the same time, GMOs have not generally proven more productive: Note that Western Europe, without GMOs and using less pesticide, has long enjoyed corn and canola yields comparable to the GMO-dependent US. (Int. J. of Agricultural Sustainability, 2013)*

##### **The world produces plenty of food:**

*We used the FAO data base to search for Food Supply Quantity in kcal/capita/day for the world's population.*

*Here are instructions on how to replicate our search and view the raw data we used to understand this fact:*

(1) Go to <http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368#anchor>

(2) In the field labeled "country" please select "World + Total"

(3) In the field labeled "year" please select "2009"

(4) Click "Show Data"

We Found:

There were 2,831 kcal/capita/day available for consumption in the world in 2009. This is more than enough food to feed every person on earth at that time.

### **Sustainable farming increases crop yields:**

De Schutter, Olivier. "Agroecology and the Right to Food." United Nations, General Assembly December 20, 2010. A/HRC/16/49. Accessed October 2, 2013. [http://www.srfood.org/images/stories/pdf/officialreports/20110308\\_a-hrc-16-49\\_agroecology\\_en.pdf](http://www.srfood.org/images/stories/pdf/officialreports/20110308_a-hrc-16-49_agroecology_en.pdf).

#### Source Says:

"Instead, agroecology seeks to improve the sustainability of agroecosystems by mimicking nature instead of industry. This report suggests that scaling up agroecological practices can simultaneously increase farm productivity and food security, improve incomes and rural livelihoods, and reverse the trend towards species loss and genetic erosion." (pg 6)

"Such resource-conserving, low-external-input techniques have a proven potential to significantly improve yields. In what may be the most systematic study of the potential of such techniques to date, Jules Pretty et al. compared the impacts of 286 recent sustainable agriculture projects in 57 poor countries covering 37 million hectares (3 per cent of the cultivated area in developing countries). They found that such interventions increased productivity on 12.6 million farms, with an average crop increase of 79 per cent, while improving the supply of critical environmental services. Disaggregated data from this research showed that average food production per household rose by 1.7 tonnes per year (up by 73 per cent) for 4.42 million small farmers growing cereals and roots on 3.6 million hectares, and that increase in food production was 17 tonnes per year (up 150 per cent) for 146,000 farmers on 542,000 hectares cultivating roots (potato, sweet potato, cassava). After UNCTAD and UNEP reanalyzed the database to produce a summary of the impacts in Africa, it was found that the average crop yield increase was even higher for these projects than the global average of 79 per cent at 116 per cent increase for all African projects and 128 per cent increase for projects in East Africa." (pg 8)

### **Sustainable agriculture could increase our food supply as much as 50 percent:**

Badgley, Catherine, Jeremy Moghtader, Eileen Quintero, Emily Zakem, M. Jahi Chappell, Katia Avilés-Vázquez, Andrea Samulon, and Ivette Perfecto. "Organic Agriculture and the Global Food Supply." *Renewable Agriculture and Food Systems* 22:2 (2006) 86-108. Accessed October 2, 2013. doi: 10.1017/S1742170507001640.

[http://www.organicvalley.coop/fileadmin/pdf/organics\\_can\\_feed\\_world.pdf](http://www.organicvalley.coop/fileadmin/pdf/organics_can_feed_world.pdf)

#### Source Says:

"According to Model 2, the estimated organic food supply exceeds the current food supply in all food categories, with most estimates over 50% greater than the amount of food currently produced (Figure 1)." (pg 91)

### **GMOs have generally not proven more productive than traditional seeds:**

Heinemann, Jack A., Melanie Massaro, Dorien S. Coray, Sarah Zanon Agapito-Tenfen, and Jiajun Dale Wen. "Sustainability and Innovation in Staple Crop Production in the US Midwest." *International Journal of Agricultural Sustainability* (2013). Accessed October 2, 2013. doi: 10.1080/14735903.2013.806408.

<http://www.tandfonline.com/doi/pdf/10.1080/14735903.2013.806408>

#### Source Says:

"Starting with maize...Between 1986 and 2010, W. Europe's yield averaged 82,899 hg/ha, just slightly above United States yields of 82,841 hg/ha (Table 1). Comparing W. Europe with the United States for the entire period 1961–2010 (Figure 1), the average yields were not significantly different (ANOVA:  $F_{1,98} = 0.53$ ;  $P = 0.47$ ). These results suggest that yield benefits (or limitations) over time are due to breeding and not GM, as reported by others (Gurian-Sherman 2009), because W. Europe has benefitted from the same, or marginally greater, yield increases without GM.

Furthermore, the difference between the estimated yield potential and actual yield or 'yield-gap' appears to be uniformly smaller in W. Europe than in the US Midwest (Licker et al. 2010). Biotechnology choices in the form of breeding stock and/or management techniques used in Europe are as effective at maintaining yield as are germplasm/management combinations in the United States." (pg 5)

(also see pg 7 for figure on rapeseed (canola) yields)

### **Data on more pesticide used on GM crops:**

Benbrook, Charles M.. "Impacts of Genetically Engineered Crops on Pesticide use in the U.S. -- The First Sixteen Years." *Environmental Sciences Europe* 24:24 (2012). Accessed October 2, 2013. doi: 10.1186/2190-4715-24-24.

<http://www.enveurope.com/content/24/1/24/abstract>

#### Source Says:

"Herbicide-resistant crop technology has led to a 239 million kilogram (527 million pound) increase in herbicide use in the United States between 1996 and 2011, while Bt crops have reduced insecticide applications by 56 million kilograms (123 million pounds). Overall, pesticide use increased by an estimated 183 million kgs (404 million pounds), or about 7%."

## **CONCLUSION:**

*In any case, GMOs distract humanity from the most critical and urgent questions: How can we grow food in ways that bring dignity and decent livelihoods to farmers, as they sustain soil, water, and seed diversity, as well as radically*

*reduce agriculture's huge climate impact? And how do all people gain power to secure healthy food? Fortunately, agroecological farming practices help poor farmers to break free of dependency, poverty, and hunger as they grow healthy food. (UNCTAD & UNEP, IAASTD)*

**UNCTAD and UNEP:**

*Wake Up Before It Is Too Late*, UN Conference on Trade and Development, 2013. Accessed September 26, 2013. [http://unctad.org/en/PublicationsLibrary/ditcted2012d3\\_en.pdf](http://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf).

Note: See especially Jack A. Heineman, Commentary VI: "Genetic Engineering and Biotechnology for Food Security and for Climate Change Mitigation and Adaptation: Potential and Risks." (pg 203)

*Organic Agriculture and Food Security in Africa*, UN Conference on Trade and Development and the UN Environmental Programme, New York and Geneva, 2008. Accessed October 2, 2013. [http://unctad.org/en/Docs/ditcted200715\\_en.pdf](http://unctad.org/en/Docs/ditcted200715_en.pdf).

**IAASTD:**

"Agriculture at a Crossroads" International Assessment of Agricultural Knowledge, Science and Technology for Development Global Report (2009). Accessed October 2, 2013. [http://www.unep.org/dewa/agassessment/reports/IAASTD/EN/Agriculture%20at%20a%20Crossroads\\_Global%20Report%20%28English%29.pdf](http://www.unep.org/dewa/agassessment/reports/IAASTD/EN/Agriculture%20at%20a%20Crossroads_Global%20Report%20%28English%29.pdf).